



MARINA COAST WATER DISTRICT

MARINA, CA

**REGIONAL URBAN WATER AUGMENTATION PROJECT
RECYCLED WATER PIPELINE AND BLACKHORSE RECYCLED WATER RESERVOIR**

CIP # RW-0156

Volume 1 of 2

SPECIFICATIONS

MAY 2017



MARINA COAST WATER DISTRICT
RECYCLED WATER PIPELINE DESIGN COMP BID SERVICES

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CONTRACT DOCUMENTS FOR
REGIONAL URBAN WATER AUGMENTATION PROJECT
RECYCLED WATER PIPELINE AND BLACKHORSE RESERVOIR

CIP # RW-0156

Marina Coast Water District
11 Reservation Road
Marina, California 93933

Board of Directors

Howard Gustafson, President
Dr. Thomas P. Moore, Vice-President
William Y. Lee
Jan Shriner
Herbert Cortez

Submitted



Anne Prudhel, P.E. - Carollo Engineers



Approved

Michael Wegley, P.E. - District Engineer

MARINA COAST WATER DISTRICT
MARINA, CA
CIP # RW-0156, REGIONAL URBAN WATER MANAGEMENT PROJECT
RECYCLED WATER PIPELINE AND BLACKHORSE RECYCLED WATER RESERVOIR

INVITATION TO BIDDERS

Sealed Bids for the construction of the **Regional Urban Water Augmentation Project Recycled Water Pipeline and Blackhorse Recycled Water Reservoir** will be received by the Marina Coast Water District (herein after referred to as MCWD), at 11 Reservation Road, Marina, CA 93933, until 2:00 p.m. local time on **June 20, 2017**, at which time the Bids received will be publicly opened and read. The Project consists of constructing **approximately 40,000 linear feet of 24-inch transmission main pipeline in paved and non-paved roadways and easements, connecting to existing facilities, pipeline valves and appurtenances, two bore and jack roadway crossings, a 2.0 MG welded steel reservoir with potable water backup pumping system and associated appurtenances and electrical and SCADA improvements, for a complete in-place operational system.**

Bids will be received for a single prime Contract. Bids shall be on a lump sum and unit price basis, with additive alternate bid items as indicated in the Bid Form.

The Issuing Office for the Bidding Documents is: MCWD Engineering Office, 2840 4th Avenue, Marina, CA 93933, point of contact: **Stephenie Verduzco, Ph. (831)883-5929 or email SVerduzco@mcwd.org**. Prospective Bidders may examine the Bidding Documents at the Issuing Office on Mondays through Thursdays between the hours of 8:00 a.m. to 5:00 p.m., and may obtain copies of the Bidding Documents from the Issuing Office as described below.

Bidding Documents also may be examined at the Central Coast Builder's Exchange Plan Room, 20 Quail Run Circle, Salinas, CA 93907; and online at www.mcwd.org; and the office of the Engineer, Carollo Engineers, Inc., 2700 Ygnacio Valley Road, Suite 300, Walnut Creek, CA 94598, on Mondays through Fridays between the hours of 8:00 a.m. to 5:00 p.m.

Bidding Documents may be obtained from the Issuing Office during the hours indicated above. Bidding Documents are available on compact disc (as portable document format (PDF) files) for a non-refundable charge of \$5.00, plus shipping charge unless via in-person pick-up. Alternatively, printed Bidding Documents may be obtained from ARC , 2 Harris Court, Unit A-5, Monterey, CA 93940 Contact ARC at (831 646-1170 for a non-refundable cost of printed Bidding Documents , approximately \$205 for half size and \$295 for full size plus a non-refundable shipping charge. Upon ARC's receipt of payment, printed Bidding Documents will be sent via the prospective Bidder's delivery method of choice; the shipping charge will depend on the shipping method chosen. The date that the Bidding Documents are transmitted by the Issuing Office for compact disc or ARC for printed documents will be considered the prospective Bidder's date of receipt of the Bidding Documents. Partial sets of Bidding Documents will not be available from the Issuing Office. Neither Owner nor Engineer will be responsible for full or partial sets of Bidding Documents, including Addenda if any, obtained from sources other than the Issuing Office.

A **mandatory** pre-bid conference followed by a site visit to the areas of the project that are not publically accessible will be held at **10:00 a.m.** local time on **May 15, 2017** at the MCWD Engineering Office, 2840 4th Avenue, Marina, CA 93933. Attendance at the pre-bid conference is mandatory. Bids will not be accepted from any bidder who did not attend the Pre-Bid Conference. The site visit involves travel on unpaved roads.

The Project will be funded in whole or in part by the following funding sources in addition to District funds:

- Drinking Water State Revolving Fund (SRF) and Proposition 1 Ground Water (Prop 1)

Bids must comply with all requirements associated with these funding sources, including, but not limited to, USEPA Disadvantaged Business Enterprise compliance and American Iron and Steel. In addition, the successful Bidder will be required to comply with all requirements associated with the SRF and Prop 1 funding in carrying out the Project.

Since this Project is funded in whole or in part with SRF funds, the work must also comply with the minimum rates for wages for laborers and mechanics as determined by the Secretary of Labor in accordance with the provisions of Davis-Bacon. A copy of these wage rates is available on-line at <http://www.dir.ca.gov/oprl/DPreWageDetermination.htm>. **If there is a difference between the State and Federal rates, the higher of the two rates must be paid.** Attention is directed to the SRF Funding Requirements section of the Contract Documents.

Each bidder shall be a California licensed contractor pursuant to the Business and Professions Code and shall be licensed in the following appropriate classification(s) of contractor's license(s), for the work bid upon, and must maintain the license(s) throughout the duration of the Contract: A (General Engineering) or C-34 (Pipeline). In addition, the successful bidder will be required to self-perform at least 50% of the work.

Bid security shall be furnished in accordance with the Instructions to Bidders.

Owner: **Marina Coast Water District**

By: **Michael Wegley, PE**

Title: **District Engineer**

Pub. Date: **May 2 & 9, 2017**

+ + END OF INVITATION TO BIDDERS + +

INSTRUCTIONS TO BIDDERS

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ARTICLE 1 – DEFINED TERMS

- 1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:
- A. *Issuing Office* – The office from which the Bidding Documents are to be issued, which is the MCWD Engineering Office, 2840 4th Avenue, Marina, CA 93933.

ARTICLE 2 – COPIES OF BIDDING DOCUMENTS

- 2.01 Complete sets of the Bidding Documents may be obtained from the Issuing Office on CD and on the website www.MCWD.org in the number and format stated in the advertisement or invitation to bid.
- 2.02 Complete sets of Bidding Documents shall be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.
- 2.03 Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not authorize or confer a license for any other use.

ARTICLE 3 – QUALIFICATIONS OF BIDDERS

- 3.01 To demonstrate Bidder's qualifications to perform the Work, Bidder shall submit with its Bid (a) written evidence establishing its qualifications such as financial data, previous experience, and present commitments, and (b) the following additional information:
- A. Evidence of Bidder's authority to do business in the state where the Project is located.
- B. Bidder's state or other contractor license number, if applicable.
- 3.02 To demonstrate Bidder's qualifications to perform the Work, Bidder shall submit within 3 business days following the bid opening the following additional information:
- A. Qualifications information for the welded steel tank fabricator.
- B. Disadvantaged Business Enterprise documentation.
- 3.03 A Bidder's failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.
- 3.04 No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder's qualifications.
- 3.05 Bidder is advised to carefully review those portions of the Bid Form requiring Bidder's representations and certifications.

ARTICLE 4 – SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE

- 4.01 *Site and Other Areas*
- A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of

materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.

- B. See Section 01140 - Work Restrictions, for constraints on site access, sequencing and scheduling of work.

4.02 *Existing Site Conditions*

A. Subsurface and Physical Conditions; Hazardous Environmental Conditions

1. The Supplementary Conditions identify:

- a. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site.
- b. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).
- c. reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.
- d. Technical Data contained in such reports and drawings.

2. Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.

B. Underground Facilities: Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or adjacent to the Site are set forth in the Contract Documents and are based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.

C. Adequacy of Data: Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions, and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated subsurface or physical conditions appear in Paragraphs 5.03, 5.04, and 5.05 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work, appear in Paragraph 5.06 of the General Conditions.

4.03 *Site Visit and Testing by Bidders*

- A. Bidder shall conduct the required Site visit during normal working hours, and shall not disturb any ongoing operations at the Site.

NOTE(S) TO USER:

1. *Site visits are to be conducted during the pre-bid meeting and by appointment only for the following locations: Armstrong Ranch, Marshall Elementary School, CSUMB and Blackhorse Reservoir Site. Contact Patrick Breen at (831) 883-5951 for arranging the visit by appointment and conditions of access.*
- B. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.
 - C. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner's authority regarding the Site.
 - D. Bidder shall comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.
 - E. Bidder shall fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

4.04 Owner's Safety Program

- A. Site visits and work at the Site may be governed by an Owner safety program. As the General Conditions indicate, if an Owner safety program exists, it will be noted in the Supplementary Conditions.

4.05 Other Work at the Site

- A. Reference is made to Article 8 of the Supplementary Conditions for the identification of the general nature of other work of which Owner is aware (if any) that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) and relates to the Work contemplated by these Bidding Documents. If Owner is party to a written contract for such other work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters), if any.

ARTICLE 5 – BIDDER'S REPRESENTATIONS**5.01 It is the responsibility of each Bidder before submitting a Bid to:**

- A. examine and carefully study the Bidding Documents, and any data and reference items identified in the Bidding Documents;
- B. visit the Site, conduct a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfy itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;
- C. become familiar with and satisfy itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work;
- D. carefully study all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or

subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings;

- E. consider the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs;
- F. agree, based on the information and observations referred to in the preceding paragraph, that at the time of submitting its Bid no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents;
- G. become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;
- H. promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder;
- I. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work; and
- J. agree that the submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

ARTICLE 6 – PRE-BID CONFERENCE

- 6.01 A mandatory pre-Bid conference will be held at the time and location stated in the invitation or advertisement to bid. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are encouraged to attend and participate in the conference. Engineer will transmit to all prospective Bidders of record such Addenda as Engineer considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

ARTICLE 7 – INTERPRETATIONS AND ADDENDA

- 7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to Owner in writing. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all parties recorded as having received the Bidding Documents. Questions received less than seven calendar days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.02 Addenda may be issued to clarify, correct, supplement, or change the Bidding Documents.

ARTICLE 8 – BID SECURITY

- 8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of 10% (ten percent) of Bidder's maximum Bid price (determined by adding the base bid and all alternates) and in the form of a certified check, bank money order, or a Bid bond (on the form included in the Bidding Documents) issued by a surety meeting the requirements of Paragraphs 6.01 and 6.02 of the General Conditions.
- 8.02 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract Documents, furnished the required contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited. Such forfeiture shall be Owner's exclusive remedy if Bidder defaults.
- 8.03 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of seven days after the Effective Date of the Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.
- 8.04 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within seven days after the Bid opening.

ARTICLE 9 – CONTRACT TIMES

- 9.01 The number of days within which, or the dates by which, the Work is to be substantially completed, and completed and ready for final payment, are set forth in the Agreement.

ARTICLE 10 – LIQUIDATED DAMAGES

- 10.01 Provisions for liquidated damages, if any, for failure to timely attain a Milestone, Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Agreement.

ARTICLE 11 – SUBSTITUTE AND "OR-EQUAL" ITEMS

- 11.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, and those "or-equal" or substitute or materials and equipment subsequently approved by Engineer prior to the submittal of Bids and identified by Addendum. No item of material or equipment will be considered by Engineer as an "or-equal" or substitute unless written request for approval has been submitted by Bidder and has been received by Engineer at least 15 days prior to the date for receipt of Bids. Each such request shall comply with the requirements of Paragraphs 7.04 and 7.05 of the General Conditions. The burden of proof of the merit of the proposed item is upon Bidder. Engineer's decision of approval or disapproval of a proposed item will be final. If Engineer approves any such proposed item, such approval will be set forth in an Addendum issued to all prospective Bidders. Bidders shall not rely upon approvals made in any other manner.
- 11.02 All prices that Bidder sets forth in its Bid shall be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as

supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of "or-equal" or substitution requests are made at Bidder's sole risk.

ARTICLE 12 – SUBCONTRACTORS, SUPPLIERS, AND OTHERS

- 12.01 A Bidder shall be prepared to retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of the Work if required by the Bidding Documents (most commonly in the Specifications) to do so. If a prospective Bidder objects to retaining any such Subcontractor, Supplier, or other individual or entity, and the concern is not relieved by an Addendum, then the prospective Bidder should refrain from submitting a Bid.
- 12.02 Subsequent to the submittal of the Bid, Owner may not require the Successful Bidder or Contractor to retain any Subcontractor, Supplier, or other individual or entity against which Contractor has reasonable objection.
- 12.03 The apparent Successful Bidder, and any other Bidder so requested, shall within three business days after Bid opening, submit to Owner qualifications information for the Subcontractors or Suppliers proposed for the following portions of the Work: **Welded Steel Tank Fabricator**
- If requested by Owner, such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, or other individual or entity. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case apparent Successful Bidder shall submit a substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.
- 12.04 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, or other individuals or entities. Declining to make requested substitutions will not constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.06 of the General Conditions.

ARTICLE 13 – PREPARATION OF BID

- 13.01 The Bid Form is included with the Bidding Documents.
- A. All blanks on the Bid Form shall be completed in ink and the Bid Form signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each section, Bid item, alternate, adjustment unit price item, and unit price item listed therein.
- B. If the Bid Form expressly indicates that submitting pricing on a specific alternate item is optional, and Bidder elects to not furnish pricing for such optional alternate item, then Bidder may enter the words "No Bid" or "Not Applicable."
- 13.02 A Bid by a corporation shall be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation shall be shown.

- 13.03 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The partnership's address for receiving notices shall be shown.
- 13.04 A Bid by a limited liability company shall be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the firm's address for receiving notices shall be shown.
- 13.05 A Bid by an individual shall show the Bidder's name and address for receiving notices.
- 13.06 A Bid by a joint venture shall be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture's address for receiving notices shall be shown.
- 13.07 All names shall be printed in ink below the signatures.
- 13.08 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form.
- 13.09 Postal and e-mail addresses and telephone number for communications regarding the Bid shall be shown.
- 13.10 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state where the Project is located, or Bidder shall covenant in writing to obtain such authority and qualification prior to award of the Contract and attach such covenant to the Bid. Bidder's state contractor license number, if any, shall also be shown on the Bid Form.

ARTICLE 14 – BASIS OF BID

14.01 *Unit Price*

- A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the unit price section of the Bid Form.
- B. The "Bid Price" (sometimes referred to as the extended price) for each unit price Bid item will be the product of the "Estimated Quantity" (which Owner or its representative has set forth in the Bid Form) for the item and the corresponding "Bid Unit Price" offered by the Bidder. The total of all unit price Bid items will be the sum of these "Bid Prices"; such total will be used by Owner for Bid comparison purposes. The final quantities and Contract Price will be determined in accordance with Paragraph 13.03 of the General Conditions.
- C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

14.02 *Allowances*

- A. For cash allowances the Bid price shall include such amounts as the Bidder deems proper for Contractor's overhead, costs, profit, and other expenses on account of cash allowances, if any, named in the Contract Documents, in accordance with Paragraph 13.02.B of the General Conditions.
- B. If the Owner includes reimbursement allowances, the allowance value will be pre-entered in the Bid Form.

ARTICLE 15 – SUBMITTAL OF BID

- 15.01 With each copy of the Bidding Documents, a Bidder is furnished one separate unbound copy of the Bid Form, and, if required, the Bid Bond Form. The unbound copy of the Bid Form is to be completed and submitted with the Bid security and the other documents required to be submitted under the terms of Article 7 of the Bid Form.
- 15.02 A Bid shall be received no later than the date and time prescribed and at the place indicated in the advertisement or invitation to bid and shall be enclosed in a plainly marked package with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid shall be addressed to Marina Coast Water District, 11 Reservation Road, Marina, CA 93933, ATTN: District Engineer.
- 15.03 Bids received after the date and time prescribed for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

ARTICLE 16 – MODIFICATION AND WITHDRAWAL OF BID

- 16.01 A Bid may be withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.
- 16.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 16.01 and submit a new Bid prior to the date and time for the opening of Bids.
- 16.03 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, that Bidder will be disqualified from further bidding on the Work.

ARTICLE 17 – OPENING OF BIDS

- 17.01 Bids will be opened at the time and place indicated in the advertisement or invitation to bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 18 – BIDS TO REMAIN SUBJECT TO ACCEPTANCE

- 18.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 19 – EVALUATION OF BIDS AND AWARD OF CONTRACT

- 19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner will reject the Bid of any Bidder that

Owner finds, after reasonable inquiry and evaluation, to not be responsible. If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, then the Owner will reject the Bid as nonresponsive; provided that Owner also reserves the right to waive all minor informalities not involving price, time, or changes in the Work.

19.02 If Owner awards the contract for the Work, such award shall be to the responsible Bidder submitting the lowest responsive Bid.

19.03 Evaluation of Bids

- A. In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.
- B. In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers proposed for those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.
- C. Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

ARTICLE 20 – BONDS AND INSURANCE

20.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds and insurance. When the Successful Bidder delivers the Agreement (executed by Successful Bidder) to Owner, it shall be accompanied by required bonds and insurance documentation.

ARTICLE 21 – SIGNING OF AGREEMENT

21.01 When Owner issues a Notice of Award to the Successful Bidder, it shall be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder shall execute and deliver the required number of counterparts of the Agreement (and any bonds and insurance documentation required to be delivered by the Contract Documents) to Owner. Within ten days thereafter, Owner shall deliver one fully executed counterpart of the Agreement to Successful Bidder, together with printed and electronic copies of the Contract Documents as stated in Paragraph 2.02 of the General Conditions.

ARTICLE 22 – SALES AND USE TAXES (NOT USED)

ARTICLE 23 – RETAINAGE

23.01 Provisions concerning Contractor's rights to deposit securities in lieu of retainage are set forth in the Supplemental Conditions.

ARTICLE 24 – PREVAILING WAGE

24.01 Prevailing wage requirements are set forth in the Supplementary Conditions.

END OF DOCUMENT

BID FORM

**CIP # RW-0156, REGIONAL URBAN WATER MANAGEMENT PROJECT
RECYCLED WATER PIPELINE AND BLACKHORSE RECYCLED WATER RESERVOIR**

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ARTICLE 1 – BID RECIPIENT

1.01 This Bid is submitted to:

Marina Coast Water District

11 Reservation Road

Marina, CA 93933

ATTN: District Engineer

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 – BIDDER’S ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 90 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 3 – BIDDER’S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, and any data and reference items identified in the Bidding Documents, and hereby acknowledges receipt of the following Addenda:

<u>Addendum No.</u>	<u>Addendum, Date</u>
_____	_____
_____	_____
_____	_____
_____	_____

B. Bidder has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfied itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder is familiar with and has satisfied itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.

- E. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and any Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs.
- F. Bidder agrees, based on the information and observations referred to in the preceding paragraph, that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.
- G. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
- H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and confirms that the written resolution thereof by Engineer is acceptable to Bidder.
- I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work.
- J. The submission of this Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, and that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

ARTICLE 4 – BIDDER'S CERTIFICATION

4.01 Bidder certifies that:

- A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;
- B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;
- C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and
- D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:
 - 1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process;
 - 2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
 - 3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

ARTICLE 5 – BASIS OF BID

- 5.01 Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

Item No.	Description	Unit	Estimated Quantity	Bid Unit Price	Bid Price
1	Mobilization and Demobilization	LS	1		
2	Sheeting, Shoring & Bracing	LS	1		
3	Traffic Control	LS	1		
4	24-inch Transmission Main (Non-paved Areas)	LF	28,115		
5	24-inch Transmission Main (Paved Areas)	LF	11,420		
6	24-inch Transmission Main (Jack and Bore)	LF	380		
7	24-inch Butterfly Valves	EA	35		
8	Blow-off Assemblies	EA	25		
9	1-inch Combination Air/Vacuum Valves	EA	26		
10	Dual 3-inch ARV Assembly	EA	1		
11	Fill Stations	EA	3		
12	24-inch Customer Turnout	EA	5		
13	16-inch Customer Turnout	EA	2		
14	12-inch Customer Turnout	EA	5		
15	8-inch Customer Turnout	EA	1		
16	6-inch Customer Turnout	EA	12		
17	Asphalt Concrete Overlay (City of Marina)	SY	61,820		
18	Misc Asphalt Concrete Repairs (allowance for areas outside Marina)	SY	2,000		
19	All Weather Access Road - 6" Crushed Rock	SY	12,338		
20	Blackhorse Reservoir (excluding work covered by Items 21-24)	LS	1		
21	Over-Excavation and Backfill Beneath Blackhorse Reservoir	CY	26,049		
22	Allowance for Additional Over-Excavation and Backfill at Blackhorse Reservoir	ALW	1	\$50,000	\$50,000
23	Potable Water Backup Pumping System	LS	1		
24	Electrical Studies	LS	1		
25	Test Existing 16" RW Pipe on CSUMB Campus	LS	1		
Total of All Unit Price Bid Items					\$

ALW=Allowance, CF=Cubic Foot, CY=Cubic Yard, DY=Day, HR=Hour, LF=Linear Foot, LS=Lump Sum, SF=Square Foot, SY=Square Yard

Bidder acknowledges that (1) each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor’s overhead and profit for each separately identified item, and (2) estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all unit price Bid items will be based on actual quantities, determined as provided in the Contract Documents.

Total of Lump Sum and Unit Price Bids = Total Bid Price \$ _____

ARTICLE 6 – TIME OF COMPLETION

- 6.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.
- 6.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 7 – ATTACHMENTS TO THIS BID

- 7.01 The items listed in Document 00 43 93, Bid Submittal checklist, are submitted with and made a condition of this Bid.

ARTICLE 8 – DEFINED TERMS

- 8.01 The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 9 – BID SUBMITTAL

BIDDER: *[Indicate correct name of bidding entity]*

By: _____
[Signature]

[Printed name]
(If Bidder is a corporation, a limited liability company, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest: _____
[Signature]

[Printed name]

Title: _____

Submittal Date: _____

Address for giving notices:

Telephone Number: _____

Fax Number: _____

Contact Name and e-mail address: _____

Bidder's License No.: _____
(where applicable)

BID BOND

Any singular reference to Bidder, Surety, Owner or other party shall be considered plural where applicable.

BIDDER (*Name and Address*):

SURETY (*Name, and Address of Principal Place of Business*):

OWNER (*Name and Address*):

Marina Coast Water District
11 Reservation Road
Marina, CA 93933

BID

Bid Due Date: June 20, 2017

Description: CIP # RW-0156, REGIONAL URBAN WATER MANAGEMENT PROJECT
RECYCLED WATER PIPELINE AND BLACKHORSE RECYCLED WATER RESERVOIR
MARINA COAST WATER DISTRICT

BOND

Bond Number:

Date:

Penal sum _____ \$ _____
(10% (ten percent) of the Total Bid Value, in Words) (Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

BIDDER

SURETY

(Seal)

(Seal)

Bidder's Name and Corporate Seal

Surety's Name and Corporate Seal

By:

Signature

By:

Signature (Attach Power of Attorney)

Print Name

Print Name

Title

Title

Attest:

Signature

Attest:

Signature

Title

Title

Note: Addresses are to be used for giving any required notice.

Provide execution by any additional parties, such as joint venturers, if necessary.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation shall be null and void if:
 - 3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
 - 3.2 All Bids are rejected by Owner, or
 - 3.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after the Bid due date.
7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

BID SUBMITTAL CHECKLIST

All information required by the terms of the Bid Documents must be furnished. Important items to be submitted are including, but not limited to, those listed below:

ARTICLE 1 - SUBMIT WITH BID

	Form Number	Form Name
<input type="checkbox"/>	00 41 00	Bid Form
<input type="checkbox"/>	No form included	Certificate of Contractor's License
<input type="checkbox"/>	00 43 00	Bid Bond (or Bid Security)
<input type="checkbox"/>	00 45 10	Qualifications Statement
<input type="checkbox"/>	00 45 12	List of Project References
<input type="checkbox"/>	00 45 14	Designation of Subcontractors
<input type="checkbox"/>	00 45 16	List of Suppliers
<input type="checkbox"/>	00 45 18	Designation of Insurance Agent or Broker
<input type="checkbox"/>	00 45 20	Stop Notice Information
<input type="checkbox"/>	00 45 22	Non-Collusion Statement
<input type="checkbox"/>	00 45 24	Prevailing Wage Statement
<input type="checkbox"/>	00 45 26	Public Works Contractor Registration Certification
<input type="checkbox"/>	00 45 28	Local Hiring for Public Works
<input type="checkbox"/>	00 45 30	Iran Contracting Act Certification
<input type="checkbox"/>	00 45 32	American Iron and Steel Certification
<input type="checkbox"/>	00 45 34	Anti-Lobbying Certification
<input type="checkbox"/>	00 45 36	DBE Good Faith Efforts Verification

ARTICLE 2 – SUBMIT PRIOR TO OWNER'S EXECUTION OF CONTRACT (After Notice of Award)

<input type="checkbox"/>	00 52 00	Agreement
<input type="checkbox"/>	00 61 00	Performance Bond
<input type="checkbox"/>	00 61 50	Payment Bond
<input type="checkbox"/>	No form included	Insurance Certificates
	SF-LLL	Disclosure of Lobbying Activities

END OF DOCUMENT

LIST OF PROJECT REFERENCES

**CIP # RW-0156, REGIONAL URBAN WATER MANAGEMENT PROJECT
RECYCLED WATER PIPELINE AND BLACKHORSE RECYCLED WATER RESERVOIR**

SUBMIT WITH BID

The Bidder shall provide three projects that they have successfully completed in the last ten years of like nature (each including at least 1 mile of ductile iron pipe greater than 12-inches) and equaling \$25,000,000 in total value. The Bidder shall provide the project name, owner representative and phone number. The projects listed shall be of similar scope and type as the project identified in this document.

	Project Name	Owner Representative	Owner Phone #	Contract Amount
1				
2				
3				

END OF DOCUMENT

DESIGNATION OF SUBCONTRACTORS

Regional Urban Water Augmentation Project

SUBMIT WITH BID

In compliance with the provisions of Sections 4100-4113 of the Public Contract Code of the State of California, and any amendments thereof, and, if applicable, with the requirements of County relating to projects for the construction, improvement or repair of Public Works, the undersigned bidder has set forth below the name and location of the place of business of each subcontractor who will perform work or labor or render service to the undersigned in or about the construction of the work, and each subcontractor who, under subcontract, will specially fabricate and install a portion of the work or improvement according to detailed drawings contained in the plans and specifications, for such work to be performed under the Contract Documents to which the attached bid is responsive, and the portion of the work which will be done by each subcontractor and for each subcontract in excess of one half of one percent of the undersigned's total aggregate bid. Traffic signal equipment suppliers shall be listed at time of bidding on this form.

Name of Subcontractor	Location (Address, City, Zip, Phone)	Division of Work

COMPANY NAME: _____

By: _____
Bidder's Signature

Date: _____

END OF DOCUMENT

LIST OF SUPPLIERS

Regional Urban Water Augmentation Project

SUBMIT WITH BID

	Supplier	Product
1		
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41		

END OF DOCUMENT

DESIGNATION OF INSURANCE AGENT OR BROKER

**CIP # RW-0156, REGIONAL URBAN WATER MANAGEMENT PROJECT
RECYCLED WATER PIPELINE AND BLACKHORSE RECYCLED WATER RESERVOIR**

SUBMIT WITH BID

It is proposed that the following insurance agent/broker and insurance company will provide policies of insurance or insurance certificates as required by the bid documents.

Insurance Agent or Broker: _____

Street: _____

City, State and Zip: _____

Telephone: _____

Name of Insurance Company
Providing Coverage _____

Best's Key Rating Guide of at least A VII? Yes _____ No _____

It is proposed that the following bonding agent or surety will provide payment and performance bonds as required by the bid documents.

Bonding Agent or Broker: _____

Street: _____

City, State and Zip: _____

Telephone: _____

Name of Surety Company
Providing Bonds: _____

- 1. Admitted in California? Yes _____ NO _____
OR
 Current Treasury Listed Surety (Federal Register)? Yes _____ NO _____
AND
 Current A.M. Best BB or better rating? Yes _____ NO _____
OR
 Current Standard and Poor's Rating of BBB or better? Yes _____ NO _____

2. (in lieu of 1)

An admitted surety insurer which complies with the provisions of the code of Civil Procedure, Section 995.660*.

California Code of Civil Procedure Section 995.660 in summary, states that an admitted surety must provide 1) the original, or a certified copy of instrument authorizing the person who executed the bond to do so; 2) a certified copy of the Certificate of Authority issued by the Insurance Commissioner, 3) a certificate from county Clerk of Monterey County that Certificate of Authority has not been surrendered, revoked, canceled, annulled or suspended; 4) a financial statement showing the assets and liabilities of the insurer at the end of the quarter calendar year, prior to 30 days next preceding the date of the execution of the bond.

OR

3. In lieu of 1 and 2, a company of equal financial size and stability that is approved by the MCWD Insurance/Risk Manager.

By signing below, the bidder certifies that:

The above comply with the MCWD standards for liability insurers and sureties pursuant to Article 6 of the General and Supplementary Conditions: Yes _____ NO _____. If "No", your bid is subject to rejection.

COMPANY NAME: _____

BY: _____
(Bidder's signature)

DATE: _____

END OF DOCUMENT

STOP NOTICE INFORMATION

SUBMIT WITH BID

PROJECT NAME: CIP # RW-0156, REGIONAL URBAN WATER MANAGEMENT PROJECT
RECYCLED WATER PIPELINE AND BLACKHORSE RECYCLED WATER RESERVOIR

CONTRACTOR’S NAME AND ADDRESS: _____

Reference: California Civil Code, Division 3, Part 4, Title 15, Chapter 4

The following is provided for the information of contractors, subcontractors and suppliers of labor, materials, equipment, and services under MCWD contracts, and is not intended as legal advice. Advice of legal counsel should be obtained to ensure compliance with legal requirements relating to public works stop notices.

WHERE TO FILE: All original stop notices and preliminary-20 day notices (if required by California Civil Code 53098) must be filed with the Marina Coast Water District, 11 Reservation Road, Marina, CA 93933.

STOP NOTICE CONTENTS: See California Civil Code 3103. written notice, signed and verified by the claimant and including information such as the kind of labor, equipment, materials or service furnished or agreed to be furnished by the claimant; the name of the person/entity to or for whom the same was done or furnished; the amount in value of that already done or furnished and/or agreed to be done or furnished. Blank stop Notice forms are commercially available.

WHO MAY SERVE STOP NOTICE: See California Code 53181. All persons furnishing labor, materials, equipment or services to the job (except the original contractor) and persons furnishing provisions, provender or other supplies.

HOW THE STOP NOTICE IS SERVED: See California Code S3103. Served by personal service, registered mail, or certified mail.

TIME FOR SERVICE: See California Civil Code 3184. Stop notices must be served before the expiration of 30 days after the recording of a Notice of Completion (sometimes referred to as a Notice of Acceptance) or Notice of Cessation, if such notice is recorded or if no Notice of Completion or Notice of Cessation is recorded, 90 days after actual completion or cessation.

NOTICE OF PUBLIC ENTITY (OWNER): See California Civil Code 3185. Provided that a stop notice claimant has paid to the Clerk of the Board of Supervisors the sum of \$2.00 at the time of filing a stop notice, the Clerk shall provide each stop notice claimant with notice of filing of a Notice of

Completion or after the cessation of labor has been deemed a completion of a public work or after the acceptance of completion, whichever is later, to each stop notice claimant, by personal service or registered or certified mail.

RELEASE OF STOP NOTICE: See California Civil Code 3196 and following. A stop notice can be released if the original contractor files a corporate surety bond with the Clerk of the Board of Supervisors, in the amount of 125% of the stop notice claim. Alternatively, the original contractor may file an affidavit pursuant to California Civil Code S3198, stating objections to the validity of the stop notice. A counter affidavit may be filed by the claimant pursuant to 53200 and a summary legal proceeding may be held pursuant to 3201 and following, to determine the validity of the stop notice. If no counter affidavit is filed, the stop notice funds shall be released. Alternatively, the Stop Notice claimant may file a Release in a form which substantially complies with California Civil Code 3262.

STOP NOTICE LAWSUIT: See California Civil Code 53210 through 3214. These sections provide that a stop notice is perfected only by the filing of a lawsuit. A lawsuit must be filed no sooner than 10 days after service of a stop notice and no later than 90 days after the expiration of the time for filing stop notices. Notice of suit must be given to the Clerk of the Board within 5 days after commencement. The Court has the discretionary right to dismiss the lawsuit if it is not brought to trail within two years.

I HEREBY ACKNOWLEDGE THAT I RECEIVED AND READ THE ABOVE STOP NOTICE INFORMATION AND IF I AM AWARDED THIS CONTRACT, I AGREE TO INCLUDE A COPY OF THIS PAGE IN ALL SUBCONTRACTS AND CONTRACTS FOR LABOR, MATERIALS, EQUIPMENT, AND SERVICES THAT I ENTER INTO FOR THIS PROJECT:

Bidder's Signature: _____

Bidder's Name and Title (Print): _____

Date: _____

END OF DOCUMENT

NON-COLLUSION DECLARATION TO BE EXECUTED BY BIDDER

CIP # RW-0156, REGIONAL URBAN WATER MANAGEMENT PROJECT
RECYCLED WATER PIPELINE AND BLACKHORSE RECYCLED WATER RESERVOIR

SUBMIT WITH BID

I, _____, am the
(name)
_____ of _____,
(Position Title) (Company)

the party making the foregoing bid that the bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or sham; that the bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid; and has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that the bidder has not in any manner directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder or any other bidder, or to fix any overhead, profit, or cost element of the bid price, or of that of any other bidder, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and, further, that the bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, company association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct:

Signature

Date

END OF DOCUMENT

PREVAILING WAGE STATEMENT

SUBMIT WITH BID

If awarded the contract, we and our subcontractors shall pay all the workers we assign to the project not less than the prevailing wage as determined by the state of California, Director of Industrial Relations in compliance with Article 7 of the Supplementary Conditions. We are aware that the contractor shall be penalized for non-compliance by either the contractor or his subcontractor(s).

In addition, we are informed of the following:

Copies of the prevailing wage rates are on file at:

Marina Coast Water District
11 Reservation Road
Marina, CA 93933

or

State of California Department of Industrial Relations
Division of Labor Statistics and Research
455 Golden Gate Avenue, 10th Floor
San Francisco, CA 94104
(415) 703-4774

On-line at <https://www.dir.ca.gov/oprl/DPreWageDetermination.htm>

The successful bidder shall be required to post the prevailing wage determinations at each job site.

Each contractor and subcontractor shall keep accurate payroll records showing the name, address, social security number, work classification, straight time and overtime hours worked each day and week, and the actual per them wages paid to each journeyman, apprentice, worker or other employee employed by him or her in connection the public work.

Certified copies of such payroll records must be furnished to the State or Marina Coast Water District upon request.

By signing below, the bidder certifies that he shall comply with the prevailing wage laws.

Company Name: _____

Bidder's Signature: _____

Date: _____

END OF DOCUMENT

PUBLIC WORKS CONTRACTOR REGISTRATION CERTIFICATION

SUBMIT WITH BID

Pursuant to Labor Code sections 1725.5 and 1771.1, all contractors and subcontractors that wish to bid on, be listed in a bid proposal, or enter into a contract to perform public work must be registered with the Department of Industrial Relations. See <http://www.dir.ca.gov/Public-Works/PublicWorks.html> for additional information.

No bid will be accepted nor any contract entered into without proof of the contractor's and subcontractors' current registration with the Department of Industrial Relations to perform public work.

Bidder hereby certifies that it is aware of the registration requirements set forth in Labor Code sections 1725.5 and 1771.1 and is currently registered as a contractor with the Department of Industrial Relations.

Name of Bidder: _____

DIR Registration Number: _____

Bidder further acknowledges:

1. Bidder shall maintain a current DIR registration for the duration of the project.
2. Bidder shall include the requirements of Labor Code sections 1725.5 and 1771.1 in its contract with subcontractors and ensure that all subcontractors are registered at the time of bid opening and maintain registration status for the duration of the project.
3. Failure to submit this form or comply with any of the above requirements may result in a finding that the bid is non-responsive.

Bidder's Signature: _____

Bidder's Name and Title: _____

Firm: _____

Date: _____

END OF DOCUMENT

IRAN CONTRACTING ACT CERTIFICATION

SUBMIT WITH BID

Reference: Public Contract Code Section 2200 et seq.

As required by California Public Contract Code Section 2204, the Contractor certifies subject to penalty for perjury that the option checked below relating to the Contractor's status in regard to the Iran Contracting Act of 2010 (Public Contract Code Section 2200 et seq.) is true and correct:

The Contractor is not:

(i) identified on the current list of persons and entities engaging in investment activities in Iran prepared by the California Department of General Services in accordance with subdivision (b) of Public Contract Code Section 2203; or

(ii) a financial institution that extends, for 45 days or more, credit in the amount of \$20,000,000 or more to any other person or entity identified on the current list of persons and entities engaging in investment activities in Iran prepared by the California Department of General Services in accordance with subdivision (b) of Public Contract Code Section 2203, if that person or entity uses or will use the credit to provide goods or services in the energy sector in Iran.

MCWD has exempted the Contractor from the requirements of the Iran Contracting Act of 2010 after making a public finding that, absent the exemption, MCWD will be unable to obtain the goods and/or services to be provided pursuant to the Contract.

The amount of the Contract payable to the Contractor for the Project does not exceed \$1,000,000.

Bidder's Signature: _____

Bidder's Name and Title: _____

Firm: _____

Date: _____

Note: In accordance with Public Contract Code Section 2205, false certification of this form shall be reported to the California Attorney General and may result in civil penalties equal to the greater of \$250,000 or twice the Contract amount, termination of the Contract and/or ineligibility to bid on contracts for three years.

END OF DOCUMENT

AMERICAN IRON AND STEEL CERTIFICATION

SUBMIT WITH BID

1. Identification of American-made Iron and Steel Products: The Bidder certifies that this bid effects the Bidder's best, good faith effort to identify domestic sources of iron and steel products for every component contained in the bid solicitation where such American-made components are required. The term "iron and steel products" means the following products made primarily of iron or steel - lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials.

2. Verification of U.S. Production: If this bid is accepted, the Bidder agrees that it will provide, to the Owner, reasonable, sufficient, and timely verification of the U.S. production of each Iron and Steel Product incorporated into the Project.

3. Documentation Regarding Non-American-made Iron and Steel: The Bidder certifies that for any Iron or Steel Product that is not American-made but was incorporated in the development of this bid, is allowed by waiver of the U.S. Environmental Protection Agency and such waiver is attached to this certification.

4. Warranty of Bidder: The Bidder hereby represents and warrants to and for the benefit of Owner that (a) Bidder has reviewed and understands the American Iron and Steel Requirement, and (b) if the bid is selected, all of the iron and steel products used in the project will be produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is attached to this certification.

Bidder's Signature: _____

Bidder's Name and Title: _____

Firm: _____

Date: _____

Q & A's, Waiver request instructions, and a list of approved waivers can be found at http://water.epa.gov/grants_funding/aisrequirement.cfm

END OF DOCUMENT

ANTI-LOBBYING CERTIFICATION

SUBMIT WITH BID

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form LLL, "Disclosure of Lobbying Activities," in accordance with its instructions. A copy of this form is included as part of the SRF Funding Requirements section of the Contract Documents.

(3) The undersigned shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including sub-contracts, sub grants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

Typed Name & Title of Authorized Representative

Signature and Date of Authorized Representative

END OF DOCUMENT

DBE GOOD FAITH EFFORT VERIFICATION

SUBMIT WITHIN 3 DAYS OF BID OPENING

Project: _____ Bid Opening Date: _____
 Bidder Name: _____ Bidder Phone Number: _____
 Bidder Address: _____

Owner, in accordance with 40 CFR part 33, requires bidders to provide information pertaining to the use of minority businesses, women's business enterprises, and labor surplus area firms (referred to herein as "DBEs").

Please provide the following information, using additional sheets of paper if necessary, and submit this form with your bid. Bidder should also submit mail logs, phone logs, electronic searches and communication, newspaper clippings or similar records documenting efforts to meet the Good Faith Effort requirements.

1. Solicitation Lists/Publications. The names and dates of each publication in which a request for DBE participation for this project was placed by the bidder (please attach copies of advertisements or proofs of publication), or information related to solicitation lists on which DBEs were included. Postings/publications should be at least 30 days before the bid closing date.

Publications/Solicitation Lists	Date of Advertisement

2. Soliciting DBEs as Potential Sources. The names and dates of written notices sent to certified DBEs soliciting bids for this project and the dates and methods used for following up initial solicitations to determine with certainty whether the DBEs were interested (please attach copies of solicitations, telephone records, fax confirmations, etc.):

Name of DBEs Solicited	Date of Initial Solicitation	Follow-up Methods and Dates

--	--	--	--	--

4. Delivery Schedules. Efforts made to establish delivery schedules or break down work items, where the requirement permits, which encourage participation by small and minority businesses, and women's business enterprises:

5. Services of Other Agencies. The names of agencies, organizations or groups contacted to provide assistance in contacting, recruiting and using DBE firms, such as the Small Business Administration and the Minority Business Development Agency of the Department of Commerce (please attach copies of requests to agencies and any responses received, i.e., lists, Internet page download, etc.):

Name of Agency/Organization	Method/Date of Contact	Results

6. DBE Forms. Complete the attached State Water Resources Control Board forms **4500-3** (DBE Subcontractor Performance Form) and **4500-4** (DBE Subcontractor Utilization Form) and submit with the bid.

7. Additional Data. Provide any additional data to support a demonstration of good faith efforts (use additional sheets if necessary):

END OF DOCUMENT



**Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Performance Form**

This form is intended to capture the DBE¹ subcontractor's² description of work to be performed and the price of the work submitted to the prime contractor. A Financial Assistance Agreement Recipient must require its prime contractor to have its DBE subcontractors complete this form and include all completed forms in the prime contractor's bid or proposal package.

Subcontractor Name		Project Name	
Bid / Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact	
Address			
Telephone No.		Email Address	
Prime Contractor Name		Issuing/Funding Entity	

Contract Item Number	Description of Work Submitted from the Prime Contractor Involving Construction, Services, Equipment or Supplies	Price of Work Submitted to the Prime Contractor
DBE Certified By: <input type="checkbox"/> DOT <input type="checkbox"/> SBA <input type="checkbox"/> Other: _____		Meets/exceeds EPA certification standards? <input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> Unknown

¹ A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.2015 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.
² Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an award of financial assistance.

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

Prime Contractor Signature	Print Name
Title	Date

Subcontractor Signature	Print Name
Title	Date

The public reporting and record keeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Do not send the completed form to this address.

FORM 4500-3 (DBE Subcontractor Performance Form)



Disadvantaged Business Enterprise (DBE) Program DBE Subcontractor Utilization Form

This form is intended to capture the prime contractor's actual and/or anticipated use of identified certified DBE¹ subcontractor's² and the estimated dollar amount of each subcontract. A Financial Assistance Agreement Recipient must require its prime contractors to complete this form and include it in the bid or proposal package. Prime contractors should also maintain a copy of this form on file.

Prime Contractor Name		Project Name	
Bid / Proposal No.	Assistance Agreement ID No. (if known)	Point of Contact	
Address			
Telephone No.		Email Address	
Issuing/Funding Entity			

I have identified potential DBE certified subcontractors. ___ YES ___ NO If yes, please complete the table below. If no, please explain:			
Subcontractor Name/ Company Name	Company Address / Phone / Email	Estimated Dollar Amount	Currently DBE Certified?

--Continue on back if needed--

¹ A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.2015 or certified by EPA. EPA accepts certifications from entities that meet or exceed EPA certification standards as described in 40 CFR 33.202.

² Subcontractor is defined as a company, firm, joint venture, or individual who enters into an agreement with a contractor to provide services pursuant to an award of financial assistance.

I certify under penalty of perjury that the forgoing statements are true and correct. Signing this form does not signify a commitment to utilize the subcontractors above. I am aware that in the event of a replacement of a subcontractor, I will adhere to the replacement requirements set forth in 40 CFR Part 33 Section 33.302 (c).

Prime Contractor Signature	Print Name
Title	Date

The public reporting and record keeping burden for this collection of information is estimated to average three (3) hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, including through the use of automated collection techniques to the Director, Collection Strategies Division, U.S. Environmental Protection Agency (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Do not send the completed form to this address.

FORM 4500-4 (DBE Subcontractor Utilization Form)

BIDDER'S LIST

SUBMIT WITH BID

Bidder is required to provide the following information for all DBE and non-DBE subcontractors who provided a proposal, bid or quote to the Prime Contractor. Provide this form to all subcontractors and have them complete and return it with their proposal, bid or quote. This information must be submitted with the bid.

Prime Contractor: _____

Project: CIP # RW-0156, REGIONAL URBAN WATER MANAGEMENT PROJECT
RECYCLED WATER PIPELINE AND BLACKHORSE RECYCLED WATER RESERVOIR

<p>Firm Name: _____</p> <p>Business Address: _____</p> <p>Phone: _____ Fax: _____</p> <p>Contact Person: _____</p> <p>E-mail: _____</p> <p>Is the firm currently certified as a DBE? <input type="checkbox"/> No <input type="checkbox"/> Yes Cert. Number: _____</p> <p>Type of work/services/materials proposed by bidder:</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Amount of Bid/Quote: \$ _____</p> <p>Date of Bid/Quote: _____</p>
--

END OF DOCUMENT

NOTICE OF AWARD

Date of Issuance:

Owner: Marina Coast Water District

Owner's Contract No.:

Engineer:

Engineer's Project No.:

Project:

Contract Name:

Bidder:

Bidder's Address:

TO BIDDER:

You are notified that Owner has accepted your Bid dated [_____] for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

_____ .
[describe Work, alternates, or sections of Work awarded]

The Contract Price of the awarded Contract is: \$ _____ *[note if subject to unit prices, or cost-plus]*

unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically. *[revise if multiple copies accompany the Notice of Award]*

a set of the Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 15 days of the date of this Notice of Award:

1. Deliver to Owner [_____] counterparts of the Agreement, fully executed by Bidder.
2. Deliver with the executed Agreement(s) the Contract security *[e.g., performance and payment bonds]* and insurance documentation as specified in the Instructions to Bidders and General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any):

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within ten days after you comply with the above conditions, Owner will return to you one fully executed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner:

Authorized Signature

By:

Title:

Copy: Engineer

AGREEMENT
BETWEEN MARINA COAST WATER DISTRICT
AND _____
FOR THE
REGIONAL URBAN WATER AUGMENTATION PROJECT
RECYCLED WATER PIPELINE AND BLACKHORSE RECYCLED WATER RESERVOIR
CIP# RW-0156

THIS AGREEMENT is by and between Marina Coast Water District (“Owner”) and _____ (“Contractor”).

Owner and Contractor hereby agree as follows:

ARTICLE 1 – WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

The Work includes construction of approximately 40,000 linear feet of 24-inch transmission main pipeline in paved and non-paved roadways and easements, connections to existing facilities, pipeline valves and appurtenances, two bore and jack roadway crossings, a 2.5 MG welded steel reservoir with potable water backup pumping system and associated appurtenances and electrical and SCADA improvements, for a complete in-place operational system.

ARTICLE 2 – THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: CIP # RW-0156, REGIONAL URBAN WATER AUGMENTATION PROJECT RECYCLED WATER PIPELINE AND BLACKHORSE RECYCLED WATER RESERVOIR

ARTICLE 3 – ENGINEER

3.01 The part of the Project that pertains to the Work has been designed by Carollo Engineers, Inc., 2700 Ygnacio Valley Road, Suite 300, Walnut Creek, CA 94598.

3.02 The Owner has retained Carollo Engineers (“Engineer”) to act as Owner’s representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

ARTICLE 4 – CONTRACT TIMES

4.01 *Time of the Essence*

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 *Contract Times: Days*

-
- A. The Work will be substantially completed within 350 calendar days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within 410 calendar days after the date when the Contract Times commence to run.

4.03 *Liquidated Damages*

- A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with the Contract. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):
1. Substantial Completion: Contractor shall pay Owner \$2,000 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified in Paragraph 4.02.A above for Substantial Completion until the Work is substantially complete.
 2. Completion of Remaining Work: After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner \$2,000 for each day that expires after such time until the Work is completed and ready for final payment.
 3. Liquidated damages for failing to timely attain Substantial Completion and final completion are not additive and will not be imposed concurrently.

4.04 *Special Damages*

- A. In addition to the amount provided for liquidated damages, Contractor shall reimburse Owner (1) for any fines or penalties imposed on Owner as a direct result of the Contractor's failure to attain Substantial Completion according to the Contract Times, and (2) for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Substantial Completion (as duly adjusted pursuant to the Contract), until the Work is substantially complete.
- B. After Contractor achieves Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times, Contractor shall reimburse Owner for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Work to be completed and ready for final payment (as duly adjusted pursuant to the Contract), until the Work is completed and ready for final payment.

ARTICLE 5 – CONTRACT PRICE

- 5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents the amounts that follow, subject to adjustment under the Contract:
- A. For all Unit Price Work, an amount equal to the sum of the extended prices (established for each separately identified item of Unit Price Work by multiplying the unit price (adjusted for any math errors in the submitted bid form) times the actual quantity of that item):

Item No.	Description	Unit	Estimated Quantity	Bid Unit Price	Bid Price
1	Mobilization	LS	1		
2	Sheeting, Shoring & Bracing	LS	1		
3	Traffic Control	LS	1		
4	24-inch Transmission Main (Non-paved Areas)	LF	28,115		
5	24-inch Transmission Main (Paved Areas)	LF	11,420		
6	24-inch Transmission Main (Jack and Bore)	LF	380		
7	24-inch Butterfly Valves	EA	35		
8	Blow-off Assemblies	EA	25		
9	1-inch Combination Air/Vacuum Valves	EA	26		
10	Dual 3-inch ARV Assembly	EA	1		
11	Fill Stations	EA	3		
12	24-inch Customer Turnout	EA	5		
13	16-inch Customer Turnout	EA	2		
14	12-inch Customer Turnout	EA	5		
15	8-inch Customer Turnout	EA	1		
16	6-inch Customer Turnout	EA	12		
17	Asphalt Concrete Overlay (City of Marina)	SY	61,820		
18	Misc Asphalt Concrete Repairs (allowance for areas outside Marina)	SY	2,000		
19	All Weather Access Road - 6" Crushed Rock	SY	12,338		
20	Blackhorse Reservoir (excluding work covered by Items 21-24)	LS	1		
21	Over-Excavation and Backfill Beneath Blackhorse Reservoir	CY	26,049		
22	Allowance for Additional Over-Excavation and Backfill at Blackhorse Reservoir	ALW	1	\$50,000	\$50,000
23	Potable Water Backup Pumping System	LS	1		
24	Electrical Studies	LS	1		
25	Test Existing 16" RW Pipe on CSUMB Campus	LS	1		
Total of all Extended Prices for Unit Price Work (subject to final adjustment based on actual quantities)					\$

The extended prices for Unit Price Work set forth as of the Effective Date of the Contract are based on estimated quantities. As provided in Paragraph 13.03 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by Engineer.

ARTICLE 6 – PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

- A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

- A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment on or about the 30th day of each month during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract

- a. 95 percent of Work completed (with the balance being retainage). If the Work has been 50 percent completed as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work remain satisfactory to Owner and Engineer, there will be no additional retainage; and
- b. 50 percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

- B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to 100 percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less 200 percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

- A. Upon final completion and acceptance of the Work in accordance with Paragraph 15.06 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by Engineer as provided in said Paragraph 15.06.

ARTICLE 7 – INTEREST

- 7.01 All amounts not paid when due shall bear interest at the legal rate unless otherwise specified according to California law.

ARTICLE 8 – CONTRACTOR’S REPRESENTATIONS

- 8.01 In order to induce Owner to enter into this Contract, Contractor makes the following representations:
- A. Contractor has examined and carefully studied the Contract Documents, and any data and reference items identified in the Contract Documents.
 - B. Contractor has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
 - C. Contractor is familiar with and is satisfied as to all Laws and Regulations that may affect cost, progress, and performance of the Work.
 - D. Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.
 - E. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Site-related reports and drawings identified in the Contract Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (3) Contractor’s safety precautions and programs.
 - F. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.
 - G. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
 - H. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
 - I. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
 - J. Contractor’s entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

ARTICLE 9 – CONTRACT DOCUMENTS9.01 *Contents*

- A. The Contract Documents consist of the following:
 - 1. This Agreement.

-
2. Performance bond.
 3. Payment bond.
 4. General Conditions.
 5. Supplementary Conditions.
 6. Specifications as listed in the table of contents of the Project Manual.
 7. Drawings (not attached but incorporated by reference) consisting of 95 sheets with each sheet bearing the following general title: Regional Urban Water Augmentation Project RW Pipeline and Blackhorse Recycled Water Reservoir.
 8. Typical Details listed or incorporated into the Project Manual.
 9. Addenda (numbers 1 to , inclusive).
 10. Exhibits to this Agreement (enumerated as follows):
 - a. List of Project References (00 45 12)
 - b. Designation of Subcontractors (00 45 14)
 - c. List of Suppliers (0045 16)
 - d. Designation of Insurance Agent or Broker (00 45 18)
 - e. Stop Notice Information (00 45 20)
 - f. Non-Collusion Declaration (00 45 22)
 - g. Prevailing Wage (00 45 24)
 - h. Public Works Contractor Registration Certification (00 45 26)
 - i. Iran Contracting Act Certification (00 45 30)
 - j. American Iron and Steel Certification (00 45 32)
 - k. Anti-Lobbying Certification (00 45 34)
 - l. DBE Good Faith Efforts Verification (00 45 36)
 - m. Bidder's List (00 45 38)
 11. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
 - a. Notice to Proceed.
 - b. Work Change Directives.
 - c. Change Orders.
 - d. Field Orders.
 12. The standard Plans and Specifications of the Marina Coast Water District, dated November 2007 (not attached but incorporated by reference).
- B. The documents listed in Paragraph 9.01.A are attached to this Agreement (except as expressly noted otherwise above).
- C. There are no Contract Documents other than those listed above in this Article 9.

- D. The Contract Documents may only be amended, modified, or supplemented as provided in the General Conditions.

ARTICLE 10 – MISCELLANEOUS

10.01 *Terms*

- A. Terms used in this Agreement will have the meanings stated in the General Conditions and the Supplementary Conditions.

10.02 *Assignment of Contract*

- A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party hereto of any rights under or interests in the Contract will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

10.03 *Successors and Assigns*

- A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

10.04 *Severability*

- A. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

10.05 *Contractor's Certifications*

- A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 10.05:
1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process or in the Contract execution;
 2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
 3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and
 4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

- 10.06 In accordance with Section 1775, California Labor Code, Contractor shall forfeit to Owner, as a penalty, not more than \$50 for each calendar day, or portion thereof, for each worker paid, either by Contractor or any subcontractor, less than the prevailing rates as determined by the Director of California Department of Industrial Relations for the Work.
- 10.07 In the performance of the Work, a day's work shall be 8 hours of labor in any workday and 40 hours in any work week and any other work as required by Section 510, California Labor Code, and Contractor shall further conform to the requirements of Section 1813, California Labor Code, or forfeit to Owner, as a penalty, the sum of \$25 for each worker employed in the execution of the Work by Contractor or any subcontractor, for each day during which any worker is required or permitted to labor more than 8 hours in any workday or more than 40 hours in any 1 calendar week in violation of Section 510.
- 10.08 Contractor shall carry workers' compensation insurance and require subcontractors to carry workers' compensation insurance as required by Section 3700, California Labor Code.
- 10.09 Pursuant to California Labor Code Section 6705, excavation of any trench or trenches 5 feet or more in depth, involving estimated expenditures in excess of \$25,000 shall require, in advance of excavation, a detailed plan showing the design of shoring, bracing, sloping or other provisions to be made for worker protection prepared by a registered civil or structural engineer.
- 10.10 *Contractor registration:*
- A. Project is subject to compliance monitoring and enforcement by the California Department of Industrial Relations (DIR).
- 10.11 Pursuant to Section 1770 et seq., California Labor Code, the successful Bidder shall pay not less than the prevailing rate of per diem wages as determined by the Director of California Department of Industrial Relations. A copy of such prevailing rate is on file at the offices of the [Owner], which copy will be made available for examination during business hours to any party on request.
- 10.12 Contractor, by signing this Agreement, certifies the following: "I am aware of the provisions of Section 3700 of the Labor Code which require every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of the Work of this Contract."
- 10.13 Nothing in this Agreement shall prevent Contractor or any Subcontractor from employing properly registered apprentices in the execution of the Agreement. Contractor shall have responsibility for compliance with California Labor Code Section 1777.5 for all apprenticeable occupations.
- 10.14 *Other Provisions*
- A. Owner stipulates that the General Conditions that are made a part of this Contract are the EJCDC® C-700, Standard General Conditions for the Construction Contract, published by the Engineers Joint Contract Documents Committee®, with modifications made solely in the Supplementary Conditions.
- B. Since this Project is funded in whole or in part with SRF funds, the work must also comply with the minimum rates for wages for laborers and mechanics as determined by the Secretary of Labor in accordance with the provisions of Davis-Bacon. As between the State and Federal rates, the higher of the two rates must be paid. Attention is directed to the SRF Funding Requirements section of the Contract Documents.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on _____ (which is the Effective Date of the Contract).

OWNER:

CONTRACTOR:

By: _____

By: _____

Title: General Manager

Title: _____

(If Contractor is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest: _____

Attest: _____

Title: _____

Title: _____

Address for giving notices:

Address for giving notices:

Marina Coast Water District

11 Reservation Road

Marina, CA 93933

License No.: _____

(where applicable)

NOTICE TO PROCEED

Owner:	Marina Coast Water District	Owner's Contract No.:
Contractor:		Contractor's Project No.:
Engineer:		Engineer's Project No.:
Project:		Contract Name:
		Effective Date of Contract:

TO CONTRACTOR:

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on [_____, 20__]. [see Paragraph 4.01 of the General Conditions]

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work shall be done at the Site prior to such date. In accordance with the Agreement, [the date of Substantial Completion is _____, and the date of readiness for final payment is _____] **or** [the number of days to achieve Substantial Completion is _____, and the number of days to achieve readiness for final payment is _____].

Before starting any Work at the Site, Contractor must comply with the following:
[Note any access limitations, security procedures, or other restrictions]

Owner:

Authorized Signature

By:

Title:

Date Issued:

Copy: Engineer

PERFORMANCE BOND

CONTRACTOR *(name and address):*

SURETY *(name and address of principal place of business):*

OWNER *(name and address):*

Marina Coast Water District
11 Reservation Road, Marina, CA 93933

CONSTRUCTION CONTRACT

Effective Date of the Agreement:

Amount:

Description *(name and location):*

BOND

Bond Number:

Date *(not earlier than the Effective Date of the Agreement of the Construction Contract):*

Amount:

Modifications to this Bond Form: None See Paragraph 16

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

SURETY

Contractor's Name and Corporate Seal *(seal)*

Surety's Name and Corporate Seal *(seal)*

By: _____
Signature

By: _____
Signature *(attach power of attorney)*

Print Name

Print Name

Title

Title

Attest: _____
Signature

Attest: _____
Signature

Title

Title

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after:

3.1 The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

3.2 The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

3.3 The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence,

to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

7.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

7.2 additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

7.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

11. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit shall be applicable.

14.2 Construction Contract: The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

12. Notice to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

14.3 Contractor Default: Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

14.4 Owner Default: Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

14. Definitions

14.5 Contract Documents: All the documents that comprise the agreement between the Owner and Contractor.

14.1 Balance of the Contract Price: The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other

15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

16. Modifications to this Bond are as follows:

PAYMENT BOND

CONTRACTOR *(name and address):*

SURETY *(name and address of principal place of business):*

OWNER *(name and address):*

Marina Coast Water District
11 Reservation Road, Marina, CA 93933

CONSTRUCTION CONTRACT

Effective Date of the Agreement:
Amount:
Description *(name and location):*

BOND

Bond Number:
Date *(not earlier than the Effective Date of the Agreement of the Construction Contract):*
Amount:
Modifications to this Bond Form: None See Paragraph 18

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL

SURETY

Contractor's Name and Corporate Seal *(seal)*

Surety's Name and Corporate Seal *(seal)*

By: _____
Signature

By: _____
Signature *(attach power of attorney)*

Print Name

Print Name

Title

Title

Attest: _____
Signature

Attest: _____
Signature

Title

Title

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.
2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.
4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.
5. The Surety's obligations to a Claimant under this Bond shall arise after the following:
 - 5.1 Claimants who do not have a direct contract with the Contractor,
 - 5.1.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
 - 5.1.2 have sent a Claim to the Surety (at the address described in Paragraph 13).
 - 5.2 Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).
6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.
7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:
 - 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and
 - 7.2 Pay or arrange for payment of any undisputed amounts.
 - 7.3 The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.
8. The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.
9. Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.
10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.
11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

12. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

13. Notice and Claims to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. **Definitions**

16.1 **Claim:** A written statement by the Claimant including at a minimum:

1. The name of the Claimant;
2. The name of the person for whom the labor was done, or materials or equipment furnished;
3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;
4. A brief description of the labor, materials, or equipment furnished;
5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
7. The total amount of previous payments received by the Claimant; and

8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

16.2 **Claimant:** An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic’s lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms of “labor, materials, or equipment” that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor’s subcontractors, and all other items for which a mechanic’s lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.3 **Construction Contract:** The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

16.4 **Owner Default:** Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

16.5 **Contract Documents:** All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

18. Modifications to this Bond are as follows:

CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner: Marina Coast Water District
Contractor:
Engineer:
Project:

Owner's Contract No.:
Contractor's Project No.:
Engineer's Project No.:
Contract Name:

This [preliminary] [final] Certificate of Substantial Completion applies to:

- All Work The following specified portions of the Work:

Date of Substantial Completion

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Work or portion thereof designated above is hereby established, subject to the provisions of the Contract pertaining to Substantial Completion. The date of Substantial Completion in the final Certificate of Substantial Completion marks the commencement of the contractual correction period and applicable warranties required by the Contract.

A punch list of items to be completed or corrected is attached to this Certificate. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner's use or occupancy of the Work shall be as provided in the Contract, except as amended as follows: *[Note: Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.]*

Amendments to Owner's responsibilities: None As follows

Amendments to Contractor's responsibilities: None As follows:

The following documents are attached to and made a part of this Certificate: *[punch list; others]*

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents, nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract.

EXECUTED BY ENGINEER:		RECEIVED:		RECEIVED:	
By: _____	By: _____	By: _____	By: _____	By: _____	By: _____
(Authorized signature)	Owner (Authorized Signature)	Owner (Authorized Signature)	Contractor (Authorized Signature)	Contractor (Authorized Signature)	Contractor (Authorized Signature)
Title: _____	Title: _____	Title: _____	Title: _____	Title: _____	Title: _____
Date: _____	Date: _____	Date: _____	Date: _____	Date: _____	Date: _____

**DOCUMENT 00 72 00
STANDARD GENERAL CONDITIONS
OF THE CONSTRUCTION CONTRACT**

Prepared by



Issued and Published Jointly by



Endorsed by



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National Society of Professional Engineers
1420 King Street, Alexandria, VA 22314-2794
(703) 684-2882
www.nspe.org

American Council of Engineering Companies
1015 15th Street N.W., Washington, DC 20005
(202) 347-7474
www.acec.org

American Society of Civil Engineers
1801 Alexander Bell Drive, Reston, VA 20191-4400
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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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ARTICLE 1 – DEFINITIONS AND TERMINOLOGY**1.01 Defined Terms**

- A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
 2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.
 3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
 4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 5. *Bidder*—An individual or entity that submits a Bid to Owner.
 6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.
 7. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.
 8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.
 9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.
 10. *Claim*—(a) A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein: seeking an adjustment of Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract; or (b) a demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision

regarding a Change Proposal; or seeking resolution of a contractual issue that Engineer has declined to address. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. (“CERCLA”); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5101 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. (“RCRA”); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.
12. *Contract*—The entire and integrated written contract between the Owner and Contractor concerning the Work.
13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.
14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents. .
15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.
16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.
17. *Cost of the Work*—See Paragraph 13.01 for definition.
18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.
19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.
20. *Engineer*—The individual or entity named as such in the Agreement.
21. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.
22. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.
23. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
24. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

25. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date or by a time prior to Substantial Completion of all the Work.
26. *Notice of Award*—The written notice by Owner to a Bidder of Owner’s acceptance of the Bid.
27. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.
28. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.
29. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor’s plan to accomplish the Work within the Contract Times.
30. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.
31. *Project Manual*—The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.
32. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative or “RPR” includes any assistants or field staff of Resident Project Representative.
33. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.
34. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer’s review of the submittals and the performance of related construction activities.
35. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor’s Applications for Payment.
36. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.
37. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands furnished by Owner which are designated for the use of Contractor.

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38. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.
 39. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.
 40. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion thereof.
 41. *Successful Bidder*—The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.
 42. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.
 43. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.
 44. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.
 45. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
 46. *Unit Price Work*—Work to be paid for on the basis of unit prices.
 47. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.
 48. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 Terminology

- A. The words and terms discussed in the following paragraphs are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.
- B. *Intent of Certain Terms or Adjectives:*
1. The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.
- C. *Day:*
1. The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.
- D. *Defective:*
1. The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
 - a. does not conform to the Contract Documents; or
 - b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
 - c. has been damaged prior to Engineer’s recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or 15.04).
- E. *Furnish, Install, Perform, Provide:*
1. The word “furnish,” when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
 2. The word “install,” when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
 3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
 4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words

“furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

- F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

- A. *Bonds*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.
- B. *Evidence of Contractor’s Insurance*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract), the certificates and other evidence of insurance required to be provided by Contractor in accordance with Article 6.
- C. *Evidence of Owner’s Insurance*: After receipt of the executed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or otherwise), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

- A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.
- B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

- A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise specifically required by the Contract Documents), Contractor shall submit to Engineer for timely review:
1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;
 2. a preliminary Schedule of Submittals; and
 3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.
- B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Initial Acceptance of Schedules*

- A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.03.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.
 - 1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.
 - 2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.
 - 3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

2.06 *Electronic Transmittals*

- A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other submittals, in electronic media or digital format, either directly, or through access to a secure Project website.
- B. If the Contract does not establish protocols for electronic or digital transmittals, then Owner, Engineer, and Contractor shall jointly develop such protocols.
- C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE**3.01 Intent**

- A. The Contract Documents are complementary; what is required by one is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents.
- C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic or digital versions of the Contract Documents (including any printed copies derived from such electronic or digital versions) and the printed record version, the printed record version shall govern.
- D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.
- E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

3.02 Reference Standards

- A. Standards Specifications, Codes, Laws and Regulations
 - 1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
 - 2. No provision of any such standard specification, manual, reference standard, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 Reporting and Resolving Discrepancies

- A. *Reporting Discrepancies:*
 - 1. *Contractor's Verification of Figures and Field Measurements:* Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.

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2. *Contractor's Review of Contract Documents:* If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract Documents issued pursuant to Paragraph 11.01.
 3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.
- B. *Resolving Discrepancies:*
1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:
 - a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or
 - b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).
- 3.04 *Requirements of the Contract Documents*
- A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work thereunder.
 - B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.
 - C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly give written notice to Owner and Contractor that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

- A. Contractor and its Subcontractors and Suppliers shall not:
 - 1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or
 - 2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.
- B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

- A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

- A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to such date.

4.03 *Reference Points*

- A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.
 - 1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

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2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 11.
- B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.
- 4.05 *Delays in Contractor's Progress*
- A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Times and Contract Price. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.
- C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:
1. severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;
 2. abnormal weather conditions;
 3. acts or failures to act of utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and
 4. acts of war or terrorism.
- D. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5.
- E. Paragraph 8.03 governs delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.
- F. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor.
- G. Contractor must submit any Change Proposal seeking an adjustment in Contract Price or Contract Times under this paragraph within 30 days of the commencement of the delaying, disrupting, or interfering event.

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS**5.01 Availability of Lands**

- A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.
- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 Use of Site and Other Areas

- A. *Limitation on Use of Site and Other Areas:*
 - 1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.
 - 2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.12, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or at law; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.
- B. *Removal of Debris During Performance of the Work:* During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste

materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

- C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.
- D. *Loading of Structures*: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

- A. *Reports and Drawings*: The Supplementary Conditions identify:
 - 1. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site;
 - 2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities); and
 - 3. Technical Data contained in such reports and drawings.
- B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:
 - 1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
 - 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
 - 3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.04 *Differing Subsurface or Physical Conditions*

- A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site either:
 - 1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate; or
 - 2. is of such a nature as to require a change in the Drawings or Specifications; or
 - 3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

- B. *Engineer's Review:* After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine the necessity of Owner's obtaining additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A above; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.
- C. *Owner's Statement to Contractor Regarding Site Condition:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.
- D. *Possible Price and Times Adjustments:*
 1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, or both, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. such condition must fall within any one or more of the categories described in Paragraph 5.04.A;
 - b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,
 - c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
 2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
 - a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise; or
 - b. the existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site

and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

- c. Contractor failed to give the written notice as required by Paragraph 5.04.A.
3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.
4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

5.05 *Underground Facilities*

- A. *Contractor's Responsibilities:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:
 1. Owner and Engineer do not warrant or guarantee the accuracy or completeness of any such information or data provided by others; and
 2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
 - a. reviewing and checking all information and data regarding existing Underground Facilities at the Site;
 - b. locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;
 - c. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
 - d. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.
- B. *Notice by Contractor:* If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer.
- C. *Engineer's Review:* Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and advise Owner in writing of Engineer's findings, conclusions, and

recommendations. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

- D. *Owner's Statement to Contractor Regarding Underground Facility:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question, addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.
- E. *Possible Price and Times Adjustments:*
1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, or both, to the extent that any existing Underground Facility at the Site that was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;
 - b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;
 - c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times; and
 - d. Contractor gave the notice required in Paragraph 5.05.B.
 2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, or both, then any such adjustment shall be set forth in a Change Order.
 3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, or both, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

5.06 *Hazardous Environmental Conditions at Site*

- A. *Reports and Drawings:* The Supplementary Conditions identify:
1. those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and
 2. Technical Data contained in such reports and drawings.
- B. *Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer,

or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or
 2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or
 3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.
- C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.
- D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.
- E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.
- F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.
- G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off.
- H. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special

conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

- I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6 – BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

- A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of all of Contractor's obligations under the Contract. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the Supplementary Conditions, or other specific provisions of the Contract. Contractor shall also furnish such other bonds as are required by the Supplementary Conditions or other specific provisions of the Contract.
- B. All bonds shall be in the form prescribed by the Contract except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (as amended and supplemented) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. A bond

signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

- C. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds in the required amounts.
- D. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or its right to do business is terminated in any state or jurisdiction where any part of the Project is located, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the bond and surety requirements above.
- E. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.
- F. Upon request, Owner shall provide a copy of the payment bond to any Subcontractor, Supplier, or other person or entity claiming to have furnished labor or materials used in the performance of the Work.

6.02 *Insurance—General Provisions*

- A. Owner and Contractor shall obtain and maintain insurance as required in this Article and in the Supplementary Conditions.
- B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.
- C. Contractor shall deliver to Owner, with copies to each named insured and additional insured (as identified in this Article, in the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Contractor has obtained and is maintaining the policies, coverages, and endorsements required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- D. Owner shall deliver to Contractor, with copies to each named insured and additional insured (as identified in this Article, the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Owner has obtained and is maintaining the policies, coverages, and endorsements required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- E. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor

to identify a deficiency in compliance from the evidence provided, shall not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

- F. If either party does not purchase or maintain all of the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.
- G. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16.
- H. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price shall be adjusted accordingly.
- I. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.
- J. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner and other individuals and entities in the Contract.

6.03 Contractor's Insurance

- A. *Workers' Compensation*: Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:
 - 1. claims under workers' compensation, disability benefits, and other similar employee benefit acts.
 - 2. United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).
 - 3. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement in monopolist worker's compensation states).
 - 4. Foreign voluntary worker compensation (if applicable).
- B. *Commercial General Liability—Claims Covered*: Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against:
 - 1. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees.
 - 2. claims for damages insured by reasonably available personal injury liability coverage.
 - 3. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.
- C. *Commercial General Liability—Form and Content*: Contractor's commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:
 - 1. Products and completed operations coverage:
 - a. Such insurance shall be maintained for three years after final payment.

- b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
 2. Blanket contractual liability coverage, to the extent permitted by law, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
 3. Broad form property damage coverage.
 4. Severability of interest.
 5. Underground, explosion, and collapse coverage.
 6. Personal injury coverage.
 7. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.
 8. For design professional additional insureds, ISO Endorsement CG 20 32 07 04, "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.
- D. *Automobile liability*: Contractor shall purchase and maintain automobile liability insurance against claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy shall be written on an occurrence basis.
- E. *Umbrella or excess liability*: Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the paragraphs above. Subject to industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.
- F. *Contractor's pollution liability insurance*: Contractor shall purchase and maintain a policy covering third-party injury and property damage claims, including clean-up costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance shall be maintained for no less than three years after final completion.
- G. *Additional insureds*: The Contractor's commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner and Engineer, and any individuals or entities identified in the Supplementary Conditions; include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements.
- H. *Contractor's professional liability insurance*: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of two years after Substantial

Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.

- I. *General provisions:* The policies of insurance required by this Paragraph 6.03 shall:
 1. include at least the specific coverages provided in this Article.
 2. be written for not less than the limits of liability provided in this Article and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.
 3. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 10 days prior written notice has been given to Contractor. Within three days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.
 4. remain in effect at least until final payment (and longer if expressly required in this Article) and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract Documents.
 5. be appropriate for the Work being performed and provide protection from claims that may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable.
- J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

6.04 *Owner's Liability Insurance*

- A. In addition to the insurance required to be provided by Contractor under Paragraph 6.03, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.
- B. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

6.05 *Property Insurance*

- A. *Builder's Risk:* Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the full insurable replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:
 1. include the Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as "insureds."

2. be written on a builder's risk "all risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.
 3. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.
 4. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).
 5. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).
 6. extend to cover damage or loss to insured property while in transit.
 7. allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
 8. allow for the waiver of the insurer's subrogation rights, as set forth below.
 9. provide primary coverage for all losses and damages caused by the perils or causes of loss covered.
 10. not include a co-insurance clause.
 11. include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.
 12. include performance/hot testing and start-up.
 13. be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.
- B. *Notice of Cancellation or Change*: All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this

Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.

- C. *Deductibles*: The purchaser of any required builder's risk or property insurance shall pay for costs not covered because of the application of a policy deductible.
- D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.
- E. *Additional Insurance*: If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.05, it may do so at Contractor's expense.
- F. *Insurance of Other Property*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount.

6.06 *Waiver of Rights*

- A. All policies purchased in accordance with Paragraph 6.05, expressly including the builder's risk policy, shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all Subcontractors, all individuals or entities identified in the Supplementary Conditions as insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.
- B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for:
 - 1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by,

- arising out of, or resulting from fire or other perils whether or not insured by Owner; and
2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06.
- C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 6.06.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.
 - D. Contractor shall be responsible for assuring that the agreement under which a Subcontractor performs a portion of the Work contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by builder's risk insurance and any other property insurance applicable to the Work.

6.07 *Receipt and Application of Property Insurance Proceeds*

- A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.05 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.
- B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.05 shall distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.
- C. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

7.01 *Supervision and Superintendence*

- A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

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- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.02 *Labor; Working Hours*

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.
- B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.03 *Services, Materials, and Equipment*

- A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.
- B. All materials and equipment incorporated into the Work shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.
- C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.04 *"Or Equals"*

- A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment, or items from other proposed suppliers under the circumstances described below.
 - 1. If Engineer in its sole discretion determines that an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer shall deem it an "or equal" item. For the purposes of this paragraph, a proposed item of material or equipment will be considered functionally equal to an item so named if:

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- a. in the exercise of reasonable judgment Engineer determines that:
 - 1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;
 - 2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;
 - 3) it has a proven record of performance and availability of responsive service; and
 - 4) it is not objectionable to Owner.
 - b. Contractor certifies that, if approved and incorporated into the Work:
 - 1) there will be no increase in cost to the Owner or increase in Contract Times; and
 - 2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.
- B. *Contractor's Expense:* Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.
- C. *Engineer's Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal", which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.
- D. *Effect of Engineer's Determination:* Neither approval nor denial of an "or-equal" request shall result in any change in Contract Price. The Engineer's denial of an "or-equal" request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents.
- E. *Treatment as a Substitution Request:* If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer considered the proposed item as a substitute pursuant to Paragraph 7.05.

7.05 Substitutes

- A. Unless the specification or description of an item of material or equipment required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment under the circumstances described below. To the extent possible such requests shall be made before commencement of related construction at the Site.
 1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of material or equipment from anyone other than Contractor.

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2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.
 3. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:
 - a. shall certify that the proposed substitute item will:
 - 1) perform adequately the functions and achieve the results called for by the general design,
 - 2) be similar in substance to that specified, and
 - 3) be suited to the same use as that specified.
 - b. will state:
 - 1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times,
 - 2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and
 - 3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
 - c. will identify:
 - 1) all variations of the proposed substitute item from that specified, and
 - 2) available engineering, sales, maintenance, repair, and replacement services.
 - d. shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.
 - B. *Engineer's Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.
 - C. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
 - D. *Reimbursement of Engineer's Cost:* Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the
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Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

- E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.
- F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request shall be final and binding, and may not be reversed through an appeal under any provision of the Contract Documents. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.05.D, by timely submittal of a Change Proposal.

7.06 *Concerning Subcontractors, Suppliers, and Others*

- A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner.
- B. Contractor shall retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of designated parts of the Work if required by the Contract to do so.
- C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against which Contractor has reasonable objection.
- D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable, during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within five days.
- E. Owner may require the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors, Suppliers, or other individuals or entities for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor, Supplier, or other individual or entity so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity.
- F. If Owner requires the replacement of any Subcontractor, Supplier, or other individual or entity retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, or both, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.
- G. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

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- H. On a monthly basis Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.
 - I. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions.
 - J. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.
 - K. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.
 - L. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.
 - M. All Work performed for Contractor by a Subcontractor or Supplier shall be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer.
 - N. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by the particular Subcontractor or Supplier.
 - O. Nothing in the Contract Documents:
 - 1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier, or other individual or entity; nor
 - 2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

7.07 *Patent Fees and Royalties*

- A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.
- B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the

performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

- C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.08 *Permits*

- A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work

7.09 *Taxes*

- A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.10 *Laws and Regulations*

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It shall not be Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.
- C. Owner or Contractor may give notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if

any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.11 *Record Documents*

- A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.12 *Safety and Protection*

- A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:
1. all persons on the Site or who may be affected by the Work;
 2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.
- C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.
- D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.
- E. All damage, injury, or loss to any property referred to in Paragraph 7.12.A.2 or 7.12.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly

or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

- F. Contractor's duties and responsibilities for safety and protection shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).
- G. Contractor's duties and responsibilities for safety and protection shall resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.13 *Safety Representative*

- A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

7.14 *Hazard Communication Programs*

- A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

- A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

7.16 *Shop Drawings, Samples, and Other Submittals*

- A. *Shop Drawing and Sample Submittal Requirements:*
 - 1. Before submitting a Shop Drawing or Sample, Contractor shall have:
 - a. reviewed and coordinated the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
 - b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
 - c. determined and verified the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
 - d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.
 - 2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that submittal, and that Contractor approves the submittal.

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3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be set forth in a written communication separate from the Shop Drawings or Sample submittal; and, in addition, in the case of Shop Drawings by a specific notation made on each Shop Drawing submitted to Engineer for review and approval of each such variation.
- B. *Submittal Procedures for Shop Drawings and Samples:* Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals. Each submittal will be identified as Engineer may require.
1. *Shop Drawings:*
 - a. Contractor shall submit the number of copies required in the Specifications.
 - b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.D.
 2. *Samples:*
 - a. Contractor shall submit the number of Samples required in the Specifications.
 - b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 7.16.D.
 3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.
- C. *Other Submittals:* Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.
- D. *Engineer's Review:*
1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
 2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto.
 3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
 4. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and

Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order.

5. Engineer's review and approval of a Shop Drawing or Sample shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 7.16.A and B.
 6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, shall not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.
 7. Neither Engineer's receipt, review, acceptance or approval of a Shop Drawing, Sample, or other submittal shall result in such item becoming a Contract Document.
 8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.D.4.
- E. *Resubmittal Procedures:*
1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.
 2. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.
 3. If Contractor requests a change of a previously approved submittal item, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

7.17 *Contractor's General Warranty and Guarantee*

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on Contractor's warranty and guarantee.
- B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
 1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
 2. normal wear and tear under normal usage.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

1. observations by Engineer;
 2. recommendation by Engineer or payment by Owner of any progress or final payment;
 3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
 4. use or occupancy of the Work or any part thereof by Owner;
 5. any review and approval of a Shop Drawing or Sample submittal;
 6. the issuance of a notice of acceptability by Engineer;
 7. any inspection, test, or approval by others; or
 8. any correction of defective Work by Owner.
- D. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract shall govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

- A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.
- B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.
- C. The indemnification obligations of Contractor under Paragraph 7.18.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:
1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
 2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

7.19 Delegation of Professional Design Services

- A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable Laws and Regulations.
- B. If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.
- C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.
- D. Pursuant to this paragraph, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 7.16.D.1.
- E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.

ARTICLE 8 – OTHER WORK AT THE SITE**8.01 Other Work**

- A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.
- B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any utility work at or adjacent to the Site, Owner shall provide such information to Contractor.
- C. Contractor shall afford each other contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or

alter others' work with the written consent of Engineer and the others whose work will be affected.

- D. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 8, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

8.02 *Coordination*

- A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:
1. the identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;
 2. an itemization of the specific matters to be covered by such authority and responsibility; and
 3. the extent of such authority and responsibilities.
- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

- A. If, in the course of performing other work at or adjacent to the Site for Owner, the Owner's employees, any other contractor working for Owner, or any utility owner for whom the Owner is responsible causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment shall take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract. When applicable, any such equitable adjustment in Contract Price shall be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due to Contractor, and assign to such other contractor or utility owner the Owner's contractual

rights against Contractor with respect to the breach of the obligations set forth in this paragraph.

- C. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due to Contractor.
- D. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9 – OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

- A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

- A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents shall be that of the former Engineer.

9.03 *Furnish Data*

- A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

- A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

- A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.
- B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.
- C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

- 9.06 *Insurance*
- A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.
- 9.07 *Change Orders*
- A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.
- 9.08 *Inspections, Tests, and Approvals*
- A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.
- 9.09 *Limitations on Owner's Responsibilities*
- A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- 9.10 *Undisclosed Hazardous Environmental Condition*
- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.
- 9.11 *Evidence of Financial Arrangements*
- A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents (including obligations under proposed changes in the Work).
- 9.12 *Safety Programs*
- A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.
- B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

- 10.01 *Owner's Representative*
- A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.
- 10.02 *Visits to Site*
- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On

the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.08. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Project Representative*

- A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 10.08. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent, or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

10.04 *Rejecting Defective Work*

- A. Engineer has the authority to reject Work in accordance with Article 14.

10.05 *Shop Drawings, Change Orders and Payments*

- A. Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Paragraph 7.16.
- B. Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, are set forth in Paragraph 7.19.
- C. Engineer's authority as to Change Orders is set forth in Article 11.
- D. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.06 *Determinations for Unit Price Work*

- A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.07 *Decisions on Requirements of Contract Documents and Acceptability of Work*

- A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.08 *Limitations on Engineer's Authority and Responsibilities*

- A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, shall create, impose, or give rise to any duty in

contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

- B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.
- D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 15.06.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.
- E. The limitations upon authority and responsibility set forth in this Paragraph 10.08 shall also apply to the Resident Project Representative, if any.

10.09 *Compliance with Safety Program*

- A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs (if any) of which Engineer has been informed.

ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK

11.01 *Amending and Supplementing Contract Documents*

- A. The Contract Documents may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.
 - 1. *Change Orders:*
 - a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order. A Change Order also may be used to establish amendments and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.
 - b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.
 - 2. *Work Change Directives:* A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents

governing adjustments, expressly including Paragraph 11.04 regarding change of Contract Price. Contractor must submit any Change Proposal seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 30 days after the completion of the Work set out in the Work Change Directive. Owner must submit any Claim seeking an adjustment of the Contract Price or the Contract Times, or both, no later than 60 days after issuance of the Work Change Directive.

3. *Field Orders*: Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.02 *Owner-Authorized Changes in the Work*

- A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Such changes shall be supported by Engineer's recommendation, to the extent the change involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters. Such changes may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.03 *Unauthorized Changes in the Work*

- A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.

11.04 *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall comply with the provisions of Article 12.
- B. An adjustment in the Contract Price will be determined as follows:
 1. where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03); or
 2. where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.04.C).
- C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit shall be determined as follows:
1. a mutually acceptable fixed fee; or
 2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. for costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee shall be 15 percent;
 - b. for costs incurred under Paragraph 13.01.B.3, the Contractor's fee shall be five percent;
 - c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.04.C.2.a and 11.04.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of five percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted work the maximum total fee to be paid by Owner shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;
 - d. no fee shall be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;
 - e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and
 - f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 11.04.C.2.a through 11.04.C.2.e, inclusive.

11.05 *Change of Contract Times*

- A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.
- B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor's progress.

11.06 *Change Proposals*

- A. Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; appeal an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; contest a set-off against payment due; or seek other relief under

the Contract. The Change Proposal shall specify any proposed change in Contract Times or Contract Price, or both, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents.

1. *Procedures:* Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than 30 days) after the start of the event giving rise thereto, or after such initial decision. The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal. The supporting data shall be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event. Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal.
 2. *Engineer's Action:* Engineer will review each Change Proposal and, within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.
 3. *Binding Decision:* Engineer's decision will be final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.
- B. *Resolution of Certain Change Proposals:* If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

11.07 Execution of Change Orders

- A. Owner and Contractor shall execute appropriate Change Orders covering:
1. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;
 2. changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;
 3. changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.02, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters; and
 4. changes in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.

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- B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.

11.08 *Notification to Surety*

- A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12 – CLAIMS

12.01 *Claims*

- A. *Claims Process:* The following disputes between Owner and Contractor shall be submitted to the Claims process set forth in this Article:
1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;
 2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents; and
 3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters.
- B. *Submittal of Claim:* The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim shall rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, or both, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.
- C. *Review and Resolution:* The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim shall be stated in writing and submitted to the other party, with a copy to Engineer.
- D. *Mediation:*
1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate shall stay the Claim submittal and response process.
 2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process shall resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal

and decision process shall resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.
- E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action shall be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.
- F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim shall be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.
- G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim shall be incorporated in a Change Order to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

- A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:
 1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or
 2. To determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.
- B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 13.01.C, and shall include only the following items:
 1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing

Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.
3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.
4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.
5. Supplemental costs including the following:
 - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
 - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
 - c. Rentals of all construction equipment and machinery, and the parts thereof, whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.
 - d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.
 - e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
 - f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 6.05), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or

indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

- g. The cost of utilities, fuel, and sanitary facilities at the Site.
- h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.
- i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.
2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.
5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee:* When the Work as a whole is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 11.04.C.

E. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

13.02 Allowances

- A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

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- B. *Cash Allowances*: Contractor agrees that:
 - 1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
 - 2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.
 - C. *Contingency Allowance*: Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
 - D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

13.03 *Unit Price Work*

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of the following paragraph.
- E. Within 30 days of Engineer's written decision under the preceding paragraph, Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price if:
 - 1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement;
 - 2. there is no corresponding adjustment with respect to any other item of Work; and
 - 3. Contractor believes that it is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price, and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 14 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK**14.01 Access to Work**

- A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

14.02 Tests, Inspections, and Approvals

- A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.
- B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work shall be governed by the provisions of Paragraph 14.05.
- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
- D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:
 - 1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;
 - 2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;
 - 3. by manufacturers of equipment furnished under the Contract Documents;
 - 4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and
 - 5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests shall be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

- E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.
- F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering shall be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to

cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

- A. *Contractor's Obligation:* It is Contractor's obligation to assure that the Work is not defective.
- B. *Engineer's Authority:* Engineer has the authority to determine whether Work is defective, and to reject defective Work.
- C. *Notice of Defects:* Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.
- D. *Correction, or Removal and Replacement:* Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.
- E. *Preservation of Warranties:* When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.
- F. *Costs and Damages:* In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs, losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work shall be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

- A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.
- B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

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- C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.
1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.
 2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

- A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, then Owner may, after seven days written notice to Contractor, correct or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.
- C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

- A. *Basis for Progress Payments:* The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.
- B. *Applications for Payments:*
1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens, and evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.
 2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
 3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.
- C. *Review of Applications:*
1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
 2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:
 - a. the Work has progressed to the point indicated;
 - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon

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- Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and
- c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
 - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or
 - b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.
 4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
 - a. to supervise, direct, or control the Work, or
 - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or
 - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or
 - d. to make any examination to ascertain how or for what purposes Contractor has used the money paid on account of the Contract Price, or
 - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
 5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.
 6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:
 - a. the Work is defective, requiring correction or replacement;
 - b. the Contract Price has been reduced by Change Orders;
 - c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or
 - e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due:*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner:*

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:
 - a. claims have been made against Owner on account of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account of Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;
 - b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;
 - c. Contractor has failed to provide and maintain required bonds or insurance;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;
 - e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;
 - f. the Work is defective, requiring correction or replacement;
 - g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - h. the Contract Price has been reduced by Change Orders;
 - i. an event that would constitute a default by Contractor and therefore justify a termination for cause has occurred;
 - j. liquidated damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;
 - k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;
 - l. there are other items entitling Owner to a set off against the amount recommended.
2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed shall be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 15.01.C.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than seven days after the time of payment by Owner.

15.03 *Substantial Completion*

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.
- B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
- C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which shall fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.
- D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.
- E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

-
- F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:
 1. At any time Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through E for that part of the Work.
 2. At any time Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
 3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
 4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.05 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

- A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

- A. *Application for Payment:*
 1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.11), and other documents, Contractor may make application for final payment.

-
2. The final Application for Payment shall be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents;
 - b. consent of the surety, if any, to final payment;
 - c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.
 - d. a list of all disputes that Contractor believes are unsettled; and
 - e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.
 3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.
- B. *Engineer's Review of Application and Acceptance:*
1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to the provisions of Paragraph 15.07. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.
- C. *Completion of Work:* The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment.
- D. *Payment Becomes Due:* Thirty days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer (less any further sum Owner is entitled to set off against Engineer's recommendation, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

15.07 Waiver of Claims

- A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 15.05, from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.
- B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted or appealed under the provisions of Article 17.

15.08 Correction Period

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents), any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
 - 1. correct the defective repairs to the Site or such other adjacent areas;
 - 2. correct such defective Work;
 - 3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
 - 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting therefrom.
- B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).
- C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.
- E. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION**16.01** *Owner May Suspend Work*

- A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension. Any Change Proposal seeking such adjustments shall be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

- A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:
1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule);
 2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;
 3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or
 4. Contractor's repeated disregard of the authority of Owner or Engineer.
- B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) ten days written notice that Owner is considering a declaration that Contractor is in default and termination of the contract, Owner may proceed to:
1. declare Contractor to be in default, and give Contractor (and any surety) notice that the Contract is terminated; and
 2. enforce the rights available to Owner under any applicable performance bond.
- C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.
- D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within seven days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.
- E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When

exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

- F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.
- G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond shall govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate For Convenience*

- A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):
 - 1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
 - 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and
 - 3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.
- B. Contractor shall not be paid on account of loss of anticipated overhead, profits, or revenue, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

- A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.
- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES**17.01 *Methods and Procedures***

- A. *Disputes Subject to Final Resolution:* The following disputed matters are subject to final resolution under the provisions of this Article:
1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full; and
 2. Disputes between Owner and Contractor concerning the Work or obligations under the Contract Documents, and arising after final payment has been made.
- B. *Final Resolution of Disputes:* For any dispute subject to resolution under this Article, Owner or Contractor may:
1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions; or
 2. agree with the other party to submit the dispute to another dispute resolution process; or
 3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18 – MISCELLANEOUS**18.01 *Giving Notice***

- A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:
1. delivered in person, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended; or
 2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the sender of the notice.

18.02 *Computation of Times*

- A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

- A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

- A. A party's non-enforcement of any provision shall not constitute a waiver of that provision, nor shall it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

18.07 *Controlling Law*

- A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Headings*

- A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

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I. General

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract, Document 00 07 00 (EJCDC® C-700, 2013 Edition). All provisions that are not so amended or supplemented remain in full force and effect.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added thereto.

II. Specific Items**ARTICLE 1 – DEFINITIONS AND TERMINOLOGY***SC-1.01 Defined Terms*

SC-1.01.A.28 Add the following sentence to the end of Paragraph 1.01.A.29: The Terms "Owner", "District" and "MCWD" shall be used interchangeably and shall have the same meaning.

ARTICLE 2 – PRELIMINARY MATTERS*SC-2.02 Copies of Documents*

SC-2.02.A. Delete Paragraph 2.02.A in its entirety and insert the following new paragraph in its place:

- A. Owner shall furnish to Contractor 5 copies of conformed Contract Documents incorporating and integrating all Addenda and any amendments negotiated prior to the Effective Date of the Contract (including one fully executed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies of the conformed Contract Documents will be furnished upon request at the cost of reproduction.

ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE*SC-3.01 Intent*

SC-3.01.F Add the following new paragraphs immediately after Paragraph 3.01.E:

- F. In case of conflicts between the Contract Documents, the order of precedence shall be as follows:
 1. Change Orders, Field Orders or Work Change Directives
 2. Permits from Agencies having jurisdiction
 3. Addenda
 4. SRF and Proposition 1 Funding Requirements (Document 00 08 20)
 5. Special Conditions (Document 00 08 00)
 6. Technical Specifications (Divisions 01 to 17)

-
7. Drawings
 8. Agreement (Document 00 05 20)
 9. General Conditions (Document 00 07 00)
 10. Instructions to Bidders
 11. Contractor's Bid Forms (Documents 00 04 10 to 00 04 __)
 12. Standard Specifications
 13. Standard Plans (Drawings)
 14. Reference Documents
- G. With respect to the Drawings, the order of precedence shall be as follows:
1. Figures govern over scaled dimensions
 2. Detail drawings govern over general drawings
 3. Addenda, Change Orders, Field Orders or Work Change Directives govern over Contract Drawings, with the most recent governing over earlier changes
 4. Contract Drawings govern over Standard Drawings
 5. Contract Drawings govern over Shop Drawings

ARTICLE 5 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

SC-5.03 Subsurface and Physical Conditions

SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.B:

- C. The following reports of explorations and tests of subsurface conditions at or adjacent to the Site are known to Owner:
1. Report dated August 7, 2007, prepared by ENGEO Inc, Consulting Engineers, San Ramon, Ca., entitled: "Geotechnical Exploration, Marina Coast Water District, Regional Urban Water Augmentation Project, Marina, Ca."
 2. Report dated October 23, 2006, prepared by ENGEO Inc, Consulting Engineers, San Ramon, Ca., entitled: "Preliminary Trenching Evaluation."
 3. Report dated November 17, 2008, prepared by Kleinfelder, Salinas, Ca., entitled: "Geotechnical Review and Supplemental Geotechnical Recommendations for the Proposed D Zone Welded Steel Water Storage Tank, Marina Coast Water District in Marina, California".
 4. Report dated December 6, 2005, Prepared by Kleinfelder, Salinas, Ca., entitled: "Revised Geotechnical Investigation Report - Proposed East Garrison "B" Zone Tanks, "D" Zone Reservoirs, "E" Zone Hydro pneumatic Pump Station, and Transmission Main, Marina Coast Water District in Marina, California".
- D. The following drawings of physical conditions relating to existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities) are known to Owner:
1. Drawings dated *March 5, 2007, of existing CSUMB recycled water pipeline, prepared by Carollo Engineer, Inc.: "Record Drawings: Regional Urban Water Augmentation*

Project Recycled Water Pipeline”, consisting of 3 sheets numbered C-28 to C-30, inclusive.

2. Drawings dated June 2006, of existing recycled water pipeline in General Jim Moore Boulevard, prepared by Creegan & D’Angelo: “Record Drawings: General Jim Moore Boulevard, Fort Ord Reuse Authority”, consisting of 6 sheets numbered cover and C-04 to C-08, inclusive.
 - a. None of the contents of such drawings is Technical Data on whose accuracy Contractor may rely.
- E. Contractor may examine copies of reports and drawings identified in SC 5.03.C and SC 5.03.D that were not included with the Bidding Documents at Marina Coast Water District, Engineering Office, 2840 4th Avenue, Marina, CA 93933, during regular business hours, or may request copies from Engineer.

SC-5.06 Hazardous Environmental Conditions

SC 5.06.A Delete Paragraphs 5.06.A and 5.06.B in their entirety and insert the following:

- A. The Site is located on the former Fort Ord in an area identified as a possible location of munitions and explosives of concern.
- B. No reports or drawings related to Hazardous Environmental Conditions at the Site are known to Owner.

SC-5.07 Environmental Reports

Add the following new subparagraphs immediately before Article 6:

SC-5.07 Environmental Reports

- A. Environmental Report(s) have been prepared for this project under the California Environmental Quality Act (CEQA), as listed below. Contractor shall familiarize himself with these reports and implement the applicable mitigation measures during construction as outlined therein.
 1. Report dated November 2005, prepared by Denise Duffy & Associates, Inc., Monterey, CA, entitled: “Initial Study / Negative Declaration for the Marina Station Property Annexation”, consisting of 36 pages.
 2. Report dated October 2006, prepared by Denise Duffy & Associates, Inc., Monterey, Ca, entitled: "Regional Urban Recycled Water Project, and Addendums No. 1, No. 2, and No. 3 to the Environmental Impact Report."
- B. Copies of reports itemized in SC-5.07.A that are not included with Bidding Documents may be examined at Marina Coast Water District, Engineering Office, 2840 4th Ave, Marina, CA 93933 during regular business hours. These reports are not part of the Contract Documents, but the controls and mitigation measures contained therein which are required for performance of the Work are incorporated therein by reference.

ARTICLE 6 – BONDS AND INSURANCE

SC-6.02 Insurance—General Provisions

SC-6.02.C Add the following paragraph immediately after Paragraph 6.02.C:

1. All insurance shall be provided on policy forms acceptable to the Owner (Accord Form 25-S or equivalent), signed by the insurer’s representative. Such evidence shall include an original copy of the additional insured endorsement signed by the insurer’s representative.

SC-6.03 Contractor’s Insurance

SC 6.03 Add the following new paragraph immediately after Paragraph 6.03.J:

K. The limits of liability for the insurance required by Paragraph 6.03 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

1. Workers’ Compensation, and related coverages under Paragraphs 6.03.A.1 and A.2 of the General Conditions:

State:	Statutory
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Federal, if applicable (e.g., Longshoreman’s):	Statutory
--	-----------

Jones Act coverage, if applicable:

Bodily injury by accident, each accident	\$ N/A
--	--------

Bodily injury by disease, aggregate	\$ N/A
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Employer’s Liability:

Bodily injury, each accident	\$ 1,000,000.00
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Bodily injury by disease, each employee	\$ 1,000,000.00
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Bodily injury/disease aggregate	\$ 1,000,000.00
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For work performed in monopolistic states, stop-gap liability coverage shall be endorsed to either the worker’s compensation or commercial general liability policy with a minimum limit of:	\$ N/A
--	--------

Foreign voluntary worker compensation	Statutory
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2. Contractor’s Commercial General Liability under Paragraphs 6.03.B and 6.03.C of the General Conditions:

General Aggregate	\$ 2,000,000.00
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Products - Completed Operations Aggregate	\$ 1,000,000.00
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Personal and Advertising Injury	\$ 1,000,000.00
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Each Occurrence (Bodily Injury and Property Damage) \$ 1,000,000.00

3. Automobile Liability under Paragraph 6.03.D. of the General Conditions:

Bodily Injury:

Each person \$ 1,000,000.00

Each accident \$ 1,000,000.00

Property Damage:

Each accident \$ 1,000,000.00

4. Excess or Umbrella Liability:

Per Occurrence \$ 1,000,000.00

General Aggregate \$ 1,000,000.00

5. Contractor's Pollution Liability:

Each Occurrence \$ 2,000,000.00

General Aggregate \$ 1,000,000.00

If box is checked, Contractor is not required to provide Contractor's Pollution Liability insurance under this Contract

6. Additional Insureds: In addition to Owner and Engineer, include as additional insureds the following:

a. Owner's inspector or construction manager - TBD

b. City of Marina, CA

c. City of Seaside, CA

d. California State University

e. United States Army

7. Contractor's Professional Liability:

Each Claim \$ 1,000,000.00

Annual Aggregate \$ 2,000,000.00

8. All insurance maintained by the Contractor shall include coverage for work in and around areas of with munitions and explosives of concern, or claims, damage or injury which arise from munitions or explosives of concern.

SC-6.05 Property Insurance

SC-6.05.A.1 Add the following new subparagraph after subparagraph 6.05.A.1:

- a. In addition to Owner, Contractor, and all Subcontractors, include as insureds the following:
 - 1. Owner's Inspector or Construction Manager - TBD
 - 2. City of Marina, CA
 - 3. City of Seaside, CA
 - 4. California State University
 - 5. United States Army

SC-6.05.A. Add the following to the list of items in Paragraph 6.05.A, as numbered items:

- 17. include by express endorsement coverage of damage to Contractor's equipment.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

SC-7.02 Labor; Working Hours

SC-7.02.B. Add the following new subparagraphs immediately after Paragraph 7.02.B:

- 1. Owner's legal holidays are:
 - a. New Year's Day
 - b. Martin Luther King Day
 - c. President's Day
 - d. Memorial Day
 - e. Independence Day
 - f. Labor Day
 - g. Veterans Day
 - h. Thanksgiving Weekend (Thursday and Friday)
 - i. Christmas Day

SC-7.08 Permits

SC-7.08 Add the following new subparagraph immediately after Paragraph 7.08.A:

- B. The Owner shall provide the following permits:
 - 1. CEQA Environmental Documentation
 - 2. USACE Nationwide Permit
 - 3. Construction easement / right of entry

SC-7.10 Laws and Regulations

SC-7.10 Add the following new paragraphs immediately after Paragraph 7.10.C:

7.10.D. Public Contract Provisions

1. The Contractor is responsible for his own compliance, and is responsible for all Subcontractors' compliance, with all applicable sections of the California Labor Code regarding the payment of wages, the employment of apprentices, and hours of work, all as set forth in Section 1170 through Section 1815 of that Code. Those requirements are set forth below.
2. Payment of Prevailing Wages
 - a. Pursuant to Sections 1774 and 1775 of the Labor Code, unless the contract price is under \$1,000.00, the Contractor and any subcontractor under him, shall pay not less than the general prevailing rate of per diem wages, including holiday and overtime pay, to all workmen employed in the execution of this Contract. Failure to so comply will result in a fine of \$25.00 per day per violation, and the obligation to compensate each such employee the difference between the wage actually paid and the prevailing wage applicable to that employee's craft.
 - b. Pursuant to Section 1773.2 of the California Labor Code, the District has on file at its principal office, copies of the prevailing rate of per diem wages for each craft, and classification or type of workman needed to execute the contract, and a copy shall be available to any interested party upon request.
 - c. The Contractor shall obtain and post copies of the prevailing per diem wage rates at the job site during the term of this project.
 - d. Pursuant to Labor Code Section 1776, the Contractor and each subcontractor shall keep an accurate payroll record, showing the name, address, social security number, work classification, straight time and overtime hours worked each day and week, the actual per diem wages paid to each journeyman, apprentice, worker, or other employee employed by the Contractor or subcontractor in connection with the project, and such other information as required by law, and such payroll records shall be certified and made available for inspection and release all in accordance with Labor Code Section 1776 and 8 California Code of Regulations Section 16000 et seq. All contractors and subcontractors must furnish electronic certified payroll records directly to the Labor Commissioner (aka Division of Labor Standards Enforcement). The Contractor shall file with the District certified copies of its and all its subcontractors' payroll records within thirty (30) calendar days after completion of each payroll period at no cost to the District.
 - e. Pursuant to Section 1773.8 of the Labor Code, travel and subsistence payments shall also be paid to each workman needed to execute such work if such travel and subsistence payments are set forth in the applicable collective bargaining agreements and filed with the Department of Industrial Relations thirty (30) days prior to the call for bids.
 - f. Unless the Contract amount is under \$30,000 or will be completed in less than twenty (20) days (or if this Contract involves a specialty contractor under \$2,000 or less than 5 days) the Contractor shall comply with Section 1777.5 regarding the employment of registered apprentices upon public works by hiring, and by requiring that all subcontractors hire apprentices at the wage rate and ratio required, if at all, and by requiring the contribution of funds to appreciable crafts or trades as applicable under Section 1777.5.

- g. The Contractor shall, as a penalty to the District, forfeit not more than two hundred dollars (\$200.00) for each calendar day, or portion thereof, for each worker paid less than the prevailing rates as determined by the Director of the Department of Industrial Relations for such work or craft in which such worker is employed for any public work done under this contract by the Contractor or by any subcontractor under the Contractor. The difference between such prevailing wage rates and the amount paid to each worker for each calendar day or portion thereof for which each worker was paid less than the prevailing wage rate shall be paid to each worker by the Contractor. Labor Code Section 1775.
- h. Required California Department of Industrial Relations provisions:
- No contractor or subcontractor may be listed on a bid proposal for a public works project unless registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5 [with limited exceptions from this requirement for bid purposes only under Labor Code section 1771.1(a)].
 - No contractor or subcontractor may be awarded a contract for public work on a public works project unless registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5.
 - This project is subject to compliance monitoring and enforcement by the Department of Industrial Relations.
- i. The Contractor certifies that the Contractor and all subcontractors for this public works project have been registered with the Department of Industrial Relations pursuant to Labor Code section 1725.5.
- j. The District shall not recognize any claim for additional compensation from the Contractor because of the payment by the Contractor of any wage rate in excess of the prevailing rate of per diem wages. The possibility of wage increases is one of the elements to be considered by the Contractor in determining its bid and will not, under any circumstances, be considered as the basis of a claim against the District under this contract.
3. Hours of Labor
- a. Pursuant to Sections 1810 through 1815 of the Labor Code, eight hours of labor constitutes a legal day's work, and work performed by employees of the Contractor or any subcontractor in excess of eight hours per day, and forty hours in any one week, shall be compensated at not less than one and one-half times their basic rate of pay. Violation of this condition shall result in a penalty of \$25.00 per day per workman so underpaid.
4. Unidentified Utilities – Costs (Government Code 4215)
- a. The District shall be responsible for the timely removal, relocation, or protection of existing main or trunk line utility facilities located on the construction site, if such utilities are not identified in the plans and specifications for the work. The Contractor shall be compensated for his actual costs of locating, repairing damage not due to his failure to exercise reasonable care, and removing or relocating such utility facilities not indicated in the plans and specifications with reasonable accuracy and for equipment on the project necessarily idled during such work. If the Contractor discovers utility facilities not identified in the contract plans or specifications, he shall immediately notify the District and the utility in writing. The Contractor shall not be assessed liquidated damages for delay if caused by the

failure of the District or the owner of the utility to provide for removal or relocation of such utility facilities. The District shall provide a layout of all main lines and existing service laterals. The Contractor shall exercise due care in verifying the locations provided by the District and shall notify the District of site conditions that differ from those indicated.

5. Dispute Resolution Procedures for Claims of Less Than \$375,000
 - a. Sections 20104 - 20104.6 of the Public Contract Code set forth required procedures for the parties to resolve claim disputes involving less than \$375,000, including the presentation of written claims with substantiating documents on or before the date of final payment, requests for additional documentation, time limits for responding to written claims, and requiring a conference to meet and confer; and also relating to filing a claim before suit, and required arbitration provisions in the event of a civil action filed to resolve the claim. All of such procedures, time limits and requirements shall be complied with if such Code sections are applicable to disputed claim.
6. Assignment of Antitrust/Unfair Business Practice Claims
 - a. Pursuant to Public Contract Code Section 7103, Contractor and any subcontractors supplying goods, services or materials under this contract agree to assign District all rights, title and interest in and to all causes of action it may have under Section 4 of the Clayton Act (15 U.S.C Sec. 15) or under the Cartwright Act (Chapter 2 commencing with Section 16700 of Part 2 of Division 7 of the Business and Professions Code), arising from purchases of goods, services or materials pursuant to this contract or the subcontract.
7. Substitution of Securities for Retention. Pursuant to Public Contract Code Section 22300 and upon Contractor's request, the District will make payments into escrow of funds which would otherwise be retained from progress payments under the payments to contractor provisions in the Agreement and the Supplementary and General Conditions if the Contractor deposits into that escrow securities eligible for investment under Public Contract Code Section 22300 (hereafter collectively referred to as "securities"), upon the following terms and conditions:
 - a. The escrow agent shall be either the District Treasurer or a state or federal chartered bank acceptable to the District.
 - b. The Contractor shall bear all expenses of the District and of the escrow agent in connection with the escrow.
 - c. The fair market value of the securities shall be at least equal to 100 percent of the cash amount withheld as retention under the contract and the amount of the required securities shall be adjusted from time to time based upon changes in the fair market value of the securities on deposit with the escrow agent. Such securities shall be valued by the District Treasurer whose decision on valuation of the securities shall be final.
 - d. The Contractor shall enter into an escrow agreement substantially similar in form to that prescribed in Public Contract Code Section 22300.
 - e. The Contractor shall obtain the written consent to the escrow agreement of the surety or sureties furnishing Contractor with its performance and payment bonds.

SC-7.12 Safety and Protection

SC-7.12 Add the following new paragraphs after paragraph 7.12.G:

- H. In carrying out his/her work, the Contractor shall at all times, exercise all necessary precautions for the safety of employees appropriate to the nature of the work and the conditions under which the work is to be performed, and be in compliance with all federal, state and local statutory and regulatory requirements including California Department of Industrial Relations (Cal/OSHA) regulations; and the U.S. Department of Transportation Omnibus Transportation Employee Testing Act (as applicable). Safety precautions as applicable shall include, but shall not be limited to, adequate life protection, and lifesaving equipment; adequate illumination for underground and night operations; instructions in accident prevention for all employees such as machinery guards, safe walkways, scaffolds, ladders, bridges, gang planks; confined space procedures; trenching and shoring; fall protection; and other safety devices, equipment and wearing apparel as are necessary or lawfully required to prevent accidents, injuries, or illnesses; and adequate facilities for the proper inspection and maintenance of all safety measures.
- I. The Contractor shall be responsible for the safeguarding of all utilities. At least two working days before beginning work, the Contractor shall call the Underground Service Alert (USA) in order to determine the location of sub-structures. The Contractor shall immediately notify the District and the utility owner if he/she disturbs, disconnects, or damages any utility.
- J. In accordance with Section 6705 of the California Labor Code, the Contractor shall submit to the District specific plans to show details of provisions for worker protection from caving ground during excavations of trenches of five feet or more in depth. The excavation/trench safety plan shall be submitted to and accepted by the District prior to starting excavation. The trench safety plan shall have details showing the design of shoring, bracing, sloping or other provisions to be made for worker protection from the hazard of caving ground. If such a plan varies from the shoring system standards established by the Construction Safety Orders of the California Department of Industrial Relations (Cal/OSHA), the plan shall be prepared by a California registered civil or structural engineer. As part of the plan, a note shall be included stating that the registered civil or structural engineer certifies that the plan complies with the Cal/OSHA Construction Safety Orders, or that the registered civil or structural engineer certifies that the plan is not less effective than the shoring, bracing, sloping or other provisions of the Safety Orders. In no event shall the Contractor use a shoring, sloping, or protective system less effective than that required by said Construction Safety Orders. Submission of this plan in no way relieves the Contractor of the requirement to maintain safety in all areas. If excavations or trench work requiring a Cal/OSHA permit are to be undertaken, the Contractor shall submit his/her permit with the excavation/trench work safety plan to the District before work begins.
- K. Trench Excavation: Approval of Plan for Protection from Caving
 - 1. If the contract involves an estimated expenditure of more than \$25,000, for the excavation of any trench or trenches five feet or more in depth, the Contractor shall submit, for acceptance and approval by the District or its designated engineer, in advance of excavation, a detailed plan showing the design of shoring, bracing, sloping, or other provision to be made for worker protection from the hazard of

caving ground during such excavation, all in accordance with Labor Code Section 6705.

- L. Excavations Deeper than Four Feet Involving Hazardous Wastes or Materially Different Site Conditions
1. If the contract involves digging trenches or other excavations that extend deeper than four feet below the surface:
 - a. The Contractor shall promptly, and before any of the following conditions are disturbed, notify the District, in writing, of any:
 - (1) Material that the Contractor believes may be material that is hazardous waste as defined in Section 25117 of the Health and Safety Code, that is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing law;
 - (2) Subsurface or latent physical conditions at the site differing from those indicated;
 - (3) Unknown physical conditions at the site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the contract.
 - b. The District shall promptly investigate the conditions, and if it finds that the conditions do materially so differ, or do involve hazardous waste, and cause a decrease or increase in the Contractor's cost of, or the time required for, performance of any part of the work, it shall issue a change order under the procedures described in the Agreement.
 - c. In the event that a dispute arises between the District and the Contractor whether the conditions materially differ, or involve hazardous waste, or cause a decrease or increase in the Contractor's cost of, or time required for, performance of any part of the work, the Contractor shall not be excused from any scheduled completion date provided for by the Agreement, but shall proceed with all work to be performed under the Agreement. The Contractor shall retain any and all rights provided either by contract or by law, which pertains to the resolution of disputes and protests between the contracting parties.

SC-7.16 *Shop Drawings, Samples and Other Submittals*

SC-7.16 Delete Paragraph 7.16.E.2 in its entirety and insert the following in its place:

2. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than two submittals. Engineer will record Engineer's time for reviewing a third or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for

Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.

SC-7.18 Indemnification

SC-7.18.A Delete paragraph 7.18.A in its entirety and insert the following in its place:

- A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work or the failure, neglect or refusal of the Contractor to perform the Work and all obligations under the Contract, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.

ARTICLE 9 – OWNER’S RESPONSIBILITIES

SC-9.13 Owner’s Site Representative

SC-9.13 Add the following new paragraph immediately after Paragraph 9.12 of the General Conditions:

SC-9.13 Owner will furnish an “Owner’s Site Representative” to represent Owner at the Site and assist Owner in observing the progress and quality of the Work. The Owner’s Site Representative is not Engineer’s consultant, agent, or employee. Owner’s Site Representative will be [TBD]. The authority and responsibilities of Owner’s Site Representative follow: [TBD]

ARTICLE 10 – ENGINEER’S STATUS DURING CONSTRUCTION

SC-10.03 Project Representative

- B. On this Project, by agreement with the Owner, Engineer will not furnish a Resident Project Representative to represent Engineer at the Site or assist Engineer in observing the progress and quality of the Work.

ARTICLE 11 – AMENDING THE CONTRACT DOCUMENTS; CHANGES IN THE WORK

SC-SC-11.01 Amending and Supplementing Contract Documents

SC-11.01 Insert the following subparagraphs immediately following 11.02.A.1.b

- c. In signing a Change Order, the Owner and Contractor acknowledge and agree that:
- 1) the stipulated compensation (Contract Price or Contract Times, or both) set forth in the Change Order includes not only all direct costs of Contractor such as labor, material, job overhead, and profit markup, but also includes any costs for modifications or changes in sequence of work to be performed, delays, rescheduling,

disruptions, extended direct overhead or general overhead, acceleration, material or other escalation which includes wages and other impact costs. This document will become a supplement to the Contract and all Contract provisions will apply hereto. It is understood that this Change Order shall be effective on the date approved by the Owner's Representative.

- 2) the Change Order constitutes full mutual accord and satisfaction for the change to the Work;
- 3) no reservation of rights to pursue subsequent claims on the Change Order will be made by either party; and
- 4) no subsequent claim or amendment of the Contract Documents will arise out of or as a result of the Change Order.

SC-SC-11.05 Change of Contract Times

SC-11.05 Add the following new paragraphs immediately after 11.05.B:

C. Use of Float:

1. A request for adjustment of Contract Times (or Milestones), otherwise allowable under the Contract Documents, shall be granted only when the time lost or gained exceeds the float for the activity at the time of the event giving rise to the claim. Float, the amount of time between the early start date and the late start date, or the early finish date and the late finish date, is jointly owned by both Owner and Contractor whether expressly disclosed or implied in any manner.
2. Contractor shall not use float suppression techniques (including, but not limited to, preferential sequencing caused by late starts of follow-up trades, unreasonably small crews, extended durations, or imposed dates) in information provided to Engineer.

D. Weather Days:

1. The Contract Time includes a weather day allowance of 20 working days. No extension in Contract Time will be allowed for the first 15 working days lost due to weather conditions.

ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

SC-13.02 Allowances

SC 13.02 Add the following new subparagraph immediately paragraph 13.02.D:

- E. *Reimbursement Allowance*: Contractor agrees that a reimbursement allowance, if any, is for reimbursement of the actual cost or fee for which it is designated (typically permits), without additional markup for overhead, profit or handling. If the Owner includes a reimbursement allowance in the Bid Form, the Owner will establish its value.

SC-13.03 Unit Price Work

SC 13.03.E Delete Paragraph 13.03.E in its entirety and insert the following in its place:

- E. The unit price of an item of Unit Price Work shall be subject to reevaluation and adjustment under the following conditions:
1. if the extended price of a particular item of Unit Price Work amounts to 10 percent or more of the Contract Price (based on estimated quantities at the time of Contract formation) and the variation in the quantity of that particular item of Unit Price Work actually furnished or performed by Contractor differs by more than 10 percent from the estimated quantity of such item indicated in the Agreement; and
 2. if there is no corresponding adjustment with respect to any other item of Work; and
 3. if Contractor believes that Contractor has incurred additional expense as a result thereof, Contractor may submit a Change Proposal, or if Owner believes that the quantity variation entitles Owner to an adjustment in the unit price, Owner may make a Claim, seeking an adjustment in the Contract Price.

ARTICLE 15 – PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

SC-15.03 Substantial Completion

SC 15.03.B Add the following new subparagraph to Paragraph 15.03.B:

1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, shall be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

SC-17.01 Methods and Procedures

SC-17.01 Add the following subparagraphs immediately after Paragraph 17.01.B.3:

4. resolve claims of \$375,000 or less pursuant to California Public Contract Code Section 20104 et seq., unless Owner elects to resolve the dispute pursuant to California Public Contract Code Section 10240 et seq.

ARTICLE 18 – MISCELLANEOUS

SC-18.07 Controlling Law

SC-18.07 Delete paragraph 18.07.A in its entirety and replace it with the following:

- A. This Contract shall be construed and enforced according to the laws of the State of California, and the parties hereby agree that the County of Monterey shall be the proper venue for any dispute arising hereunder.

STATE REVOLVING FUND AND PROPOSITION 1 FUNDING REQUIREMENTS

1. Project Access. CONTRACTOR shall ensure that the State Water Board, the Governor of the State, the United States Environmental Protection Agency, the Office of Inspector General, any member of Congress, the President of the United States, or any authorized representative of the foregoing, will have safe and suitable access to the Project site at all reasonable times during Project construction and thereafter for the term of the Agreement.

2. Project Records. CONTRACTOR and its subcontractors shall maintain separate books, records and other material relative to Project. CONTRACTOR shall maintain such records for a minimum of thirty-six (36) years after Project Completion. CONTRACTOR and its subcontractors shall make such books, records, and other material available at all reasonable times (at a minimum during normal business hours) to inspection, copying, and audit by the State Water Board, the Bureau of State Audits, the United States Environmental Protection Agency (USEPA), the Office of Inspector General, the Internal Revenue Service, the Governor, or any authorized representatives of the aforementioned. CONTRACTOR shall allow and shall require its subcontractors to allow interviews during normal business hours of any employees who might reasonably have information related to such records. CONTRACTOR agrees to include a similar duty regarding audit, interviews, and records retention in any contract or subcontract related to the performance of the Agreement. The provisions of this section shall survive the expiration or termination of the Agreement.

3. Project Sign. CONTRACTOR shall place a sign at least four feet tall by eight feet wide made of ¾ inch thick exterior grade plywood or other approved material in a prominent location on the Project site and shall maintain the sign in good condition for the duration of the construction period. The sign must include the following disclosure statement and color logos (available from State Water Board):



“Funding for this \$_____ RUWAP Recycled Water Pipeline and Blackhorse Recycled Water Reservoir project (the "Project") has been provided in full or in part by the Clean Water State Revolving Fund through an agreement with the State Water Resources Control Board. California’s Clean Water State Revolving Fund is capitalized through a variety of funding sources, including grants from the United States Environmental Protection Agency and state bond proceeds.”

The Project sign shall include Owner's required promotional information, if any, and shall ensure that the above logos and disclosure statement are equally prominent on the sign. The sign shall be prepared in a professional manner.

4. Compliance with Laws, Regulations, etc. CONTRACTOR shall, at all times, comply with and require its subcontractors to comply with all applicable federal and state laws, rules, guidelines,

regulations, and requirements. Without limitation of the foregoing, to the extent applicable, CONTRACTOR shall:

- (a) Comply with the provisions of the adopted environmental mitigation plan, if any, for the term of the Agreement;
- (b) Comply with the State Water Board's "Policy for Implementing the Clean Water State Revolving Fund," as amended from time to time.

5. Environmental Requirements.

(a) Discovery of any potential archeological or historical resource. Should a potential archeological or historical resource be discovered during construction of the Project, CONTRACTOR agrees that all work in the area of the find will cease until a qualified archeologist has evaluated the situation and made recommendations regarding preservation of the resource, and the MCWD, in consultation with State Water Board, has determined what actions should be taken to protect and preserve the resource. CONTRACTOR shall implement appropriate actions as directed by MCWD.

(b) Discovery of any unexpected endangered or threatened species, as defined in the federal Endangered Species Act. Should a federally protected species be unexpectedly encountered during construction of Project, CONTRACTOR agrees to promptly notify MCWD, and State Water Board, if directed by MCWD. This notification is in addition to CONTRACTOR's obligations under the federal Endangered Species Act.

(c) Observation by State Water Board. CONTRACTOR shall ensure that prior to any Project monitoring, demonstration, or other implementation activities conducted or managed by CONTRACTOR, CONTRACTOR shall notify MCWD of the opportunity for State Water Board Division of Clean Water staff to observe and document such activities, and shall provide such notification directly upon request of MCWD.

6. Federal Disadvantaged Business Enterprise (DBE) Reporting. CONTRACTOR shall report DBE utilization to MCWD on the DBE Utilization Report, State Water Board Form DBE UR334. CONTRACTOR must submit such reports to MCWD annually within ten (10) calendar days following October 1 until such time as the "Notice of Completion" is issued. CONTRACTOR shall comply with 40 CFR § 33.301, and all DBE requirements set forth in Section 22 below.

7. State Non-Discrimination Provisions.

(a) During the performance of this Agreement, CONTRACTOR and its subcontractors shall not unlawfully discriminate, harass, or allow harassment against any employee or applicant for employment because of sex, race, color, ancestry, religious creed, national origin, sexual orientation, physical disability (including HIV and AIDS), mental disability, medical condition (cancer), age (over 40), marital status, denial of family care leave, or genetic information, gender, gender identity, gender expression, or military and veteran status.

(b) CONTRACTOR, and its subcontractors shall ensure that the evaluation and treatment of their employees and applicants for employment are free from such discrimination and harassment.

8. Water Board Excluded Parties Prohibition. CONTRACTOR shall not contract or allow subcontracting with excluded parties. CONTRACTOR shall not contract with any party who is debarred or suspended or otherwise excluded from or ineligible for participation in any work overseen, directed, funded, or administered by the State Water Board program for which this funding is authorized. For any work related to this Agreement, CONTRACTOR shall not contract with any individual or organization on the State Water Board's List of Disqualified Businesses and Persons that is identified as debarred or suspended or otherwise excluded from or ineligible for participation in any work overseen, directed, funded, or administered by the State Water Board program for which funding under this Agreement is authorized. The State Water Board's List of Disqualified Businesses and Persons is located at: http://www.waterboards.ca.gov/water_issues/programs/ustcf/dbp.shtml.

CONTRACTOR, in executing the Agreement, represents and warrants that CONTRACTOR is not a disqualified or excluded party, as described above, and is entitled to participate in Project.

9. State Fair Employment and Housing Act.

(a) CONTRACTOR and its subcontractors shall comply with the provisions of the Fair Employment and Housing Act and the applicable regulations promulgated thereunder. (Gov. Code, §12990, subds. (a)-(f) et seq.; Cal. Code Regs., tit. 2, § 7285 et seq.) Such regulations are incorporated into this Agreement by reference and made a part hereof as if set forth in full.

(b) CONTRACTOR, and its subcontractors shall give written notice of their obligations under this clause to labor organizations with which they have a collective bargaining or other agreement.

(c) CONTRACTOR shall include the nondiscrimination and compliance provisions of this clause in all subcontracts to perform work under the Agreement.

10. State Water Board Rights in Data. CONTRACTOR agrees that all data, plans, drawings, specifications, reports, computer programs, operating manuals, notes, and other written or graphic work produced in the performance of the Agreement are subject to the rights of the State as set forth in this section. The State shall have the right to reproduce, publish, and use all such work, or any part thereof, in any manner and for any purposes whatsoever and to authorize others to do so. As to any work which is copyrighted by MCWD, the State reserves a royalty-free, nonexclusive, and irrevocable license to reproduce, publish, and use such work, or any part thereof, and to authorize others to do so.

Federal Requirements

CONTRACTOR agrees to comply with the following federal conditions:

11. American Iron and Steel. Unless a waiver has been obtained from USEPA and is on file with MCWD and State Water Board, CONTRACTOR shall not purchase, provide, use or allow to be

used "iron and steel products" produced outside of the United States on this Project, and CONTRACTOR hereby certifies and shall ensure that all "iron and steel products" used on Project will be produced in the United States. For purposes of this section, the term "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and construction materials. "Steel" means an alloy that includes at least 50 percent iron, between .02 and 2 percent carbon, and may include other elements.

12. Wage Rate Requirements (Davis-Bacon). CONTRACTOR shall comply with and shall include in full the applicable language provided in Exhibit 1, in all subcontracts. Exhibit 1 is incorporated herein by reference.

13. Public or Media Events. CONTRACTOR shall work with MCWD to ensure that notification is provided to State Water Board and the EPA contact as provided in the notice provisions of the SRF Agreement of public or media events publicizing the accomplishment of significant events related to Project and that opportunity for attendance and participation by federal representatives is provided with at least ten (10) working days' notice.

EPA General Terms and Conditions (USEPA GTCs)

CONTRACTOR shall comply with applicable EPA general terms and conditions found at <http://www.epa.gov/ogd>, including but not limited to the following:

14. Executive Compensation. If required by EPA or State Water Board, CONTRACTOR shall report the names and total compensation of each of its five most highly compensated executives for the preceding completed fiscal year, as set forth in the USEPA GTCs.

15. Contractors, Subcontractors, Debarment and Suspension, Executive Order 12549; 2 CFR Part 180; 2 CFR Part 1532. CONTRACTOR shall comply with Subpart C of 2 CFR Part 180 and shall ensure that its subcontracts include a requirement for such compliance. CONTRACTOR shall not subcontract with any party who is debarred or suspended or otherwise excluded from or ineligible for participation in federal assistance programs under Executive Order 12549, "Debarment and Suspension". CONTRACTOR shall not subcontract with any individual or organization on USEPA's List of Violating Facilities. CONTRACTOR shall certify that it and its principals, and shall obtain certifications from its subcontractors that they and their principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any federal department or agency;

(b) Have not within a three (3) year period preceding this Agreement been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (federal, state or local) transaction or contract under a public transaction; violation of federal or state antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (federal, state or local) with commission of any of the offenses enumerated in paragraph (b) of this certification; and

(d) Have not within a three (3) year period preceding this application/proposal had one or more public transactions (federal, state or local) terminated for cause or default.

(e) Suspension and debarment information can be accessed at <http://www.sam.gov>. CONTRACTOR represents and warrants that it has or will include a term or conditions requiring compliance with this provision in all of its contracts and subcontracts under this Agreement. CONTRACTOR acknowledges that failing to disclose the information as required at 2 CFR 180.335 may result in the termination, delay or negation of this Agreement, or pursuance of legal remedies, including suspension and debarment.

16. Conflict of Interest. Within 10 days, CONTRACTOR shall disclose to MCWD, for submission to State Water Board, any potential conflict of interest consistent with section 4.0 of USEPA's Revised Interim Financial Assistance Conflict of Interest Policy at http://www.epa.gov/ogd/epa_revised_interim_financial_assistance_coi_policy_5_22_15.htm

. A conflict of interest may result in disallowance of costs.

17. Copyright and Patent.

(a) USEPA and the State Water Board have the right to reproduce, publish, use and authorize others to reproduce, publish and use copyrighted works or other data developed under the Agreement.

(b) Where an invention is made with Project Funds, USEPA and the State Water Board retain the right to a worldwide, nonexclusive, nontransferable, irrevocable, paid-up license to practice the invention owned by MCWD. CONTRACTOR shall notify the MCWD when an invention report, patent report, or utilization report is filed.

18. Credit. CONTRACTOR agrees, and shall work with MCWD to ensure, that any reports, documents, publications or other materials developed for public distribution supported by this Agreement shall contain the following statement:

"This project has been funded wholly or in part by the United States Environmental Protection Agency and the State Water Resources Control Board. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency or the State Water Resources Control Board, nor does the EPA or the Board endorse trade names or recommend the use of commercial products mentioned in this document."

19. Electronic and Information Technology Accessibility. CONTRACTOR is encouraged to follow guidelines established under Section 508 of the Rehabilitation Act, codified at 36 CFR Part 1194, with respect to enabling individuals with disabilities to participate in its programs supported by this Project.

20. Trafficking in Persons. CONTRACTOR, its employees, and subcontractors and their employees may not engage in severe forms of trafficking in persons during the term of this

Agreement, procure a commercial sex act during the term of this Agreement, or use forced labor in the performance of this Agreement. CONTRACTOR must include this provision in its subcontracts under this Agreement. CONTRACTOR must inform MCWD immediately of any information regarding a violation of the foregoing. CONTRACTOR understands that failure to comply with this provision may subject the State Water Board to loss of federal funds. CONTRACTOR agrees to compensate MCWD for any liability to State Water Board due to CONTRACTOR's failure to comply with this condition, or the failure of its contractors or subcontractors to comply with this condition.

21. Super Cross-Cutters - Civil Rights Obligations. CONTRACTOR must comply with the following federal non-discrimination requirements:

- (a) Title VI of the Civil Rights Act of 1964, which prohibits discrimination based on race, color, and national origin, including limited English proficiency (LEP). (EPA XC HB)
- (b) Section 504 of the Rehabilitation Act of 1973, which prohibits discrimination against persons with disabilities. (EPA XC HB)
- (c) The Age Discrimination Act of 1975, which prohibits age discrimination. (EPA XC HB)
- (d) 40 CFR Part 7, as it relates to the foregoing (EPA XC HB)

22. Federal Non-Discrimination Requirements - Executive Order No. 11246. CONTRACTOR shall comply with and shall include in its subcontracts related to the Project the following provisions. As used below "contractor" shall refer to CONTRACTOR and its subcontractors.

"During the performance of this contract, the contractor agrees as follows:

"(a) The contractor will not discriminate against any employee or applicant for employment because of race, creed, color, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, creed, color, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

"(b) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, creed, color, or national origin.

"(c) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer, advising the labor union or workers' representative of the contractor's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

"(d) The contractor will comply with all provisions of Executive Order No. 11246 of Sept. 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

"(e) The contractor will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

"(f) In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be cancelled, terminated or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of Sept 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

"(g) The contractor will include the provisions of Paragraphs (a) through (g) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of Sept. 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the contracting agency may direct as a means of enforcing such provisions including sanctions for noncompliance: Provided, however, That in the event the contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the contracting agency, the contractor may request the United States to enter into such litigation to protect the interests of the United States."

23. Disadvantaged Business Enterprises (40 CFR Part 33). CONTRACTOR agrees to comply with the requirements of USEPA's Program for Utilization of Small, Minority and Women's Business Enterprises. The DBE rule can be accessed at www.epa.gov/osbp. CONTRACTOR shall comply with 40 CFR Section 33.301, and retain all records documenting compliance with the six good faith efforts. (IUP). Additional DBE provisions are included in Exhibit 2, and incorporated herein by reference.

24. Procurement Prohibitions under Section 306 of the Clean Air Act and Section 508 of the Clean Water Act, including Executive Order 11738, Administration of the Clean Air Act and the Federal Water Pollution Control Act with Respect to Federal Contracts, Grants, or Loans; 42 USC § 7606; 33 USC § 1368. Except where the purpose of this Agreement is to remedy the cause of the violation, CONTRACTOR may not procure goods, services, or materials from suppliers excluded under the federal System for Award Management: <http://www.sam.gov/>

25. Debarment and Suspension Executive Order No. 12549 (1986). CONTRACTOR certifies that it is not ineligible and certifies that it will not knowingly enter into a contract with anyone who is ineligible under the 40 CFR Part 32 to participate in the Project. Subcontractors on the project must provide CONTRACTOR with the certification prior to the award of any subcontract.

26. Secured Connections. CONTRACTOR agrees that if its network or information system is connected to USEPA networks to transfer data using systems other than the Environmental Information Exchange Network or USEPA's Central Data Exchange, it will ensure that any connections are secure.

27. Anti-Lobbying Provisions (40 CFR Part 34). CONTRACTOR shall ensure that no funds under this Agreement are used to engage in lobbying of the federal government. CONTRACTOR agrees to comply with 40 CFR Part 24, New Restrictions on Lobbying. CONTRACTOR agrees to submit certification and disclosure forms in accordance with these provisions. In accordance with the Byrd Anti-Lobbying Amendment, any CONTRACTOR who makes a prohibited expenditure under 40 CFR Part 34 or fails to file the required certification or lobbying forms shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such expenditure. CONTRACTOR certifies that to the best of his/ her knowledge and belief no state, federal or local agency appropriated funds have been paid, or will be paid by or on behalf of the Consultant to any person for the purpose of influencing or attempting to influence an officer or employee of any state or federal agency; a Member of the State Legislature or United States Congress; an officer or employee of the Legislature or Congress; or any employee of a Member of the Legislature or Congress, in connection with the award of any state or federal contract, grant, loan, or cooperative agreement, or the extension, continuation, renewal, amendment, or modification of any state or federal contract, grant, loan, or cooperative agreement.

a) If any funds other than federal appropriated funds have been paid, or will be paid to any person for the purpose of influencing or attempting to influence an officer or employee of any federal agency; a Member of Congress; an officer or employee of Congress, or an employee of a Member of Congress; in connection with this Agreement, the CONTRACTOR shall complete and submit the attached Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with the attached instructions.

b) Contractor's certification provided in this section is a material representation of fact upon which reliance was placed when this Agreement was entered into, and is a prerequisite for entering into this Agreement.

c) Contractor also agrees by signing this Agreement that he/she shall require that the language set forth in this section be included in all Contractor's subcontracts which exceed \$100,000, and that all such subcontractors shall certify and disclose accordingly.

EXHIBIT 1
DAVIS BACON PROVISIONS

For purposes of this Exhibit only, “subrecipient” or “sub recipient” means MCWD.

For purposes of this Exhibit only, “recipient” means the State Water Board.

If a sub recipient has questions regarding when Davis-Bacon (DB) applies, obtaining the correct DB wage determinations, DB provisions, or compliance monitoring, it may contact the State Water Board. The recipient or sub recipient may also obtain additional guidance from DOL’s web site at <http://www.dol.gov/whd/>

1. Applicability of the Davis- Bacon (DB) prevailing wage requirements.

DB prevailing wage requirements apply to the construction, alteration, and repair of treatment works carried out in whole or in part with assistance made available by a State water pollution control revolving fund and to any construction project carried out in whole or in part by assistance made available by a clean water revolving loan fund. If a sub recipient encounters a unique situation at a site that presents uncertainties regarding DB applicability, the sub recipient must discuss the situation with the recipient State before authorizing work on that site.

2. Obtaining Wage Determinations.

(a) Sub recipients shall obtain the wage determination for the locality in which a covered activity subject to DB will take place prior to issuing requests for bids, proposals, quotes or other methods for soliciting contracts (solicitation) for activities subject to DB. These wage determinations shall be incorporated into solicitations and any subsequent contracts. Prime contracts must contain a provision requiring that subcontractors follow the wage determination incorporated into the prime contract.

(i) While the solicitation remains open, the sub recipient shall monitor www.wdol.gov weekly to ensure that the wage determination contained in the solicitation remains current. The sub recipients shall amend the solicitation if DOL issues a modification more than 10 days prior to the closing date (i.e. bid opening) for the solicitation. If DOL modifies or supersedes the applicable wage determination less than 10 days prior to the closing date, the sub recipients may request a finding from the State recipient that there is not a reasonable time to notify interested contractors of the modification of the wage determination. The State recipient will provide a report of its findings to the sub recipient.

(ii) If the sub recipient does not award the contract within 90 days of the closure of the solicitation, any modifications or supersedes DOL makes to the wage determination contained in the solicitation shall be effective unless the State recipient, at the request of the sub recipient, obtains an extension of the 90 day period from DOL pursuant to 29 CFR 1.6(c)(3)(iv). The sub recipient shall monitor www.wdol.gov on a weekly basis if it does not award the contract within 90 days of closure of the solicitation to ensure that wage determinations contained in the solicitation remain current.

(b) If the sub recipient carries out activity subject to DB by issuing a task order, work assignment or similar instrument to an existing contractor (ordering instrument) rather than by publishing a

solicitation, the sub recipient shall insert the appropriate DOL wage determination from www.wdol.gov into the ordering instrument.

(c) Sub recipients shall review all subcontracts subject to DB entered into by prime contractors to verify that the prime contractor has required its subcontractors to include the applicable wage determinations.

(d) As provided in 29 CFR 1.6(f), DOL may issue a revised wage determination applicable to a sub recipient's contract after the award of a contract or the issuance of an ordering instrument if DOL determines that the sub recipient has failed to incorporate a wage determination or has used a wage determination that clearly does not apply to the contract or ordering instrument. If this occurs, the sub recipient shall either terminate the contract or ordering instrument and issue a revised solicitation or ordering instrument or incorporate DOL's wage determination retroactive to the beginning of the contract or ordering instrument by change order. The sub recipient's contractor must be compensated for any increases in wages resulting from the use of DOL's revised wage determination.

3. Contract and Subcontract provisions.

(a) The Recipient shall insure that the sub recipient(s) shall insert in full in any contract in excess of \$2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a treatment work under the CWSRF or a construction project under the DWSRF - financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1 or the Consolidated Appropriations Act, 2016, the following clauses:

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time

actually worked therein: Provided that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers. Sub recipients may obtain wage determinations from the U.S. Department of Labor's web site, www.dol.gov.

(ii)(A) The sub recipient(s), on behalf of EPA, shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The State award official shall approve a request for an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the sub recipient(s) agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), documentation of the action taken and the request, including the local wage determination shall be sent by the sub recipient (s) to the State award official. The State award official will transmit the request, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210 and to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification request within 30 days of receipt and so advise the State award official or will notify the State award official within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the sub recipient(s) do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the award official shall refer the request and the local wage determination, including the views of all interested parties and the recommendation of the State award official, to the Administrator for determination. The request shall be sent to the EPA DB Regional Coordinator concurrently. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt of the request and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

(D) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs (a)(1)(ii)(B) or (C) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(2) Withholding. The sub recipient(s), shall upon written request of the EPA Award Official or an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

(i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly, for each week in which any contract work is performed, a copy of all payrolls to the sub recipient, that is, the entity that receives the sub-grant or loan from the State capitalization grant recipient. Such documentation shall be available on request of the State recipient or EPA. As to each payroll copy received, the sub recipient shall provide written confirmation in a form satisfactory to the State indicating whether or not the project is in compliance with the requirements of 29 CFR 5.5(a)(1) based on the most recent payroll copies for the specified week. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on the weekly payrolls. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the sub recipient(s) for transmission to the State or EPA if requested by EPA, the State, the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sub recipient(s).

(B) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under § 5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under § 5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(C) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (a)(3)(ii)(B) of this section.

(D) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.

(iii) The contractor or subcontractor shall make the records required under paragraph (a)(3)(i) of this section available for inspection, copying, or transcription by authorized representatives of the State, EPA or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the Federal agency or State may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(4) Apprentices and trainees

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended and 29 CFR part 30.

(5) Compliance with Copeland Act requirements. The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

(6) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses contained in 29 CFR 5.5(a)(1) through (10) and such other clauses as the EPA determines may be appropriate, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.

(7) Contract termination; debarment. A breach of the contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.

(8) Compliance with Davis-Bacon and Related Act requirements. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.

(9) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29

CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and sub recipient(s), State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of eligibility.

(i) By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(ii) No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

4. Contract Provision for Contracts in Excess of \$100,000.

(a) Contract Work Hours and Safety Standards Act. The sub recipient shall insert the following clauses set forth in paragraphs (a)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by Item 3, above or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (a)(1) of this section the contractor and any subcontractor responsible therefore shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (a)(1) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (a)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The sub recipient, upon written request of the EPA Award Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with

the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (a)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a)(1) through (4) of this section. (b) In addition to the clauses contained in Item 3, above, in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in 29 CFR 5.1, the Sub recipient shall insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Sub recipient shall insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the USEPA and the Department of Labor and the State Water Board, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

5. Compliance Verification

(a) The sub recipient shall periodically interview a sufficient number of employees entitled to DB prevailing wages (covered employees) to verify that contractors or subcontractors are paying the appropriate wage rates. As provided in 29 CFR 5.6(a)(6), all interviews must be conducted in confidence. The sub recipient must use Standard Form 1445 (SF 1445) or equivalent documentation to memorialize the interviews. Copies of the SF 1445 are available from EPA on request.

(b) The sub recipient shall establish and follow an interview schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. Sub recipients must conduct more frequent interviews if the initial interviews or other information indicated that there is a risk that the contractor or subcontractor is not complying with DB. Sub recipients shall immediately conduct interviews in response to an alleged violation of the prevailing wage requirements. All interviews shall be conducted in confidence."

(c) The sub recipient shall periodically conduct spot checks of a representative sample of weekly payroll data to verify that contractors or subcontractors are paying the appropriate wage rates. The sub recipient shall establish and follow a spot check schedule based on its assessment of the risks of noncompliance with DB posed by contractors or subcontractors and the duration of the contract or subcontract. At a minimum, if practicable, the sub recipient should spot check payroll data within two weeks of each contractor or subcontractor's submission of its initial

payroll data and two weeks prior to the completion date the contract or subcontract. Sub recipients must conduct more frequent spot checks if the initial spot check or other information indicates that there is a risk that the contractor or subcontractor is not complying with DB. In addition, during the examinations the sub recipient shall verify evidence of fringe benefit plans and payments there under by contractors and subcontractors who claim credit for fringe benefit contributions.

(d) The sub recipient shall periodically review contractors' and subcontractors' use of apprentices and trainees to verify registration and certification with respect to apprenticeship and training programs approved by either the U.S Department of Labor or a state, as appropriate, and that contractors and subcontractors are not using disproportionate numbers of, laborers, trainees and apprentices. These reviews shall be conducted in accordance with the schedules for spot checks and interviews described in Item 5(b) and (c) above.

(e) Sub recipients must immediately report potential violations of the DB prevailing wage requirements to the EPA DB contact listed above and to the appropriate DOL Wage and Hour District Office listed at <http://www.dol.gov/whd/america2.htm>.

EXHIBIT 2
DBE PROVISIONS

Compliance with the requirements of this document and submission of the required bid forms satisfies the Disadvantaged Business Enterprise (DBE) requirements for this construction contract. **Failure to take the six (6) affirmative steps listed under Good Faith Effort Requirements, prior to bid opening shall cause the bid to be rejected as a non-responsive bid.**

CONTRACTOR advises potential bidders that the project will be funded in whole or part with federal loan or grant funds through the California Safe Clean Water State Revolving Fund, and, therefore federal Disadvantaged Business Enterprise (DBE) regulations apply to this project. (Reference 40 Code of Federal Regulations Part 33 – Participation by Disadvantaged Business Enterprises in U.S. Environmental Protection Agency Programs).

The DBE rule requires that responsive bid shall conform with “Good Faith Efforts” to increase DBE awareness of procurement opportunities through race/gender neutral efforts. Race/gender neutral efforts are ones which increase awareness of contracting opportunities in general, including outreach, recruitment and technical assistance. Bidder agrees that it will cooperate with and assist the CONTRACTOR and OWNER in fulfilling the DBE Good Faith Effort Requirement achieving “fair share objectives” and will exercise “Good Faith Efforts” to achieve such minimum participation of small, minority and women owned businesses. In particular, in submitting a bid, the bidder shall, in the selection of any and all subcontractors, and vendors for the procurement of equipment, supplies, construction, and services related to the project, at a minimum, undertake the following affirmative “Good Faith Efforts” steps:

Good Faith Effort Requirements

1. Include disadvantaged business enterprises on solicitation lists.
2. Assure that disadvantaged business enterprises are solicited whenever they are potential sources, in a way that encourages and facilitates their participation in the competitive process.
3. Divide total requirements, when economically feasible, into small tasks or quantities to permit maximum participation by disadvantaged business enterprises.
4. Establish delivery schedules, when the requirements of the work permit, which will encourage participation by disadvantaged business enterprises.
5. Use the services and assistance of the Small Business Administration and the U.S. Minority Business Development Agency, as appropriate; and
6. If any contractor awards sub-agreements, require the contractor to take the affirmative steps in paragraphs (1) through (5) of this section.

Other Requirements:

1. The apparent successful low bidder must submit documentation showing that, prior to bid opening, the required “Good Faith Efforts” were made.

2. If the apparent successful low bidder is rejected or considered as non-responsive and/or has any non-responsive low DBE sub-bidder, a complete explanation must be provided to the CONTRACTOR.
3. If additional procurement becomes necessary after the award of the prime contract, the "Good Faith Efforts" shall be applied.
4. Failure of the apparent low bidder to perform the six affirmative "Good Faith Efforts" steps prior to bid opening will lead to its bid being declared non-responsive by MCWD. MCWD may then award the contract to the next low responsive, responsible bidder meeting the requirements of these contract provisions.
5. Prime contractor must pay its subcontractor(s) for satisfactory performance no more than 30 days from the prime contractor's receipt of payment.
6. Bidder's List- Contractor must create and maintain, and submit to MCWD, a Bidders List. The Bidders list must include all firms that bid or quote on prime contracts, or bid or quote on subcontracts, including both DBEs and non-DBEs. Information retained on the Bidder's List must include the following:
 - a. Entity's name with point of contact;
 - b. Entity's mailing address and telephone number;
 - c. The project description on which the entity bid or quoted and when;
 - d. Amount of bid/quote; and
 - e. Entity's status as a DBE or non-DBE.

Semiannual DBE Utilization Reporting

In order to fulfill federal reporting requirements, the selected prime contractor must, using the MBE/WBE Utilization form to be provided by MCWD, report to MCWD on a semiannual basis, their utilization of Minority Business Enterprise and Women's Business Enterprise subcontractor/supplier/vendors. MCWD will compile all MBE/WBE Utilization reports from prime contractor(s) and sub-contractor(s) into one report and submit to CDPH by April 15 and October 15 of each year until the last claim is submitted.

END OF DOCUMENT

DISCLOSURE OF LOBBYING ACTIVITIES

Complete this form to disclose lobbying activities pursuant to 31 U.S.C. 1352

Approved by OMB

0348-0046

(See reverse for public burden disclosure.)

1. Type of Federal Action: <input type="checkbox"/> a. contract <input type="checkbox"/> b. grant <input type="checkbox"/> c. cooperative agreement <input type="checkbox"/> d. loan <input type="checkbox"/> e. loan guarantee <input type="checkbox"/> f. loan insurance	2. Status of Federal Action: <input type="checkbox"/> a. bid/offer/application <input type="checkbox"/> b. initial award <input type="checkbox"/> c. post-award	3. Report Type: <input type="checkbox"/> a. initial filing <input type="checkbox"/> b. material change For Material Change Only: year _____ quarter _____ date of last report _____
4. Name and Address of Reporting Entity: <input type="checkbox"/> Prime <input type="checkbox"/> Subawardee Tier _____, <i>if known</i> : Congressional District, if known:	5. If Reporting Entity in No. 4 is a Subawardee, Enter Name and Address of Prime: Congressional District, if known:	
6. Federal Department/Agency:	7. Federal Program Name/Description: CFDA Number, <i>if applicable</i> : _____	
8. Federal Action Number, if known:	9. Award Amount, if known: \$ _____	
10. a. Name and Address of Lobbying Registrant <i>(if individual, last name, first name, MI):</i>	b. Individuals Performing Services <i>(including address if different from No. 10a)</i> <i>(last name, first name, MI):</i>	
11. Information requested through this form is authorized by title 31 U.S.C. section 1352. This disclosure of lobbying activities is a material representation of fact upon which reliance was placed by the tier above when this transaction was made or entered into. This disclosure is required pursuant to 31 U.S.C. 1352. This information will be available for public inspection. Any person who fails to file the required disclosure shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.	Signature: _____ Print Name: _____ Title: _____ Telephone No.: _____ Date: _____	
Federal Use Only:		Authorized for Local Reproduction Standard Form LLL (Rev. 7-97)

INSTRUCTIONS FOR COMPLETION OF SF-LLL, DISCLOSURE OF LOBBYING ACTIVITIES

This disclosure form shall be completed by the reporting entity, whether subawardee or prime Federal recipient, at the initiation or receipt of a covered Federal action, or a material change to a previous filing, pursuant to title 31 U.S.C. section 1352. The filing of a form is required for each payment or agreement to make payment to any lobbying entity for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a covered Federal action. Complete all items that apply for both the initial filing and material change report. Refer to the implementing guidance published by the Office of Management and Budget for additional information.

1. Identify the type of covered Federal action for which lobbying activity is and/or has been secured to influence the outcome of a covered Federal action.
2. Identify the status of the covered Federal action.
3. Identify the appropriate classification of this report. If this is a followup report caused by a material change to the information previously reported, enter the year and quarter in which the change occurred. Enter the date of the last previously submitted report by this reporting entity for this covered Federal action.
4. Enter the full name, address, city, State and zip code of the reporting entity. Include Congressional District, if known. Check the appropriate classification of the reporting entity that designates if it is, or expects to be, a prime or subaward recipient. Identify the tier of the subawardee, e.g., the first subawardee of the prime is the 1st tier. Subawards include but are not limited to subcontracts, subgrants and contract awards under grants.
5. If the organization filing the report in item 4 checks "Subawardee," then enter the full name, address, city, State and zip code of the prime Federal recipient. Include Congressional District, if known.
6. Enter the name of the Federal agency making the award or loan commitment. Include at least one organizational level below agency name, if known. For example, Department of Transportation, United States Coast Guard.
7. Enter the Federal program name or description for the covered Federal action (item 1). If known, enter the full Catalog of Federal Domestic Assistance (CFDA) number for grants, cooperative agreements, loans, and loan commitments.
8. Enter the most appropriate Federal identifying number available for the Federal action identified in item 1 (e.g., Request for Proposal (RFP) number; Invitation for Bid (IFB) number; grant announcement number; the contract, grant, or loan award number; the application/proposal control number assigned by the Federal agency). Include prefixes, e.g., "RFP-DE-90-001."
9. For a covered Federal action where there has been an award or loan commitment by the Federal agency, enter the Federal amount of the award/loan commitment for the prime entity identified in item 4 or 5.
10. (a) Enter the full name, address, city, State and zip code of the lobbying registrant under the Lobbying Disclosure Act of 1995 engaged by the reporting entity identified in item 4 to influence the covered Federal action.

(b) Enter the full names of the individual(s) performing services, and include full address if different from 10 (a). Enter Last Name, First Name, and Middle Initial (MI).
11. The certifying official shall sign and date the form, print his/her name, title, and telephone number.

According to the Paperwork Reduction Act, as amended, no persons are required to respond to a collection of information unless it displays a valid OMB Control Number. The valid OMB control number for this information collection is OMB No. 0348-0046. Public reporting burden for this collection of information is estimated to average 10 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0046), Washington, DC 20503.

Work Change Directive No.

Date of Issuance:	Effective Date:
Owner: Marina Coast Water District	Owner's Contract No.:
Contractor:	Contractor's Project No.:
Engineer:	Engineer's Project No.:
Project:	Contract Name:

Contractor is directed to proceed promptly with the following change(s):

Description:

Attachments: *[List documents supporting change]*

Purpose for Work Change Directive:

Directive to proceed promptly with the Work described herein, prior to agreeing to changes on Contract Price and Contract Time, is issued due to: *[check one or both of the following]*

- Non-agreement on pricing of proposed change.
- Necessity to proceed for schedule or other Project reasons.

Estimated Change in Contract Price and Contract Times (non-binding, preliminary):

Contract Price	\$	[increase] [decrease].
Contract Time	days	[increase] [decrease].

Basis of estimated change in Contract Price:

- | | |
|---|-------------------------------------|
| <input type="checkbox"/> Lump Sum | <input type="checkbox"/> Unit Price |
| <input type="checkbox"/> Cost of the Work | <input type="checkbox"/> Other |

RECOMMENDED:

AUTHORIZED BY:

RECEIVED:

By:	By:	By:
Engineer (Authorized Signature)	Owner (Authorized Signature)	Contractor (Authorized Signature)
Title:	Title:	Title:
Date:	Date:	Date:

Approved by Funding Agency (if applicable)

By:	Date:
Title:	

Change Order No. _____

Date of Issuance:

Effective Date:

Owner: Marina Coast Water District

Owner's Contract No.:

Contractor:

Contractor's Project No.:

Engineer:

Engineer's Project No.:

Project:

Contract Name:

The Contract is modified as follows upon execution of this Change Order:

Description:

Attachments: *[List documents supporting change]*

CHANGE IN CONTRACT PRICE	CHANGE IN CONTRACT TIMES <i>[note changes in Milestones if applicable]</i>
Original Contract Price: \$ _____	Original Contract Times: Substantial Completion: _____ Ready for Final Payment: _____ <div style="text-align: right;">days or dates</div>
[Increase] [Decrease] from previously approved Change Orders No. ___ to No. ___: \$ _____	[Increase] [Decrease] from previously approved Change Orders No. ___ to No. ___: Substantial Completion: _____ Ready for Final Payment: _____ _____ days
Contract Price prior to this Change Order: \$ _____	Contract Times prior to this Change Order: Substantial Completion: _____ Ready for Final Payment: _____ <div style="text-align: right;">days or dates</div>
[Increase] [Decrease] of this Change Order: \$ _____	[Increase] [Decrease] of this Change Order: Substantial Completion: _____ Ready for Final Payment: _____ <div style="text-align: right;">days or dates</div>
Contract Price incorporating this Change Order: \$ _____	Contract Times with all approved Change Orders: Substantial Completion: _____ Ready for Final Payment: _____ <div style="text-align: right;">days or dates</div>

RECOMMENDED:

ACCEPTED:

ACCEPTED:

By: _____
 Engineer (if required)

By: _____
 Owner (Authorized Signature)

By: _____
 Contractor (Authorized Signature)

Title: _____

Title: _____

Title: _____

Date: _____

Date: _____

Date: _____

Approved by Funding Agency (if applicable)

By: _____

Date: _____

Title: _____

Date of Issuance:

Effective Date:

Owner: Marina Coast Water District

Owner's Contract No.:

Contractor:

Contractor's Project No.:

Engineer:

Engineer's Project No.:

Project:

Contract Name:

Contractor is hereby directed to promptly execute this Field Order, issued in accordance with General Conditions Paragraph 11.01, for minor changes in the Work without changes in Contract Price or Contract Times. If Contractor considers that a change in Contract Price or Contract Times is required, submit a Change Proposal before proceeding with this Work.

Reference:

_____ Specification(s)

_____ Drawing(s) / Detail(s)

Description:

Attachments:

ISSUED:

RECEIVED:

By: _____
Engineer (Authorized Signature)

By: _____
Contractor (Authorized Signature)

Title: _____

Title: _____

Date: _____

Date: _____

Copy to: Owner

SECTION 01110

SUMMARY OF WORK

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Identification and summary description of the Project, the Work, location, OWNER furnished products, activities by others, coordination, and early occupancy by OWNER.

1.02 THE WORK

- A. The Work includes construction of approximately 40,000 linear feet of 24-inch transmission main pipeline in paved and non-paved roadways and easements, connections to existing facilities, pipeline valves and appurtenances, two bore and jack roadway crossings, a 2.0 MG welded steel reservoir with potable water backup pumping system and associated appurtenances and electrical and SCADA improvements, for a complete in-place operational system.

1.03 LOCATION OF PROJECT

- A. The Work is located in Monterey County, portions of which are within the City of Marina, City of Seaside, the campus of California State University Monterey Bay (CSUMB), US Army, Monterey Peninsula Unified School District, and unincorporated areas of Monterey County.

1.04 OWNER ASSIGNED SUBCONTRACTORS

- A. Assignment of Subcontractors by OWNER is not anticipated.

1.05 OWNER FURNISHED EQUIPMENT

- A. OWNER will not furnish any products or equipment.

1.06 ACTIVITIES BY OTHERS

- A. OWNER, utilities, and others may perform activities within Project area while the Work is in progress:
 - 1. Schedule the Work with OWNER, utilities, and others to minimize mutual interference.
- B. Cooperate with others to minimize interference and delays:
 - 1. When cooperation fails, submit recommendations and perform Work in coordination with work of others as directed.

1.07 COORDINATION OF WORK

- A. Maintain overall coordination of the Work.

- B. Obtain construction schedules from each subcontractor, and require each subcontractor to maintain schedules and coordinate modifications.

1.08 EARLY OCCUPANCY OF PORTIONS OF WORK

- A. Allow access at all times for OWNER's personnel; access for others authorized by OWNER for OWNER operation of existing equipment and systems.
- B. No partial acceptance of the Work will be made and no acceptance other than the final acceptance of the completed Work will be made except for those portions of Work designated for early occupancy by OWNER.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01140

WORK RESTRICTIONS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Requirements for sequencing and scheduling the Work, work restrictions and coordination between construction operations and concurrent construction projects.
- B. Related Sections:
 - 1. Section 01110 - Summary of Work.
 - 2. Section 01355 - Stormwater Pollution Prevention Construction Activity, and Best Management Practices.
 - 3. Section 01410 - Regulatory Requirements.
 - 4. Section 01500 - Temporary Facilities and Controls.

1.02 DEFINITION OF JURISDICTIONS

- A. Armstrong Easement: STA 10+00 to STA 120+80.
- B. PG&E Easement: STA 120+80 to STA 121+13.
- C. City of Marina: STA 121+13 to STA 265+80.
- D. California State University Monterey Bay (CSUMB): STA 265+80 to STA 347+30.
- E. City of Seaside: STA 347+30 to STA 348+33
- F. Army: STA 348+33 to STA 389+56 and STA A10+00 to STA A16+00.
- G. Marshall Elementary School Easement: A16+00 to A25+82.
- H. City of Seaside Easement: STA A25+82 to STA A48+40.
- I. MCWD: Blackhorse Reservoir Site.

1.03 SITE ACCESS

- A. Armstrong Ranch: Armstrong Ranch is private property and will require the Contractor to coordinate with the land owner. Land owner contact information is available from the District.
- B. Monterey Regional Wastewater Pollution Control Agency (MRWPCA): Access to Armstrong Ranch is available through MRWPCA. The Contractor shall coordinate access with MRWPCA personnel. If cattle are on Armstrong Ranch, the Contractor shall maintain a temporary gate to keep the cattle out of MRWPCA property.

1.04 CONSTRAINTS ON SEQUENCE AND SCHEDULING OF WORK

- A. The listing of schedule constraints in this Section; Section 01410, Regulatory Requirements and Section 01570, Traffic Regulation; and elsewhere in the contract documents does not mean that all constraints or special conditions have been identified. The list does not substitute for the Contractor's coordination and planning for completion of work within the Contract Time in the Agreement.
- B. The Contractor shall allow for construction and schedule constraints in preparing the construction schedules required under Section 01324A, Progress Schedules and Reports. The schedules shall include the Contractor's activities necessary to satisfy all constraints included and referenced in the Contract Documents.
- C. Utilize description of critical events in work constraints in this Section as a guideline for scheduling and undertaking the Work.
- D. General:
 - 1. The Contractor shall schedule construction activities within each segment in accordance with the requirements of all permits.
 - 2. For portions of the project located within Former Fort Ord, the Contractor will be required to undergo Munitions and Explosives of Concern (MEC) training in accordance with MMRP Items 4.4-R1 and 4.4-R2 prior to start of work.
 - 3. For all segments of the project located in paved roadways, the Contractor shall at a minimum, backfill, compact and install the first lift of permanent asphalt for all open trenches, and reopen the roadway to traffic by the end of every working day.
 - 4. For specific traffic control constraints see Section 01570, Traffic Regulation:
 - a. Agency approved detour routes are provided in Appendix C.
 - b. No two contiguous segments can be detoured at the same time.
 - 5. The Contractor is responsible for complying with all mitigation and monitoring measures identified in the CEQA/NEPA documents and in the table provided in Appendix B.
 - 6. The Contractor shall sweep the streets daily to maintain the roadway clear of all debris and loose material.
 - 7. Contractor shall provide a construction schedule, traffic control plans, and road closure schedule to all affected agencies prior to start of construction activities. Agencies include but are not limited to:
 - a. City of Marina (Public Works, Strategic Development, Public Safety).
 - b. City of Seaside (Public Works, Fire, Police).
 - c. California State University Monterey Bay.
 - d. Monterey Salinas Transit.
 - e. Army.
- E. Pipeline:
 - 1. Testing the existing pipeline in General Jim Moore Boulevard shall be the first part of the work.
 - 2. Armstrong Ranch:
 - a. Shall be built first.
 - 3. City of Marina:
 - a. Work in the City of Marina is permitted Monday through Friday unless specified otherwise in the encroachment permit.

- b. Nighttime and weekend work will be allowed only when approved in writing by both the governing agency and Engineer.
- c. Allowable working hours in the City of Marina are 9:00am to 4:00pm.
- d. All work fronting schools must be performed during school breaks.
- 4. California State University Monterey Bay (CSUMB):
 - a. All work must occur during between June 12, 2018 and August 18, 2018.
 - b. Allowable working hours at CSUMB are 7:30 a.m. to 5:00 p.m.
 - c. Testing of the existing transmission pipeline shall be the first item of work in CSUMB property.
 - d. If road closures are planned, construction must occur during school breaks.
 - e. Provide CSUMB personnel 30 days notice for planned road closures.
 - f. All work must be coordinated with other planned work, such as building construction, on CSUMB property.
- 5. General Jim Moore Boulevard:
 - a. Due to major events at the Monterey Presidio causing heavy traffic, no construction will be allowed on General Jim Moore Boulevard in February or July.
- 6. Marshall School:
 - a. All work fronting Marshall School and requiring access to school grounds shall be completed during school breaks. Approximate school breaks are shown below. Contractor shall verify school break schedule prior to scheduling construction:
 - 1) The last two weeks of March.
 - 2) The second week of June to the first week of August.
 - 3) The second week of October.
 - 4) The last two weeks of December.
 - b. Allowable working hours at Marshall School are between 8:00 a.m. and 6:00 p.m.
 - c. Access to the walk path along General Jim Moore Boulevard between Ardennes and Normandy must be maintained at all times.
- 7. City of Seaside:
 - a. Allowable working hours in the City of Seaside are between 9:00 a.m. and 4:00 p.m. Monday through Friday unless specified otherwise in the encroachment permit. Nighttime and weekend construction will be allowed only when approved in writing by both the governing agency and the Engineer.
 - b. All work fronting schools must be performed during school breaks.
- F. Blackhorse Reservoir Mechanical, Electrical, Instrumentation:
 - 1. Complete reservoir construction by September 1, 2018.
 - 2. Complete mechanical, electrical, and instrumentation construction and testing by October 1, 2018.

1.05 UTILITIES

- A. Provide advance notice to and utilize services of Underground Services Alert (U.S.A.) for location and marking of underground utilities.
- B. Maintain electrical, telephone, water, gas, sanitary facilities, and other utilities within existing facilities in service. Provide temporary utilities when necessary.

1.06 WORK BY OTHERS

- A. Where proper execution of the Work depends upon work by others, inspect and promptly report discrepancies and defects.
- B. The Contractor is responsible for coordinating work with the Contractors and Owners of other concurrent construction projects in the vicinity of this project. Specific projects that may require coordination include, but are not limited to:
 - 1. Connection to the pipeline at Station 10+00 by Monterey Regional Water Pollution Control Agency.
 - 2. SCADA related work at the Blackhorse Reservoir by Monterey Regional Water Pollution Control Agency.

1.07 TEMPORARY SERVICES, MATERIALS, AND EQUIPMENT

- A. Dimensions for all existing structures, piping, paving, and other nonstructural items are approximate. The CONTRACTOR shall field verify all dimensions and conditions and report any discrepancies to the ENGINEER a minimum of 14 days in advance of any construction in the area.
- B. Discrepancies between coordinates, bearings and lengths, and stationing shall be resolved in the following order of precedence:
 - 1. Coordinates.
 - 2. Bearings and lengths.
 - 3. Stationing.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01201
PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Procedures for submitting applications for payment and means used as a basis for Progress Payments, including:
 - 1. Cost Summaries.
 - 2. Payment for Mobilization.
 - 3. Start-up.
 - 4. Demobilization.

- B. Related Sections:
 - 1. Section 01292 - Schedule of Values.

1.02 BASIS FOR PROGRESS PAYMENTS

- A. Base Application for Payment on the breakdown of costs for each scheduled activity in the Progress Schedule and the Percentage of Completion for each activity. Generate Application for Payment by downloading cost data from the Progress Schedule to a spreadsheet type format. Identify each activity on the Progress Schedule that has a cost associated with it, the cost of each activity, the estimated Percent Complete for each activity, and the Value of Work Completed for both the payment period and job to date.

1.03 PAYMENT REQUESTS

- A. Prepare progress payment requests on a monthly basis. Base requests on the breakdowns of costs for each scheduled activity and the percentage of completion for each activity.

- B. Indicate total dollar amount of work planned for every month of the project. Equate sum of monthly amounts to Lump Sum Contract Price.

- C. Generate Progress Payment request forms by downloading cost data from the schedule information to a spreadsheet type format. Identify each activity on the Progress Schedule that has a cost associated with it, the cost for each activity, the estimated percent complete for each activity, and the value of work completed for both the payment period and job to date.

- D. Prepare summary of cost information for each Major Item of Work listed in the Schedule of Values. Identify the value of work completed for both the payment period and job to date.

- E. Submit progress payment requests at progress meetings.

1.04 COST SUMMARIES

- A. Prepare Summary of Cost Information for each Major Item of Work listed in the Schedule of Values. Identify the Value of Work Completed for both the payment period and job to date.
- B. Cash Flow Summary: Prepare cash flow summary, indicating total dollar amount of work planned for each month of the project. Equate sum of monthly amounts to Lump Sum contract price.

1.05 PAYMENT FOR MOBILIZATION

- A. Limit amounts included under Mobilization to the following items:
 - 1. Moving on the site any equipment required for first month operations.
 - 2. Installing temporary construction power and wiring.
 - 3. Developing construction water supply.
 - 4. Providing field office trailers for the CONTRACTOR and the ENGINEER, complete with all specified furnishings and utility services including telephones.
 - 5. Providing on-site sanitary facilities and potable water facilities as specified.
 - 6. Arranging for and erection of CONTRACTOR's work and storage yard.
 - 7. Subcontractor insurance and bonds.
 - 8. Obtaining all required permits, licenses, and fees.
 - 9. Developing construction schedule.
 - 10. Provide and erect the project sign.
 - 11. CONTRACTOR bonds and insurance.
- B. Furnish data and documentation to substantiate the amounts claimed under mobilization.
- C. Limit price for mobilization to no more than 5 percent of Contract Price.

1.06 PAYMENT FOR START-UP AND DEMOBILIZATION

- A. Total Price for start-up and demobilization shall not be less than 3 percent of Contract Price.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01270

UNIT PRICES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Procedures for measurement and payment of Work performed on a unit price basis.
- B. Related Documents:
 - 1. Document 00410 - Bid Form.

1.02 MEASUREMENT OF QUANTITIES

- A. Work paid at a unit price times number of units measured will be measured by ENGINEER in accordance with United States Standard Measures:
 - 1. 1 ton shall consist of 2,000 pounds avoirdupois.
- B. Provide and pay for accurate scales:
 - 1. Use platform scales of sufficient size and capacity to permit the entire vehicle or combination of vehicles to rest on the scale platform while being weighed.
 - 2. Combination vehicles may be weighed as separate units provided they are disconnected while being weighed.
 - 3. Have scales inspected and certified as often as necessary to ascertain accuracy.
 - 4. Furnish weigh slips and daily summary weigh sheets to ENGINEER.
- C. When material is shipped by rail, certified car weights will be acceptable, provided that not more than the actual weight of material will be paid, without consideration of minimum car weight used for assessing freight tariff:
 - 1. Car weight will not be acceptable for materials passing through mixing plants.
- D. Daily, or at shorter intervals when necessary to ensure accuracy, weigh empty trucks used to haul material paid by weight:
 - 1. Provide such trucks with plainly, unique, permanent, legible, identification marks.
- E. Reinforcing steel, steel shapes, castings, and similar items paid by weight will be measured by handbook weights for the type and quantity indicated for the Work.

1.03 PAY ITEMS

- A. General: Pay items following are included in Document 00410, Bid Form.
- B. Schedule of Unit Price Bid Items:
 - 1. Bid Item 1: Mobilization and Demobilization:
 - a. Mobilization and demobilization, complete as specified, including, but not limited to, surveying to establish preconstruction conditions, cost of obtaining all necessary permits not obtained by the District, cost for

- complying with all conditions set by all of the required permits, move in of equipment, tools, supplies, materials, and manpower to the jobsite, move out and cleanup of job site after the project is complete and accepted by the District.
- b. Payment for mobilization and demobilization will be made at the lump sum price named in the Bid Schedule under Item No. 1:
 - 1) A maximum of 50 percent will be paid after satisfactory mobilization.
The balance will be paid after satisfactory demobilization.
2. Bid Item 2: Sheeting, Shoring, and Bracing:
- a. Measurement for sheeting, shoring, and bracing will be based on providing all temporary sheeting, shoring, and bracing for excavations and grading required per the Contract Documents including, but not limited to, geotechnical report, engineering, permits, materials, tools, labor, and equipment necessary to performing the Work.
 - b. Payment for sheeting, shoring, and bracing will made at the lump sum price named in the in the Bid Schedule under Item No. 2:
 - 1) Payment will be made for the Work completed in proportion to the total value of the Work for this bid item.
3. Bid Item 3: Traffic Control:
- a. Measurement for payment for traffic control will be based upon completion of all necessary measures to temporarily control, detour, or stage traffic during construction and all other related Work per the Contract Documents.
 - b. Payment for traffic control will be made at the lump sum price named in the Bid Schedule under Item No. 3.
 - 1) Payment will be made for the Work completed in proportion to the total value of the Work for this bid item.
4. Bid Item 4: 24-inch Transmission Main (Non-Paved Areas):
- a. Measurement for payment for the transmission main in non-paved areas will be based on furnishing and installing complete the transmission main, including but not limited to, pipe materials, all site work, excavation, backfill, compaction, locating of existing utilities, off-hauling and disposal of excess materials, all pipe fittings and couplings (except valves), coatings, trench cutoffs, testing, witness markers, aggregate base material, control of grades, control of groundwater, and all other related Work as described in the Contract Documents.
 - b. Payment for the transmission main in non-paved areas will be made at the unit bid prices per linear foot named in the Bid Schedule under Items No. 4, which price shall constitute full compensation for completion of all such Work as required per the Contract Documents.
5. Bid Items 5: 24-inch Transmission Main (Paved Areas):
- a. Measurement for payment for the transmission main in paved areas will be based on furnishing and installing complete the recycled water pipe, including but not limited to, pipe materials, all site work, excavation, backfill, compaction, locating existing utilities, sawcutting existing pavement, off-hauling and disposal of excess materials, all pipe fittings and couplings (except valves), coatings, trench cutoffs, testing, temporary paving or patching, aggregate base material, control of grades, control of groundwater, corrosion monitoring, and all other related Work as described in the Contract Documents.
 - b. Payment for the transmission main in paved areas will be made at the unit bid prices per linear foot named in the Bid Schedule under Items No. 5,

- which price shall constitute full compensation for completion of all such Work as required per the Contract Documents.
6. Bid Item 6: 24-inch Transmission Main (Jack and Bore):
 - a. Measurement for payment of the transmission main installed by jack and bore will be based upon installing complete in place the steel casing for the recycled water pipeline at two locations (Crescent Avenue beneath Reservation Road and California Avenue beneath Imjin Parkway) including, but not limited to, jacking pits, casing pipe, carrier pipe installation, filling of voids and annular space, end seals, etc. site work, all piping and fittings, and all labor, materials, tools, and equipment necessary to perform all Work required per the Contract Documents.
 - b. Payment for the transmission main installed by bore and jack will be made at the per linear foot price named in the Bid Schedule under Bid Item No. 6, which price shall constitute full compensation for completion of all such Work as required per the Contract Documents.
 7. Bid Item 7: 24-inch Butterfly Valves:
 - a. Measurement for payment for the new butterfly valves will be based upon furnishing and installing complete the new butterfly valve including, but not limited to, earthwork, valve, piping, fittings, valve boxes, all labor, materials, tools and equipment in performing all Work per the Contract Documents.
 - b. Payment for the new butterfly valves will be made at the bid price for each butterfly valve named in the Bid Schedule under Items No. 7, which price shall constitute full compensation for completion of all such Work as required per the Contract Documents.
 8. Bid Item 8: Blow-Off Assemblies:
 - a. Measurement for payment for new blow-off assemblies will be based upon furnishing and installing complete the new blow-off assembly including, but not limited to, earthwork, valve, piping, fittings, valve boxes, all labor, materials, tools and equipment in performing all Work per the Contract Documents.
 - b. Payment for new blowoff assemblies will be made at the bid price for each blowoff assembly named in the Bid Schedule under Item No. 8, which price shall constitute full compensation for completion of all such Work as required per the Contract Documents.
 9. Bid Item 9 & 10: Combination Air/Vacuum Valves and ARVs:
 - a. Measurement for payment for combination air/vacuum valves will be based upon furnishing and installing complete the new combination air/vacuum valve assembly including, but not limited to, earthwork, valves, piping, fittings, valve boxes or vault, all labor, materials, tools and equipment in performing all Work per the Contract Documents.
 - b. Payment for combination air/vacuum valves will be made at the bid price for each combination air/vacuum valve named in the Bid Schedule under Item Nos. 9 & 10, which price shall constitute full compensation for completion of all such Work as required per the Contract Documents.
 10. Bid Item 11: Fill Stations:
 - a. Measurement for payment for the new fill stations will be based upon furnishing and installing complete the new fill station including, but not limited to, earthwork, valves, piping, fittings, valve boxes, concrete, wharf hydrant, all labor, materials, tools and equipment in performing all Work per the Contract Documents.

- b. Payment for new fill stations will be made at the bid price for each fill station named in the Bid Schedule under Item No. 16, which price shall constitute full compensation for completion of all such Work as required per the Contract Documents.
- 11. Bid Item 12 thru 16: Customer Turnouts:
 - a. Measurement for payment for the customer connections will be based upon furnishing and installing complete the new customer turnout including, but not limited to, earthwork, valves, piping, fittings (excluding cross or tee on the transmission main; this will be paid for under Bid Items 4 and 5), all labor, materials, tools and equipment required to perform all Work per the Contract Documents.
 - b. Payment for the new customer turnouts will be made at the bid price for each customer turnout named in the Bid Schedule under Items Nos. 12 and 16, which price shall constitute full compensation for completion of all such Work as required per the Contract Documents.
- 12. Bid Item 17: Asphalt Concrete Overlay (City of Marina):
 - a. Measurement for payment for the asphalt concrete overlay in the City of Marina will be based upon furnishing and installing all pavement including, but not limited to, removal of pavement markings, wedge grinds, conform grinds, asphalt concrete, raising existing utilities and monuments to grade, temporary and permanent striping and markers, all labor, materials, tools and equipment in performing all Work required per the Contract Documents. Measurement for asphalt concrete overlay in the City of Marina will be based on the square yards of overlay as indicated on the Contract Drawings.
 - b. Payment for the asphalt concrete overlay in the City of Marina will be made at the unit price per square yard named in the Bid Schedule under Item No. 17, which price shall constitute full compensation for completion of all such Work required per the Contract Documents.
- 13. Bid Item 18: Misc Asphalt Concrete Repairs (Allowance for Areas Outside Marina):
 - a. Measurement for payment for misc asphalt concrete repairs will be based upon furnishing and installing all pavement including, but not limited to, removal of pavement markings, wedge grinds, conform grinds, asphalt concrete, raising existing utilities and monuments to grade, temporary and permanent traffic striping and markers, all labor, materials, tools and equipment in performing all Work required per the Contract Documents. Measurement for asphalt concrete overlay in areas outside the City of Marina will be based on the square yards of asphalt concrete repair required as directed by the Engineer. For bidding purposes, the quantity named in the Bid Schedule under Item No. 18 shall be used as the basis for a unit cost.
 - b. Payment for asphaltic concrete overlay in areas outside the City of Marina will be made at the unit price per square yard named in the Bid Schedule under Item No. 18.
- 14. Bid Item 19: All Weather Access Road - 6" Crushed Rock
 - a. Measurement for payment for the all weather access road will be based upon furnishing and installing all crushed rock including all labor, materials, tools, and equipment in performing all Work required per the Contract Documents. Measurement for the all weather access road will be based on the cubic yards of crushed rock as indicated on the Contract Documents.

- b. Payment for the all weather access road will be made at the unit price per square yard named in the Bid Schedule under Item No. 19.
- 15. Bid Item 20: Blackhorse Reservoir (excluding work covered by Items 21-24):
 - a. Measurement for payment of the Blackhorse Reservoir will include all work at the Blackhorse Reservoir Site except that included in Bid Items 21 thru 24 and will be based upon installing complete in place the reservoir including, but not limited to, concrete foundation, site work, fencing, pipe and conduit, tank appurtenances, instrumentation and controls, all piping and fittings including yard piping and valves, valves, electrical Work, pipe supports, and all labor, materials, tools, and equipment necessary to perform all Work required per the Contract Documents.
 - b. Payment for the Blackhorse Reservoir will be made at a lump sum bid price named in the Bid Schedule under Item No. 20, which price shall constitute full compensation for completion of all such Work as required per the Contract Documents.
- 16. Bid Item 21: Over-Excavation and Backfill beneath Blackhorse Reservoir:
 - a. Measurement for payment for Over-Excavation and Backfill beneath the Blackhorse Reservoir includes the excavation and backfill of material beneath the Blackhorse Reservoir to the elevation indicated on the Drawings and will be based upon all materials, labor, and equipment necessary to complete the work.
 - b. Payment for Over-Excavation and Backfill beneath the Blackhorse Reservoir will be made at the unit price per cubic yard names in the Bid Schedule under Item No. 21.
- 17. Bid Item 22: Allowance for Additional Over-Excavation and Backfill at Blackhorse Reservoir:
 - a. Measurement and payment for Excavation and Backfill at Blackhorse Reservoir includes the excavation and backfill of material beneath the Blackhorse Reservoir below the elevation indicated on the Drawings and will be based upon all materials, labor, and equipment necessary to complete the work.
 - b. Work under bid item 22 shall be performed, if at all, only as specifically authorized in writing by the Engineer and to the extent specifically authorized in writing by the Engineer, at the Engineer's sole discretion. Notwithstanding any other provisions in the Contract Documents, all work comprising this Bid Item may be deleted in its entirety by the Engineer without any adjustments for overhead or profit. Payment for this item will be made at the unit price per cubic yard and will be charged against the allowance provided.
- 18. Bid Item 23: Potable Water Backup System:
 - a. Measurement for payment of the Potable Water Backup System will be based upon installing complete in place the pump including, but not limited to, earthwork, concrete foundation, site work, pipe and conduit, instrumentation, appurtenances, instrumentation and controls, flow meter, all piping and fittings including yard piping and valves, valves, electrical Work, pipe supports, and all labor, materials, tools, and equipment necessary to perform all Work required per the Contract Documents.
 - b. Payment for the Potable Water Backup System will be made at a lump sum bid price named in the Bid Schedule under Bid Item No. 23, which price shall constitute full compensation for completion of all such Work as required per the Contract Documents.
- 19. Bid Item 24: Electrical Studies:

- a. Measurement for payment of the Electric Studies will be based upon performing and submitting a short-circuit, protective device coordination, and arc-flash hazard study as required by the Contract Documents.
 - b. Payment for the electrical studies will be made at a lump sum bid price named in the Bid Schedule under Bid Item No. 24, which price shall constitute full compensation for completion of all such Work as required per the Contract Documents.
20. Bid Item 25: Test Existing 16" RW Pipeline on CSUMB Campus:
- a. Measurement for payment for Testing Existing 16" RW Pipeline on CSUMB Campus will be based upon developing and implementing a testing plan for the existing pipeline and all labor, materials, tools, and equipment necessary to perform all Work required per the Contract Documents.
 - b. Payment for the testing of the existing 16" RW pipeline on CSUMB campus will be made at a lump sum bid price named in the Bid Schedule under Bid Item No. 25, which price shall constitute full compensation for completion of all such Work as required per the Contract Documents.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01292

SCHEDULE OF VALUES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Requirements for preparation, format, and submittal of Schedule of Values.

1.01 DEFINITION

- A. The Schedule of Values is an itemized list that establishes the value of each part of the Work for major lump sum items. The Schedule of Values is used as the basis for preparing applications for payments. Quantities and unit prices may be included in the schedule when approved by or required by the Engineer.
- B. A major lump sum item is a lump sum item in the schedule of unit price work having a value greater than five percent of the Contract Amount, or whose value becomes greater than five percent due to an increase in quantity.

1.02 PREPARATION

- A. Print out Schedule of Values from accepted Preliminary or Baseline Schedule submitted and accepted under Section 01324A, Progress Schedules and Reports.
- B. For unit price contracts, items should include a proportional share of the Contractor's overhead and profit so that the total of all items will equal the Contract value.
- C. For lump sum equipment items where submittal of operation/maintenance data and factory and/or field testing are required, include a separate item for equipment operation and maintenance data submittal valued at 5 percent of the lump sum amount and separate items for factory and/or field testing and adjusting valued at 5 percent of the lump sum amount.
- D. Schedule of Values shall be a listing of all cost loaded, on- site construction activities from the progress schedule, listed in numerical order, showing that the sum total of all cost loaded activities equals the value of Contract.
- E. Whenever the schedule is changed or revised to include added or deleted work, the Schedule of Values shall also be revised such that the sum total of all cost loaded activities continuously equals the current Contract value.

1.03 SUBMITTALS

- A. Submit Schedule of Values for the Preliminary Schedule in accordance with the requirements in Section 01324A, Paragraph 1.07.
- B. Submit Schedule of Values for the Baseline Schedule in accordance with the requirements in Section 01324A, Paragraph 1.08.

- C. Submittal of the Schedule of Values is a condition precedent to the issuance of any payment under this Contract.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01294

APPLICATIONS FOR PAYMENT

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Procedures for preparation and submittal of Applications for Payment.
- B. Related Sections:
 - 1. Section 01292 - Schedule of Values.
 - 2. Section 01324A - Progress Schedules and Reports.

1.02 FORMAT

- A. Develop satisfactory spreadsheet-type form generated by downloading cost data from the Progress Schedule.
- B. Fill in information required on form.
- C. When Change Orders are executed, add Change Orders at end of listing of scheduled activities:
 - 1. Identify change order by number and description.
 - 2. Provide cost of change order in appropriate column.
- D. After completing, submit Application for Payment.
- E. ENGINEER will review application for accuracy. When accurate, ENGINEER will transmit application to OWNER for processing of payment.
- F. Execute application with signature of responsible officer of CONTRACTOR.

1.03 SUBSTANTIATING DATA

- A. Provide Substantiating Data with cover letter identifying:
 - 1. Project.
 - 2. Application number and date.
 - 3. Detailed list of enclosures.
 - 4. For stored products with item number and identification on application, description of specific material, and proof of insurance coverage for offsite stored products.
 - 5. Submit "certified" payroll.

1.04 SUBMITTALS

- A. Submit 5 copies of Application for Payment and Substantiating Data with cover letter.

- B. Coordinate requirements with Document 00700, General Conditions, Article 14 - Payments to Contractor and Completion.

1.05 PAYMENT REQUESTS

- A. Prepare progress payment requests on a monthly basis. Base requests on the breakdowns of costs for each scheduled activity and the percentage of completion for each activity.
- B. Base request for the quantity of each item completed using unit bid item measurement as described in Section 01270.
- C. Indicate total dollar amount of work planned for every month of the project. Equate sum of monthly amounts to Lump Sum Contract Price.
- D. Generate Progress Payment request forms by downloading cost data from the schedule information to a spreadsheet type format. Identify each activity on the Progress Schedule that has a cost associated with it, the cost for each activity, the estimated percent complete for each activity, and the value of work completed for both the payment period and job to date.
- E. Prepare summary of cost information for each Major Item of Work listed in the Schedule of Values. Identify the value of work completed for both the payment period and job to date.
- F. Submit progress payment requests at progress meetings.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01312
PROJECT MEETINGS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Requirements for conducting conferences and meetings for the purposes of addressing issues related to the Work, reviewing and coordinating progress of the Work and other matters of common interest, and includes the following:
 - 1. Qualifications of Meeting Participants.
 - 2. Preconstruction Conference Progress Meetings.
 - 3. Pre-installation Meetings.
 - 4. Preshutdown Meetings.
 - 5. Post Construction Meeting.

1.02 QUALIFICATIONS OF MEETING PARTICIPANTS

- A. Representatives of entities participating in meetings shall be qualified and authorized to act on behalf of entity each represents.

1.03 PRECONSTRUCTION CONFERENCE

- A. Upon issuance of Notice to Proceed, or earlier when mutually agreeable, ENGINEER will arrange preconstruction conference in convenient place for most persons invited, in accordance with the General Conditions.
- B. Attending Preconstruction Conference: CONTRACTOR's superintendent, OWNER, ENGINEER, representatives of utilities, major subcontractors and others involved in performance of the Work, and others necessary to agenda.
- C. ENGINEER will preside at conference.
- D. Purpose of Conference: To establish working understanding between parties and to discuss Construction Schedule, shop drawing and other submittals, cost breakdown of major lump sum items, processing of submittals and applications for payment, and other subjects pertinent to execution of the Work.
- E. Agenda Will Include:
 - 1. Adequacy of distribution of Contract Documents.
 - 2. Distribution and discussion of list of major subcontractors and suppliers.
 - 3. Proposed progress schedules and critical construction sequencing.
 - 4. Major equipment deliveries and priorities.
 - 5. Project coordination.
 - 6. Designation of responsible personnel.
 - 7. Procedures and Processing of:
 - a. Field decisions.
 - b. Proposal requests.
 - c. Submittals.

- d. Change Orders.
 - e. Applications for Payment.
 - f. Record Documents.
 - 8. Use of Premises:
 - a. Office, construction, and storage areas.
 - b. OWNER's requirements.
 - 9. Construction facilities, controls, and construction aids.
 - 10. Shoring requirements and submittal of Contractor's geotechnical report.
 - 11. Temporary utilities.
 - 12. Safety and first aid procedures.
 - 13. Security procedures.
 - 14. Housekeeping procedures.
- F. ENGINEER will record minutes of meeting and distribute copies of minutes within 7 days of meeting to participants and interested parties.

1.04 PROGRESS MEETINGS

- A. Conduct progress meetings at least once every two weeks in CONTRACTOR's field office, ENGINEER's field office or other mutually agreed upon place.
- B. Distribute to each anticipated participant written notice and agenda of each meeting at least 4 days before meeting.
- C. Require attendance of CONTRACTOR's superintendent and subcontractors who are or are proximate to be actively involved in the Work, or who are necessary to agenda.
- D. Invite OWNER, ENGINEER, utility Companies when the Work affects their interests, and others necessary to agenda.
- E. Complete and bring Application for Payment and Progress Schedule to progress meeting.
- F. Prepare and distribute agenda.
- G. Preside at meetings.
- H. Purpose of Progress Meetings: To expedite work of subcontractors or other organizations that are not meeting scheduled progress, resolve conflicts, and coordinate and expedite execution of the Work.
- I. Review progress of the Work, Progress Schedule, narrative report, Application for Payment, record documents, and additional items of current interest that are pertinent to execution of the Work.
- J. Verify:
 - 1. Actual start and finish dates of completed activities since last progress meeting.
 - 2. Durations and progress of activities not completed.
 - 3. Reason, time, and cost data for Change Order Work that will be incorporated into Progress Schedule and application for payment.

4. Percentage completion of items on Application for Payment.
 5. Reasons for required revisions to Progress Schedule and their effect on Contract Time and Contract Price.
- K. Discuss potential problems which may impede scheduled progress and corrective measures.
- L. ENGINEER will record minutes of meeting and distribute copies of minutes within 7 days of meeting to participants and interested parties.

1.05 PRE-INSTALLATION MEETINGS

- A. When required in individual specification sections, requested by Engineer, or listed below, convene pre-installation meeting at Project site before commencing work of specific section.
1. Required Pre-Installation meetings:
 - a. Blackhorse Reservoir installation. Authorized representative of the reservoir manufacturer and onsite foreman shall be in attendance.
- B. Require attendance of parties directly affecting, or affected by, Work of specific section.
- C. Notify Engineer 7 calendar days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
 1. Review conditions of installation, preparation and installation procedures.
 2. Review coordination with related work.
- E. Contractor will record minutes and distribute electronic copies within 7 calendar days after meeting to participants, with copies to Engineer, Owner, and those affected by decisions made.

1.06 PRESHTUTDOWN MEETINGS

- A. All short-term and longer-term shutdowns and other tie-ins to a facility actively in use by the Owner also require a pre-shutdown meeting at Project site prior to commencing shutdown for tie-in or modification of specific plant systems.
- B. Require attendance of parties directly affecting, or affected by shutdown, including Engineer, specific work crews, Owner's construction, operations, and maintenance staff.
- C. Prepare and submit, a minimum 7 days in advance, a draft shutdown plan. The draft shutdown plan shall be coordinated with the Owner during preparation and Contractor shall obtain Owner input in preparing the draft shutdown plan.
- D. Notify Engineer 7 calendar days in advance of meeting date.
- E. Prepare agenda and preside at meeting:
 1. Review draft shutdown plan, including conditions of shutdown, preparation, and installation procedures.
 2. Review timelines and sequences.
 3. Review responsibilities.

4. Review dry run plan and schedule, as necessary.
 5. Review coordination with related work.
- F. Contractor will record minutes and distribute copies within 5 calendar days after meeting and prior to scheduled shutdown to participants, with copies to Engineer, Owner, and those affected by decisions made.

1.07 POST CONSTRUCTION MEETING

- A. Meet with and inspect the Work 11 months after date of Substantial Completion with OWNER and ENGINEER.
- B. Arrange meeting at least 7 days before meeting.
- C. Meet in OWNER's office or other mutually agreed upon place.
- D. Inspect the Work and draft list of items to be completed or corrected.
- E. Review service and maintenance contracts, and take appropriate corrective action when necessary.
- F. Complete or correct defective work and extend correction period accordingly.
- G. Require attendance of Superintendent, appropriate manufacturers and installers of major units of constructions, and affected subcontractors.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01324A

PROGRESS SCHEDULES AND REPORTS - LARGE PROJECTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Preparation, submittal, and maintenance of computerized progress schedule and reports, Contract Time adjustments, and payment requests, including the following:
 - 1. Preliminary Schedule.
 - 2. Baseline Schedule.
 - 3. Monthly Schedule Updates.
 - 4. Weekly Summary Schedule.
 - 5. Schedule of Submittals.
 - 6. Manpower Schedule.
 - 7. Equipment Schedule.
 - 8. Commissioning and Process Start-up Schedule.
 - 9. As-built Schedule.

- B. Related sections:
 - 1. Document 00700 - General Conditions.
 - 2. Section 01292 - Schedule of Values.
 - 3. Section 01294 - Applications for Payment.
 - 4. Section 01312 - Project Meetings.
 - 5. Section 01756 - Commissioning.

1.02 SCHEDULER

- A. Designate, in writing and within 5 calendar days after Notice of Award, person responsible for preparation, maintenance, updating, and revision of all schedules.

- B. Qualifications of scheduler:
 - 1. Authority to act on behalf of Contractor.
 - 2. 8 years verifiable experience in preparation of complex construction schedules for projects of similar value, size, and complexity.
 - 3. Knowledge of critical path method (CPM) scheduling utilizing Primavera P6 Professional software.

- C. References: Submit written reference of 3 project Owners who have personal experience with this scheduler on previous projects. Identify name, address, telephone number, project name, and cost.

- D. Scheduler: Dedicated full time to this project, located on-site. All scheduling software and hardware located on-site. Scheduler will attend all project meetings called for as specified in Section 01312.

- E. Owner reserves the right to disapprove scheduler when submitted by Contractor if not qualified. Owner reserves the right to remove scheduler from the project if found to be incompetent.

1.03 SCHEDULING FORMAT AND SOFTWARE

- A. Schedule format: Utilize CPM format.
- B. Prepare computerized schedule utilizing Primavera P6 Professional, most current version:
 - 1. Provide 1 licensed copy of the scheduling software to the engineer, registered in the Engineer's name, for the duration of the project.
 - 2. The provided copy of the software shall be a standalone version for installation on a standalone computer.

1.04 PRECONSTRUCTION SCHEDULING MEETING

- A. Engineer will conduct Preconstruction Scheduling Meeting with Contractor's Project Manager, General Superintendent, and scheduler within 7 calendar days after Notice To Proceed. This meeting is separate from the Preconstruction Conference Meeting and is intended to cover schedule issues exclusively.
- B. At the meeting, review scheduling requirements. These include schedule preparation, reporting requirements, labor and equipment loading, updates, revisions, and schedule delay analysis. Present schedule methodology, planned sequence of operations, resource loading methodology, and proposed activity coding structure.
- C. Coding structure:
 - 1. Submit proposed coding structure, identifying the code fields and the associated code values it intends to use in the project schedule.
 - 2. A minimum, include code fields for Project Segment or Phase, Area of Work, Type of Work, Submittal/Procurement/Construction and Responsibility/Subcontractor. Refer to NETWORK DETAILS AND GRAPHICAL OUTPUT for listing of activity categories to be included in the schedule.
- D. Naming convention: Name schedule files with the year, month and day of the data date, revision identifier, and a description of the schedule:
 - 1. Example 1: 2014_07_30 rev 1 draft baseline schedule.xer.
 - 2. Example 2: 2014_09_30 rev 2 sep final update.xer.
- E. Filing: Post submitted files to Owner's construction document control system.

1.05 SCHEDULE PREPARATION

- A. Preparation and submittal of Progress Schedule represents Contractor's intention to execute the Work within specified time and constraints. Failure to conform to requirement may result in termination for cause as defined in Document 00700, under Suspension of Work and Termination.
- B. Contractor's bid covers all costs associated with the execution of the Work in accordance with the Progress Schedule.
- C. During preparation of the preliminary Progress Schedule, Engineer will facilitate Contractor's efforts by being available to answer questions regarding sequencing issues, scheduling constraints, interface points, and dependency relationships.

- D. Prepare schedule utilizing Precedence Diagramming Method (PDM).
- E. Prepare schedule utilizing activity durations in terms of working days. Do not exceed 15 working day duration on activities except concrete curing, submittal review, and equipment fabrication and deliveries. Where duration of continuous work exceeds 15 working days, subdivide activities by location, stationing, or other sub-element of the Work. Coordinate holidays to be observed with the Owner and incorporate them into the schedule as non-working days.
- F. Failure to include an activity required for execution of the Work does not excuse Contractor from completing the Work and portions thereof within specified times and at price specified in Contract. Contract requirements are not waived by failure of Contractor to include required schedule constraints, sequences, or milestones in schedule. Contract requirements are not waived by Owner's acceptance of the schedule. In event of conflict between accepted schedule and Contract requirements, terms of Contract govern at all times, unless requirements are waived in writing by the Owner.
- G. Reference schedule to working days with beginning of Contract Time as Day "1".
- H. Baseline Schedule and Project Completion: Should Contractor submit a Baseline Schedule showing project completion more than 20 working days prior to Contract completion date, Owner may issue Change Order, at no cost to Owner, revising time of performance of Work and Contract completion date to match Contractor's schedule completion date. Adjust accordingly any Contract milestone dates.
- I. Contract float is for the mutual benefit of both Owner and Contractor. Changes to the project that can be accomplished within this available period of float may be made by Owner without extending the Contract Time, by utilizing float. Time extensions will not be granted nor delay damages owed until Work extends beyond currently accepted Contract completion date. Likewise, Contractor may utilize float to offset delays other than delays caused by Owner. Mutual use of float can continue until all available float shown by schedule has been utilized by either Owner or Contractor, or both. At that time, extensions of the Contract Time will be granted by Owner for valid Owner-caused or third party-caused delays which affect the planned completion date and which have been properly documented and demonstrated by Contractor.
- J. Resource loading and leveling: Input labor and equipment data on each schedule activity. Manpower data consist of the man-hours estimated to perform each task, categorized by trade. Equipment data consist of equipment hours estimated to perform each task, categorized by piece of equipment. Optimize and level manpower and equipment requirements. Resource leveling reflect a reasonable plan for accomplishing Work. Individual activities may be sequenced within limits of available float. Keep to a minimum critical or near critical paths resulting from use of labor or equipment restraints. Near critical path identified as path with 15 or less working days of float.
- K. Schedule logic: Assembled to show order in which Contractor proposes to carry out Work, indicate restrictions of access, availability of Work areas, and availability and

use of manpower, materials, and equipment. Form basis for assembly of schedule logic on the following criteria:

1. Which activities must be completed before subsequent activities can be started?
 2. Which activities can be performed concurrently?
 3. Which activities must be started immediately following completed activities?
 4. What major facility, equipment, or manpower restrictions are required for sequencing these activities?
- L. Non-sequestering of float: Pursuant to float sharing requirements of Contract, schedule submittals can be rejected for, use of float suppression techniques such as preferential sequencing or logic, special lead or lag logic restraints, extended activity durations or imposed dates.
- M. Major subcontractor, parallel prime contractor sign off: Provide written confirmation of concurrence from all major subcontractors and independent prime contractors on site with all schedule submittals. Term "major subcontractor" as used in this Section means any subcontractor, at any tier, with a subcontract worth 5 percent or more of the total cost of the Work.
- N. Imposed dates, hidden logic prohibited: Do not use imposed dates or hidden logic in preparation of schedule.
- O. Interim milestone dates, operational constraints: In event there are interim milestone dates and/or operational constraints set forth in Contract, show them on schedule. Do not use Zero Total Float constraint or Mandatory Finish Date on such Contract requirements.
- P. Schedule windows for Owner-furnished, Contractor-installed equipment or materials: Immediately after Award of Contract, obtain from Engineer anticipated delivery dates of Owner furnished equipment or materials. Show these dates in the schedule in same manner indicated by Engineer.
- Q. Cost loading: All schedules:
1. Only on-site construction activities.
 2. The sum total of all cost loaded activities equal to the current value of the Contract, including change orders, at all times.
 3. Owner acceptance of the Baseline Schedule creates the Schedule of Values required as specified in Section 01292.
 4. Provide updated Schedule of Values as the monthly Payment Application as specified in Section 01294.
 5. Payments will not be made until updated Schedule of Values is accepted.

1.06 NETWORK DETAILS AND GRAPHICAL OUTPUT

- A. Produce a clear, legible, and accurate calendar based, time scaled, graphical network diagram. Group activities related to the same physical areas of the Work. Produce the network diagram based upon the early start of all activities.
- B. Include for each activity, the description, activity number, estimated duration in working days, total float, and all activity relationship lines.

- C. Illustrate order and interdependence of activities and sequence in which Work is planned to be accomplished. Incorporate the basic concept of the precedence diagram network method to show how the start of 1 activity is dependent upon the start or completion of preceding activities and its completion restricts the start of following activities.
- D. Indicate the critical path for the project.
- E. Delineate the specified contract duration and identify the planned completion of the Work as a milestone. Show the time period between the planned and Contract completion dates, if any, as an activity identified as project float unless a Change Order is issued to officially change the Contract completion date.
- F. Identify system shutdown dates, system tie-in dates, specified interim completion or milestone dates and contract completion date as milestones.
- G. Include, in addition to construction activities:
 - 1. Submission dates and review periods for major equipment submittals, shoring submittals, and indicator pile program:
 - a. Shoring reviews: Allow 4-week review period for each shoring submittal.
 - b. Pile indicator program: Allow 3-week review period for analysis of program.
 - 2. Any activity by the Owner or the Engineer that may affect progress or required completion dates.
 - 3. Equipment and long-lead material deliveries over 8 weeks.
 - 4. Approvals required by regulatory agencies or other third parties.
- H. Produce network diagram on 22-inch by 34-inch sheets with grid coordinate system on the border of all sheets utilizing alpha and numeric designations.
- I. Identify, at a minimum, the execution of the following:
 - 1. Mobilization.
 - 2. All required submittals and submittal review times showing 30 calendar day duration for such activities and equal amount of time for re-submittal reviews.
 - 3. Equipment and materials procurement/fabrication/delivery.
 - 4. Excavation.
 - 5. Shoring design and submission of detailed shoring submittals. Identify submission as a milestone.
 - 6. Shoring review, shoring materials procurement, shoring installation, and shoring removal.
 - 7. Backfill and compaction.
 - 8. Dewatering.
 - 9. Grading, subbase, base, paving, and curb and gutters.
 - 10. Fencing and landscaping.
 - 11. Concrete, including installation of forms and reinforcement, placement of concrete, curing, stripping, finishing, and patching.
 - 12. Tests for leakage of concrete structures intended to hold water.
 - 13. Metal fastenings, framing, structures, and fabrications.
 - 14. Finishes including coating and painting, flooring, ceiling, and wall covering.
 - 15. Process equipment, including identification of ordering lead-time, factory testing, and installation.

16. Pumps and drives, including identification of ordering lead time, factory testing, and installation.
17. Trenching, pipe laying, and trench backfill and compaction.
18. Piping, fittings, and appurtenances, including identification of ordering and fabrication lead time, layout, installation and testing.
19. Valves, gates, and operators, including identification of order lead-time, installation, and testing.
20. Electric transmission, service, and distribution equipment, including identification of ordering lead-time, and factory testing.
21. Other electrical work including lighting, heating and cooling, and special systems, including identification of ordering lead-time.
22. Instrumentation and controls, including identification of ordering lead-time.
23. Preliminary testing of equipment, instrumentation, and controls.
24. Commissioning Phase:
 - a. Source Testing.
 - b. Owner Training.
 - c. Installation Testing.
 - d. Functional Testing.
 - e. Clean Water Facility Testing.
25. Process Start-up Phase:
 - a. Process Start-up.
 - b. Process Operational Period.
 - c. Instrumentation and Controls Performance Testing.
26. Substantial completion.
27. Punch list work.
28. Demobilization.

1.07 SUBMITTAL OF PROGRESS SCHEDULES

- A. Submit preliminary and baseline schedule.
- B. Submit, on a monthly basis, updated schedules as specified.
- C. Submit final schedule update as specified.
- D. Submit revised schedules and time impact analyses as specified.
- E. Submit schedules in the media and number of copies as follows:
 1. 3 sets of the CPM network and/or barchart (as specified by the Owner) on D-size sheets. Color-coding to be specified by the Owner.
 2. 3 sets of Tabular reports listing all activities sorted numerically identifying duration, early start, late start, early finish, late finish, total float, and all predecessor/successor information.
 3. 2 sets of CPM Schedule data electronic files in a native backed-up file (.xer) stored on CD/DVD.

1.08 PRELIMINARY SCHEDULE

- A. Submit Preliminary Schedule within 14 calendar days after Notice to Proceed. Include a detailed plan of operations for first 90 calendar days of Work after receipt of Notice to Proceed.

- B. Meet with Engineer within 7 calendar days after receipt of Preliminary Schedule to review and make necessary adjustments. Submit revised preliminary schedule within 5 calendar days after meeting.
- C. Submit schedule of manpower and costs for all activities with revised Preliminary Schedule. Provide realistic and level manpower and costs so as not to have unusual manpower requirements.
- D. Schedule of costs:
 - 1. Schedule of Values as specified in Section 01292 for first 90 calendar days of Work.
 - 2. Submittal and acceptance of Preliminary Schedule is condition precedent to making of progress payments as specified in Section 01294 and payments for mobilization costs otherwise provided for in the Contract.
 - 3. Proceed with pay item Work after Preliminary Schedule and schedule of costs have been accepted by Owner.
- E. Incorporate unchanged, the accepted Preliminary Schedule as first 90 calendar days of activity in Contractor's Baseline Schedule.
- F. Update Preliminary Schedule monthly during first 90 calendar days after Notice to Proceed. Use Preliminary Schedule as the payment application as specified in Section 01294.

1.09 BASELINE SCHEDULE

- A. No more than 45 calendar days after Notice to Proceed, submit the Baseline Schedule for all Work of the project. Show sequence and interdependence of all activities required for complete performance of all Work, beginning with date of Notice to Proceed and concluding with date of final completion of Contract.
- B. Acceptance of the Baseline Schedule by the Owner is a condition precedent to making payments as specified in Section 01294 after the first 90 calendar days after Notice to Proceed.

1.10 WEATHER DAY ALLOWANCE

- A. Include as a separate identifiable activity on the critical path, an activity labeled "Weather Days Allowance." Insert this activity at the end of the schedule.
- B. Insert an activity in critical path to reflect weather day occurrences when weather days are experienced and accepted by Engineer. Identify this activity as a weather delay.
- C. Reduce duration of Weather Days Allowance activity as weather delays are experienced and inserted into the Schedule. Remaining weather days in Weather Day Allowance at completion of project is considered float.
- D. Weather conditions that prevent or inhibit the Contractor's performance of the Work and affect the Critical Path indicated on the Schedule shall be referred to as a Weather Day. A Weather Day is defined as the Contractor being unable to perform at least 4 hours of work on the Critical Path. The Contractor shall provide a written notice to the Engineer of the occurrence of a weather day within 2 days after the

onset of such weather and shall describe in reasonable detail the type of weather encountered and the Work interfered with or interrupted. A schedule update will not suffice as a written notice. The Engineer will determine if the weather day constitutes a use of a portion of the Weather Day Allowance. After use of all the Weather Day Allowance, the Engineer will determine if the Contractor is entitled to an extension of the Contract Time due to weather conditions. Weather days are considered excusable delay as defined in this Section.

1.11 REVIEW AND ACCEPTANCE OF SCHEDULES

- A. Engineer will review Baseline Schedule, Schedule Updates, Schedule Revisions and Time Impact Analyses to ascertain compliance with specified project constraints, compliance with milestone dates, reasonableness of durations and sequence, accurate inter-relationships, and completeness.
- B. Engineer and Owner will issue written comments following completion of review of Baseline Schedule within 21 calendar days after receipt.
- C. Written comments on review of Schedule Updates and Schedule Revisions and Time Impact Analyses will be returned to Contractor within 14 calendar days after receipt by Engineer.
- D. Revise and resubmit schedule in accordance with Engineer's comments within 7 calendar days after receipt of such comments, or request joint meeting to resolve objections.
- E. If Engineer requests a meeting, the Contractor and all major subcontractors must participate in the meeting with Engineer:
 - 1. Revise and resubmit schedule within 7 calendar days after meeting.
- F. Use accepted schedule for planning, organizing, and directing the work and for reporting progress.
- G. Engineer's submittal review response:
 - 1. When schedule reflects Owner's and Contractor's agreement of project approach and sequence, schedule will be accepted by Owner.
 - 2. Engineer's submittal review response for schedule submittal will be "Receipt Acknowledged – Filed for Record" including applicable comments.
 - 3. Acceptance of the schedules by the Owner is for general conformance with the Contract Documents and for Owner's planning information, and does not relieve the Contractor of sole responsibility for planning, coordinating, and executing the Work within the contract completion dates. Omissions and errors in the accepted schedules shall not excuse performance less than that required by the Contract Documents. Acceptance by the Owner in no way constitutes an evaluation or validation of the Contractor's plan, sequence or means, methods, and techniques of construction.

1.12 SCHEDULE UPDATES

- A. Any update:
 - 1. Prepare update using most recent accepted version of schedule including:
 - a. Actual start dates of activities that have been started.
 - b. Actual finish dates of activities that have been completed.

- c. Percentage of completion of activities that have been started but not finished.
- d. Actual dates on which milestones were achieved.
- e. Update activities by inputting percent complete figures with actual dates.
- f. Use retained logic in preparing Schedule Updates.
- g. When necessary, input remaining durations for activities whose finish dates cannot be calculated accurately with a percent complete figure only.
- h. Revisions to the schedule may be included that have been previously approved as specified in this Section under Revisions to Schedule.

B. Monthly updates:

- 1. Submit written narrative report in conjunction with each Schedule Update including descriptions of the following:
 - a. Activities added to or deleted from the schedule are to adhere to cost and other resource loading requirements:
 - 1) Identify added activities in manner distinctly different from original activity designations.
 - b. Changes in sequence or estimated duration of activities.
 - c. Current or anticipated problems and delays affecting progress, impact of these problems and delays and measures taken to mitigate impact.
 - d. Assumptions made and activities affected by incorporating change order work into the schedule.
- 2. Submit updated schedule and materials specified under Submittal of Progress Schedules, 5 calendar days before the monthly schedule update meeting.
- 3. Since Monthly Schedule Update is the application for progress payment required as specified in Section 01294, submittal and acceptance of the monthly Schedule Update is a condition precedent to the making of any progress payments.

C. Weekly progress meeting:

- 1. Update the schedule prior to weekly progress meeting:
 - a. Identify overall progress of each Major Item of Work in the Summary Schedule.
 - b. If there are significant changes to the schedule, submit a written report at the weekly progress meeting.
- 2. Should monthly Schedule Update show project completion earlier than current Contract completion date, show early completion time as schedule activity, identified as "Project Float".
- 3. Should monthly Schedule Update show project completion later than current Contract completion date, prepare and submit a Schedule Revision in accordance with the Revisions to Schedule.

1.13 REVISIONS TO SCHEDULE

A. Submit Revised Schedule within 5 days:

- 1. When delay in completion of any activity or group of activities indicates an overrun of the Contract Time or milestone dates by 20 working days or 5 percent of the remaining duration, whichever is less.
- 2. When delays in submittals, deliveries, or work stoppages are encountered making necessary the replanning or rescheduling of activities.
- 3. When the schedule does not represent the actual progress of activities.

4. When any change to the sequence of activities, the completion date for major portions of the work, or when changes occur which affect the critical path.
 5. When Contract modification necessitates schedule revision, submit schedule analysis of change order work with cost proposal.
- B. Create a separate submittal for Schedule Revisions:
1. Comply with schedule updates as specified in this Section.
 2. Do not submit with Schedule Updates.
- C. Schedule Revisions will not be reflected in the schedule until after the revision is accepted by the Owner:
1. This includes Schedule Revisions submitted for the purpose of mitigating a Contractor-caused project delay (Recovery Schedule).

1.14 PAYMENT REQUESTS AND CASH FLOW

- A. After Baseline Schedule has been submitted and accepted by the Owner, submit on a monthly basis a tabular and graphic report showing anticipated earnings each month of the Contract period. This tabulation will be based on the summation of the cost-loaded activities each month. Submit an updated payment schedule each month showing actual earned amounts and anticipated remaining earnings.
- B. Utilize cost loaded monthly Progress Schedule Updates as the applications for payment specified in Section 01294. List payment application in Excel format of all schedule activities showing cost and percentage completion during the current month for which payment is sought. Progress payments will not be made until monthly Progress Schedule Update is provided.

1.15 WEEKLY SCHEDULE

- A. Submit to Engineer, at every weekly progress meeting, a 6-Week Schedule showing the activities completed during the previous week and the Contractor's schedule of activities for following 5 weeks.
- B. Use the logic and conform to the status of the current progress schedule when producing a Weekly Schedule in CPM schedule or a bar chart format:
1. In the event that the Weekly Schedule no longer conforms to the current schedule, Contractor may be required to revise the schedule as specified in this Section.
- C. The activity designations used in the Weekly Schedule must be consistent with those used in the Baseline Schedule and the monthly Schedule Updates.
- D. Contractor and Engineer must agree on the format of the Weekly Schedule.

1.16 SCHEDULE OF VALUES

- A. Requirements for Schedule of Values are specified in Section 01292.
- B. Submit, in conjunction with the Progress Schedule, a Schedule of Values identifying costs of all on-site construction activities as generated by the cost loaded schedule. Equate the aggregate of these costs to the Lump Sum Contract Price.

1.17 ADJUSTMENT OF CONTRACT TIMES

- A. Contract Time will be adjusted only for causes specified in Contract Documents:
1. Non-excusable delay: Non-excusable delays include actions or inactions of the Contractor, or events for which the Contractor has assumed contractual responsibility (including actions or inactions of subcontractors, suppliers, or material manufacturers at any tier) that would independently delay the completion of the Work beyond the current Contract completion date). No time extensions will be granted for non-excusable delays.
 2. Excusable delay: Events which are unforeseeable, outside the control of, and without the fault or negligence of either the Owner or the Contractor (or any party for whom either is responsible), which would independently delay the completion of the Work beyond the current Contract completion date. The Contractor is entitled to a time extension only. No other damages will be approved.
 3. Compensable delay: Actions or inactions of the Owner, or events for which the Owner has assumed contractual responsibility, which would independently delay the completion of the Work beyond the current Contract completion date. The Contractor is entitled to a time extension and delay damages.
 4. Concurrent delay: Concurrent delay is any combination of the above 3 types of delay occurring on the same calendar date:
 - a. Exception to concurrent delay: Cases where the combination consists of 2 or more instances of the same type of delay occurring on the same calendar date. When one cause of delay is Owner-caused or caused by an event which is beyond the control and without the fault or negligence of either the Owner or the Contractor and the other Contractor-caused, the Contractor is entitled only to a time extension and no delay damages.
- B. If the Contractor believes that the Owner has impacted its work, such that the project completion date will be delayed, the Contractor must submit proof demonstrating the delay to the critical path. This proof, in the form of a Time Impact Analysis, may entitle the Contractor to an adjustment of Contract Time.
- C. Time Impact Analysis:
1. Use the accepted schedule update that is current relative to the time frame of the delay event (change order, third party delay, or other Owner-caused delay). Represent the delay event in the schedule by:
 - a. Inserting new activities associated with the delay event into the schedule.
 - b. Revising activity logic.
 - c. Revising activity durations.
 2. If the project schedule's critical path and completion date are impacted as a result of adding this delay event to the schedule, a time extension equal to the magnitude of the impact may be warranted.
 3. The Time Impact Analysis submittal must include the following information:
 - a. A fragment of the portion of the schedule affected by the delay event.
 - b. A narrative explanation of the delay issue and how it impacted the schedule.
 - c. A CD containing the schedule file used to perform the Time Impact Analysis.
- D. When a delay to the project as a whole can be avoided by revising preferential sequencing or logic, and the Contractor chooses not to implement the revisions, the

Contractor will be entitled to a time extension and no compensation for extended overhead.

- E. Indicate clearly that the Contractor has used, in full, all project float available for the work involved in the request, including any float that may exist between the Contractor's planned completion date and the Contract completion date. Utilize the latest version of the Schedule Update accepted at the time of the alleged delay, and all other relevant information, to determine the adjustment of the Contract Time.
- F. Adjustment of the Contract Times will be granted only when the Contract Float has been fully utilized and only when the revised date of completion of the Work has been pushed beyond the Contract completion date. Adjustment of the Contract Times will be made only for the number of days that the planned completion of the work has been extended.
- G. Actual delays in activities which do not affect the critical path work or which do not move the Contractor's planned completion date beyond the Contract completion date will not be the basis for an adjustment to the Contract Time.
- H. If completion of the project occurs within the specified Contract Time, the Contractor is not entitled to job-site or home office overhead beyond the Contractor's originally planned occupancy of the site.
- I. Notify Engineer of a request for Contract Time adjustment. Submit request as specified with Contract Documents. In cases where the Contractor does not submit a request for Contract Time adjustment for a specific change order, delay, or Contractor request within the specified period of time, then it is mutually agreed that the particular change order, delay, or Contractor request has no time impact on the Contract completion date and no time extension is required.
- J. The Engineer will, within 30 calendar days after receipt of a Contract Time adjustment, request any supporting evidence, review the facts, and advise the Contractor in writing:
 - 1. Include the new Progress Schedule data, if accepted by the Owner, in the next monthly Schedule Update.
 - 2. When the Owner has not yet made a final determination as to the adjustment of the Contract Time, and the parties are unable to agree as to the amount of the adjustment to be reflected in the Progress Schedule, reflect that amount of time adjustment in the Progress Schedule as the Engineer may accept as appropriate for such interim purpose. It is understood and agreed that any such interim acceptance by the Engineer shall not be binding and shall be made only for the purpose of continuing to schedule the Work, until such time as a final determination as to any adjustment of the Contract Time acceptable to the Engineer has been made. Revise the Progress Schedule prepared thereafter in accordance with the final decision.

1.18 SUMMARY SCHEDULE

- A. Provide Summary Schedule, which consolidates groups of activities associated with Major Items of Work shown on Baseline Schedule. Summary Schedule is intended to give an overall indication of the project schedule without a large amount of detail.

- B. Submit updated Summary Schedule at weekly progress meetings and after each Schedule Update or Schedule Revision.

1.19 SCHEDULE OF SUBMITTALS

- A. Schedule of Submittals shall include submittals required in the Contract Documents but not limited to Commissioning and Process Start-up Plans, Training Plans, test procedures, operation and maintenance manuals, shop drawings, samples, record documents, and specifically required certificates, warranties, and service agreements.
- B. Preliminary Schedule of Submittals:
 - 1. Due date: After Preliminary Schedule has been submitted and accepted by Owner.
 - 2. Format:
 - a. Include submittals anticipated in the first 90 calendar days after Notice to Proceed using early start dates.
 - b. Indicate week and month anticipated for each submittal.
 - c. Indicate "Priority" submittals where review time can impact Contractor's schedule:
 - 1) "Priority" indication will not alter review times specified in Section 01330.
 - 2) Engineer will endeavor to provide early review of "Priority" submittals where possible.
 - 3. Submittal of Preliminary Schedule of Submittals shall be a condition precedent to Owner making progress payments during the first 90 calendar days after Notice to Proceed.
- C. Final Schedule of Submittals:
 - 1. Due date: After Baseline Schedule has been submitted and accepted by Owner.
 - 2. Format:
 - a. Include submittals using early start dates.
 - b. Include all submittals, including those required in the Preliminary Schedule of Submittals.
 - c. Indicate week and month anticipated for each submittal.
 - d. Indicate "Priority" submittals where review time can impact Contractor's schedule:
 - 1) "Priority" indication will not alter review times specified in Section 01330.
 - 2) Engineer will endeavor to provide early review of "Priority" submittals where possible.
 - 3. Submittal of Final Schedule of Submittals shall be a condition precedent to Owner making progress payments after the first 90 calendar days after Notice to Proceed.
- D. Provide updated Schedule of Submittals with updated schedules if schedule revisions change listing and timing of submittals.

1.20 MANPOWER SCHEDULES

- A. Due date: After Baseline Schedule has been submitted and accepted by Owner.

- B. Format:
 - 1. Schedule histogram depicting total craft manpower and craft manpower for Contractor's own labor forces and those of each subcontractor.
 - 2. Submit electronically on a computer disk in Excel format, with 1 paper copy.
- C. Progress payments after the first 90 calendar days after Notice to Proceed will not be made until manpower schedule is provided.

1.21 EQUIPMENT SCHEDULE

- A. Due date: After Baseline Schedule has been submitted and accepted by Owner.
- B. Format:
 - 1. Tabular report listing each major piece of construction equipment to be used in performing the Work.
 - 2. Include major equipment for Contractor and each subcontractor.
 - 3. Submit electronically on a computer disk in Excel format with 1 paper copy.
- C. Progress payments after the first 90 calendar days after Notice to Proceed will not be made until equipment schedule is provided.

1.22 COMMISSIONING AND PROCESS START-UP SCHEDULE SUBMITTAL

- A. Proposed Commissioning and Process Start-up Schedule:
 - 1. Due date: As specified in Section 01756.
 - 2. Schedule requirements: As specified in Section 01756.
 - 3. Engineer response due within 20 calendar days of receipt.
 - 4. Contractor responsible for updating schedule and resubmitting within 10 calendar days of receipt of Engineer and Owner comments.
- B. The Commissioning and Process Start-up Schedule may not be combined with the Detailed Schedule until Engineer acceptance of the Proposed Commissioning and Process Start-up Schedule.
- C. Commissioning and Process Start-up Schedule monthly update requirements:
 - 1. Highlight percentages of completion, actual start and finish dates, and remaining durations, as applicable.
 - 2. Include activities not previously included in the previously accepted detail work plan Commissioning and Process Start-up Schedule.
 - 3. Change Order required for any change to contractual dates.
 - 4. Reviews of these submittals by Engineer will not be construed to constitute acceptance within the time frames, durations, or sequence of work for each added activity.

1.23 FINAL SCHEDULE SUBMITTAL

- A. The final Schedule Update becomes the As-Built Schedule:
 - 1. The As-Built Schedule reflects the exact manner in which the project was constructed by reflecting actual start and completion dates for all activities accomplished on the project.

2. Contractor's Project Manager and scheduler sign and certify the As-Built Schedule as being an accurate record of the way the project was actually constructed.

B. Retainage will not be released until final Schedule Update is provided.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01329

SAFETY PLAN

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Development and maintenance of a Construction Safety Plan.

1.02 REFERENCES

- A. California Labor Code, Section 6401.7.
- B. National Fire Protection Association (NFPA):
 - 1. 70E - Standard for Electrical Safety in the Workplace.
- C. Occupational Safety and Health Standards (OSHA).

1.03 CONSTRUCTION SAFETY PLAN

- A. Detail the Methods and Procedures to comply with California Labor Code Section 6401.7, Federal, and Local Health and Safety Laws, Rules and Requirements for the duration of the Contract Times. Include the following:
 - 1. Identification of the Certified or Licensed Safety Consultant who will prepare, initiate, maintain and supervise safety programs, and procedures.
 - 2. Procedures for providing workers with an awareness of safety and health hazards expected to be encountered in the course of construction.
 - 3. Safety equipment appropriate to the safety and health hazards expected to be encountered during construction. Include warning devices, barricades, safety equipment in public right-of-way and protected areas, and safety equipment used in multi-level structures.
 - 4. Methods for minimizing employees' exposure to safety and health hazards expected during construction.
 - 5. Procedures for reporting safety or health hazards.
 - 6. Procedures to follow to correct a recognized safety and health hazard.
 - 7. Procedures for investigation of accidents, injuries, illnesses and unusual events that have occurred at the construction site.
 - 8. Periodic and scheduled inspections of general work areas and specific work stations.
 - 9. Training for employees and workers at the jobsite.
 - 10. Methods of communication of safe working conditions, work practices and required personal protection equipment.
- B. Assume responsibility for every aspect of Health and Safety on the jobsite, including the health and safety of Subcontractors, suppliers, and other persons on the jobsite:
 - 1. Forward available information and reports to the Safety Consultant who shall make the necessary recommendations concerning worker health and safety at the jobsite.
 - 2. Employ additional health and safety measures specified by the Safety Consultant, as necessary, for workers in accordance with OSHA guidelines.

- C. Transmit to OWNER and ENGINEER copies of reports and other documents related to accidents or injuries encountered during construction.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01330

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Requirements and procedures for submitting Shop Drawings, Product Data, Samples, other submittals relating to products, and as specified in individual sections.

1.02 DEFINITIONS

- A. Manufacturer's Instructions: Instructions, stipulations, directions, and recommendations issued in printed form by the manufacturer of a product addressing handling, installation, erection, and application of the product; Manufacturers Instructions are not prepared especially for the Work.
- B. Shop Drawings: Drawings, diagrams, schedules, and other data specially prepared for the Work to illustrate some portion of the Work.
- C. Product Data: Illustrations, standard schedules, performance charts, brochures, diagrams and other information to illustrate materials or equipment for some portion of the Work.
- D. Samples: Physical examples which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged.
- E. Special Samples: Physical examples which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged, and will be incorporated in the Work.

1.03 PROCEDURES

- A. Deliver submittals to the OWNER or OWNER'S representative at a mutually agreeable location.
- B. Submit submittals in ample time for each to serve submittals' intended purpose.
- C. Submit submittals which are specified or reasonably required for construction, operation, and maintenance of the Work.
- D. Deliver submittals under acceptable transmittal form which identifies:
 - 1. Submittal date.
 - 2. Project and CONTRACTOR.
 - 3. Subcontractor and major supplier, when appropriate.
 - 4. Reference submittal to Contract Documents by Drawing, detail, and/or Specification section numbers, as appropriate.
 - 5. Variations from Contract Documents when variations are included in submittal.

- E. Submit specified number of copies of submittal.
- F. Provide or furnish products and execute the Work in accordance with accepted submittals, unless in conflict with Contract Documents.
- G. When minor deviations from Contract Documents are accepted, modify Contract Documents in accordance with the Conditions of the Contract.

1.04 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

- A. Submit Shop Drawings, Product Data, Samples, and other pertinent information in sufficient detail to show compliance with specified requirements.
- B. Check, verify, and revise submittals as necessary to bring them into conformance with Contract Documents and actual field conditions:
 - 1. Include with each submittal a copy of the relevant technical specification section, including relevant addendum updates. Indicate in the left margin, next to each pertinent paragraph, either compliance with a check (✓) or deviation with a consecutive number (1, 2, 3). Provide a list of all deviations from the specified requirements and number them consistent with marked up specification. Each listed deviation shall include a clear explanation and reason.
 - 2. Determine and verify quantities, dimensions, specified design and performance criteria, materials, catalog numbers, and similar data.
 - 3. Coordinate submittal with other submittals and with the requirements of the Contract Documents.
- C. After completion of checking, verification, and revising; stamp, sign and date submittals indicating review and approval; and submit to ENGINEER:
 - 1. Stamp and signature indicates CONTRACTOR has satisfied shop drawing review responsibilities and constitutes CONTRACTOR's written approval of shop drawing.
 - 2. Shop drawings without CONTRACTOR's written approval will be returned for resubmission.
- D. Shop Drawings: Submit 5 copies. One will be returned with reviewer's comments and stamp.
- E. Product Data and Manufacturer's Instructions: Submit 4 copies. Excise or cross out non-applicable information and clearly mark applicable information with citations to and terminology consistent with Contract Documents:
 - 1. 1 copy will be returned with reviewer's comments and stamp.
- F. Samples: Submit 2 samples labeled with reference to applicable Contract Documents. Label will be returned with reviewer's selection when appropriate, comments and stamp. Samples will not be returned unless return is requested in writing and additional sample is submitted.
- G. Special Samples: Submit 1 sample labeled with reference to applicable Contract Documents. Sample and 1 label will be returned for installation in the Work.

- H. Assume risk of expense and delays when proceeding with work related to required submittals without review and acceptance.

1.05 MANUFACTURER'S INSTRUCTIONS

- A. Submit manufacturer's instructions whenever made available by manufacturers and when installation, erection, or application in accordance with manufacturer's instructions are required by the Specifications.
- B. Submit manufacturer's instructions prior to installation, erection, or application of equipment and other project components. Submit manufacturer's instructions in accordance with requirements for Product Data.

1.06 ENGINEER'S REVIEW

- A. ENGINEER's review of submittals shall not release CONTRACTOR from CONTRACTOR's responsibility for performance of requirements of Contract Documents. Neither shall ENGINEER's review release CONTRACTOR from fulfilling purpose of installation nor from CONTRACTOR's liability to replace defective work.
- B. Do not consider submittals as Contract Documents. Purpose of submittals is to demonstrate how CONTRACTOR intends to conform with the design concepts.
- C. ENGINEER's review of shop drawings, samples, or test procedures will be only for conformance with design concepts and for compliance with information given in Contract Documents:
 - 1. ENGINEER's review does not extend to:
 - a. Accuracy of dimensions, quantities, or performance of equipment and systems designed by CONTRACTOR.
 - b. CONTRACTOR's means, methods, techniques, sequences, or procedures except when specified, indicated on the Drawings, or required by Contract Documents.
 - c. Safety precautions or programs related to safety which shall remain the sole responsibility of the CONTRACTOR.
- D. Except as may be provided in subsequent specifications, a submittal will be returned within 30 days. When a submittal cannot be returned within that period, ENGINEER will, within a reasonable time after receipt of the submittal, give notice of the date by which that submittal will be returned.
- E. For submittals returned Resubmittal Not Required - Make Corrections Noted / See all Comments, Contractor shall incorporate all review comments into the work, but resubmittal of an amended submittal package is not required.
- F. For submittals returned Correct and Resubmit – Make Corrections Noted / See All Comments, Contractor shall incorporate the review comments into a complete revised package, and resubmit it for review.
- G. For submittals returned Rejected- See All Comments, Contractor shall develop a new submittal package with materials, equipment, methods, etc. that meet the requirements of the Contract Documents.

- H. For submittals returned Submittal Not Reviewed, Filed for Record, no further action is required by the Contractor for this submittal.
- I. ENGINEER will be entitled to rely upon the accuracy or completeness of designs, calculations, or certifications made by licensed professionals accompanying a particular submittal whether or not a stamp or seal is required by Contract Documents or Laws and Regulations.
- J. Costs incurred by OWNER as a result of additional reviews of a particular submittal after the second time it has been reviewed shall be borne by CONTRACTOR. Reimbursement to OWNER will be made by deducting such costs from CONTRACTOR's subsequent partial payments.

1.07 MINOR OR INCIDENTAL PRODUCTS AND EQUIPMENT SCHEDULES

- A. Shop Drawings of minor or incidental fabricated products will not be required, unless requested.
- B. Submit tabulated lists of minor or incidental products showing the names of the manufacturers and catalog numbers, with Product Data and Samples as required to determine acceptability.

1.08 SUBMITTALS FOR INFORMATION OR RECORD ONLY

- A. Submit 5 copies of each. None will be returned.
- B. Mill Test Reports:
 - 1. Submit 4 certified copies of factory and mill test reports for record only. No copies will be returned.
 - 2. Do not incorporate Products in the Work which have not passed testing and inspection satisfactorily.
 - 3. Pay for mill and factory tests.
- C. Reinforcing Steel:
 - 1. Submit reinforcing steel fabrication and setting drawings for information or record only. No copies will be returned.
 - 2. Note deviations and variations as specified for Shop Drawings.
- D. Tunnels, Jacking, and Boring:
 - 1. Submit detailed description of tunneling or jacking operations as Shop Drawings.
 - 2. Include indications of:
 - a. Equipment to be used.
 - b. Detailed schedule for performing the Work.
 - c. Safety precautions to be taken.
 - d. Compliance with applicable Laws and Regulations.
 - e. Monitoring of railroad track or roadway movement.
 - f. Contingency plan for correcting movement.
 - g. Other pertinent information on items required to perform the Work.
 - h. Contingency plan for frack-out.

- E. Utility Potholing Data and Results:
1. Submit utility potholing data for record only. No copies will be returned.
 2. When data and results differ from what is depicted on the Contract Documents, CONTRACTOR shall modify Contract Documents in accordance with the conditions of the Contract.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01350

SPECIAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Special procedures for locating and verifying concealed existing facilities.

1.02 CONCEALED EXISTING FACILITIES

- A. Verify locations of utilities and facilities that may exist by consulting with the OWNER, utility companies, and Underground Services Alert (USA) or other service available in area of Project:
 - 1. Abide by easement and right-of-way restrictions.
- B. Notify the OWNER, owners of facilities when the Work will be in progress. Make arrangements for potential emergency repairs in accordance with requirements of owners of utility facilities, including individual or residential facilities.
- C. Assume responsibility for repair of facilities damaged by performance of the Work.
- D. Expose sanitary and storm sewers, water, gas, electric, telephone utility lines, and other underground facilities indicated to permit survey location prior to commencement of Work in affected area:
 - 1. Expose in ample time to permit relocation of interfering utilities with minimum delaying effect on contract time.
- E. Work required for raising, lowering, or relocating utilities not indicated will be performed by affected utility owners or as part of the Work at option of affected owners of utilities:
 - 1. When part of the Work, perform work in accordance with standards of affected utility owner, and adjustment to Contract Price and Contract Times will be made as stipulated in conditions of contract.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01354

HAZARDOUS MATERIAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Procedures required when encountering hazardous materials at the Work site. This Section applies to, but is not limited to, removal of existing Asbestos Cement Pipe that may be found on the project site. Part of the work occurs on land owned by the US Army and has the potential to contain military munitions.

1.02 REFERENCES

- A. California Health and Safety Code, Section 25117.
- B. State of California Code of Regulations (CCR):
 - 1. Title 8. Industrial Relations:
 - a. Division 1. Department of Industrial Relations.
 - 2. Title 22. Social Security:
 - a. Division 4. Environmental Health.
 - b. Division 4.5. Environmental Health Standards for the Management of Hazardous Waste.
- C. United States Code of Federal Regulation (CFR), Title 29 and Title 40:
 - 1. 29 CFR 1910.1000.
 - 2. 29 CFR 1910.134.
- D. Appendix B, Mitigation Monitoring and Reporting Plan, Section 4.8-R-1.

1.03 SUBMITTALS

- A. Submit laboratory reports, hazardous material removal plans, and certifications.

1.04 HAZARDOUS MATERIALS PROCEDURES

- A. Hazardous materials are those defined by California Health and Safety Code, Section 25117.
- B. When Hazardous Materials Have Been Found:
 - 1. Prepare and initiate implementation of plan of action.
 - 2. Notify immediately OWNER, ENGINEER, and other affected persons.
 - 3. Notify such agencies as are required to be notified by Laws and Regulations with the times stipulated by such Laws and Regulations.
 - 4. Designate a Certified Industrial Hygienist to issue pertinent instructions and recommendations for protection of workers and other affected persons' health and safety.

5. Identify and contact subcontractors and licensed personnel qualified to undertake storage, removal, transportation, disposal, and other remedial work required by, and in accordance with laws and regulations.
- C. Forward to ENGINEER, copies of reports, permits, receipts, and other documentation related to remedial work.
- D. Assume responsibility for worker health and safety, including health and safety of Subcontractors and their workers:
 1. Instruct workers on recognition and reporting of materials that may be hazardous.
- E. File requests for adjustments to Contract Times and Contract Price due to the finding of Hazardous Materials in the Work site in accordance with Article 5.06 of the General and Special Conditions:
 1. Minimize delays by continuing performance of the Work in areas not affected by hazardous materials operations.

1.05 ASBESTOS MATERIALS

- A. It is the specific intent of these Contract Documents to exclude from the Work any and all new products or materials containing asbestos. No new products containing asbestos shall be incorporated in the Work.
- B. Asbestos may be found in existing asbestos cement water pipe on the site. Removal of existing asbestos materials shall be performed by a subcontractor registered by Cal-OSHA and certified by the State Contractors Licensing Board. Submit copies of this certification to the ENGINEER. The CONTRACTOR shall be responsible for the proper removal and disposal of asbestos containing material.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01355A

STORMWATER POLLUTION PREVENTION CONSTRUCTION ACTIVITIES: BEST MANAGEMENT PRACTICES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Requirements for the preparation and implementation of the Stormwater Pollution Prevention Plan (SWPPP) for the Contractor's construction activities. This document (and other identified in this Section will be used for the purpose of applying for and obtaining so the Owner can apply and pay for and receive a State of California General Construction Activity Stormwater Permit. This permit authorizes the discharge of stormwater associated with construction activities from the construction site.

1.02 REFERENCES

- A. National Pollutant Discharge Elimination System (NPDES).
- B. State of California, State Water Resources Control Board, Regional Water Quality Control Board (SWRCB).
- C. United States Code of Federal Regulation (CFR):
 - 1. 40 - Protection of Environmental:
 - a. 117 - Determination of reportable quantities for hazardous substance.
 - b. 302 - Designation, reportable quantities, and notification.

1.03 SUBMITTALS

- A. Construction General Permit:
 - 1. The Contractor shall prepare and submit all Permit Registration Documents (PRD's) to the Engineer for review, approval, and certification by the Legally Responsible Person (LRP) prior to start of work and mobilization:
 - a. The LRP will electronically submit the PRDs to the Stormwater Multiple Application and Report Tracking System (SMARTS) to obtain approval of the Construction General Permit (CGP).
 - 2. The PRD's shall include but are not limited to the Notice of Intent (NOI), Risk Determination Worksheet, Site Maps, Stormwater Pollution Prevention Plan (SWPPP), Annual Fee's and Owner Certification. It shall also include all other reports, calculations, studies, exhibits, and documentation required to obtain the CGP.
 - 3. The Contractor shall provide a Qualified SWPPP Practitioner (QSP), who will be responsible for maintaining the existing CGP active throughout the duration of the project:
 - a. The Contractor shall be responsible for providing all reports required by the CGP (monitoring, inspection, Rain Event Action Plans, sampling, exceedance reports, annual reports, etc.) to the Engineer for review.

- b. Upon approval, the Contractor's QSP shall upload the information to SMARTS.
 - c. Time sensitive reports involving monitoring data shall be provided as soon as the information is made available.
 - d. All other reports shall be provided to the Engineer a minimum of 2 weeks prior to their deadline for submittal to the SWRCB through SMARTS.
 - e. All CGP documents shall be submitted to the Owner for reference and a copy shall be located on site at all times.
- B. Pollution Prevention Plan:
- 1. Prepare and submit a site-specific Stormwater Pollution Prevention Plan (SWPPP) in accordance with Section A of the General Construction Activity Stormwater Permit to the Owner for reference.
 - 2. Prepare and submit a monitoring program and reporting plan in accordance with Section B of the General Construction Activity Stormwater Permit to the Owner for reference.
 - 3. Submit to the Owner for reference a Stormwater Pollution Prevention Plan detailing the placement of physical Best Management Practices (BMPs) required for installation and the methods used to comply with those BMPs directed at operational procedures, Monitoring Program, and Reporting Plan.
 - 4. The plan shall specifically address and detail changes from the alternatives called out in this Section. The Contractor's preferred techniques shall show how it will comply with the stated objectives of the program.
 - 5. The SWPPP shall be prepared and amended by a Qualified SWPPP Developer (QSD), as defined by the CGP.
- C. The Contractor shall submit a copy of the BMP Handbook with each BMP to be utilized check marked to show compliance or marked to show deviation.
- D. The entire plan shall be kept and maintained by the Contractor on the construction site during the duration of the project.
- E. The Contractor shall be responsible for taking the proper actions to prevent contaminants and sediments from entering the storm sewer drainage system should any unforeseen circumstance occur. The Contractor shall take immediate action if directed by the Engineer, or if the Contractor observes contaminants and/or sediments entering the storm drainage system, to prevent further stormwater from entering the system.

1.04 REGULATORY REQUIREMENTS

- A. The Contractor shall comply with the State Water Resources Control Board, Regional Water Quality Control Board, county, city, and other local agency requirements regarding stormwater discharges and management.
- B. The Contractor shall not begin any construction work until the Owner receives the State of California General Construction Activity Stormwater Permit. The Contractor shall allow the Owner 30 days to obtain this permit after receipt of the information listed in this Section.

- C. The Contractor shall comply with the following prohibitions and limitations, which are contained in the Stormwater Permit:
 - 1. Discharge prohibitions:
 - a. Discharges of materials other than stormwater, which are not otherwise regulated by a NPDES permit, to a separate stormwater sewer system or water of the nation are prohibited.
 - b. Stormwater discharges shall not cause or threaten to cause pollution, contamination (including sediment), or nuisance.
 - c. Stormwater discharges regulated by this general permit shall not contain a hazardous substance equal to or in excess of a reportable quantity listed in 40 CFR 117 and 40 CFR 302.
 - 2. Receiving water limitations:
 - a. Stormwater discharges to any surface or groundwater shall not adversely impact human health or the environment.
 - b. Stormwater discharge shall not cause or contribute to a violation of any applicable water quality standards contained in the California Ocean Plan, Inland Surface Waters and Enclosed Bays and Estuaries Plan, or the applicable Regional Water Board's Basin Plan.

- D. Requirements:
 - 1. In order to comply with the permit mandates the Monterey County has developed a County-Wide Stormwater Pollution Prevention Program and summary of Best Management Practices (BMPs) that are suggested to be utilized by the Contractor. BMPs are measures or practices used to reduce the amount of pollution entering surface water. BMPs may take the form of a process, activity, or physical structure. Some BMPs are simple and can be put into place immediately, while others are more complicated and require extensive planning or space. They may be inexpensive or costly to implement. No additional compensation shall be made for implementation of BMPs.
 - 2. The Monterey County-Wide Stormwater Pollution Prevention Program and Summary of BMPs are available for review at the Owner's Water Quality Control Plant.

1.05 STORMWATER POLLUTION PREVENTION PLAN IMPLEMENTATION

- A. The Contractor's QSP shall implement all activities required by the General Permit and as detailed in the Stormwater Pollution Prevention Plan, Monitoring Program, and Reporting Plan.

1.06 NON-STORMWATER MANAGEMENT

- A. The Stormwater Pollution Prevention Plan shall discuss any non-stormwater sources (i.e., landscaping irrigation, pipe flushing, street washing, and dewatering). In addition, the Plan shall include standard observation measures and best management practices, including best available technologies economically achievable and best conventional pollutant control technologies that are to be implemented in order to reduce the pollutant loading to the waters.

1.07 AMENDMENTS

- A. The Contractor's QSP shall amend the Stormwater Pollution Prevention Plan, Monitoring Program, and Reporting Plan whenever there is a change in construction or operations which may affect the discharge of pollutants to stormwater.

- B. The Stormwater Pollution Prevention Plan shall also be amended if it is in violation of any conditions of the general permit or has not achieved the general objective of reducing pollutants in stormwater discharges.
- C. All amendments shall be completed at no additional cost to the Owner.

1.08 ANNUAL SUMMARY

- A. Contractor:
 - 1. Prepare an annual summary report (annual report) in accordance with all Regional Water Quality Control Board requirements.
 - 2. Utilize the annual report form available in the SMARTS, and submit it to the Engineer a minimum of 2 weeks prior to the deadline for submittal.
 - 3. Upon approval of the report by the Engineer, the LRP will review and certify the report for final submittal via SMARTS.

1.09 NOTICE OF TERMINATION

- A. The Contractor shall provide all necessary information for the completion of a Notice of Termination (NOT) upon completion of all construction activities (refer to Section C of the General Construction Activity Stormwater Permit for general requirements). Upon review of the information submitted, the LRP will certify and submit the NOT via SMARTS.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

3.01 GENERAL REQUIREMENTS

- A. Nonhazardous material/waste management:
 - 1. Designated area: The Contractor shall propose designated areas of the project site, for approval by the Engineer, suitable for material delivery, storage, and waste collection that, to the maximum extent practicable, are near construction entrances and away from catch basins, gutters, drainage courses, and creeks.
 - 2. Granular material:
 - a. The Contractor shall store granular material at least 50 feet away from catch basin and curb returns.
 - b. The Contractor shall not allow granular material to enter storm drains, creeks, or rivers.
 - c. When rain is forecast within 24 hours or during wet weather, the Engineer may require the Contractor to cover granular material with a tarpaulin and to surround the material with sand bags:
 - 1) All stockpiles are required to be protected immediately if they are not scheduled to be used within 14 days.

3. Dust control: The Contractor shall use reclaimed water to control dust on a daily basis or as directed by the Construction Manager.
 4. Street sweeping and vacuuming:
 - a. At the end of each working day or as directed by the Engineer, the Contractor shall clean and sweep roadways and on-site paved areas of all materials attributed to or involved in the work.
 - b. The Contractor shall not use water to flush down streets in place of street sweeping.
 - c. Additionally, the Contractor shall not use kick brooms or sweeper attachments.
- B. Spill prevention and control:
1. The Contractor shall keep a stockpile of spill cleanup materials, such as rags or absorbents, readily accessible on-site.
 2. The Contractor shall immediately contain and prevent leaks and spills from entering storm drains, and properly clean up and dispose of the waste and cleanup materials:
 - a. If the waste is hazardous, the Contractor shall dispose of hazardous waste only at authorized and permitted treatment, storage, and disposal facilities, and use only licensed hazardous waste haulers to remove the waste off-site, unless quantities to be transported are below applicable threshold limits for transportation specified in State and Federal regulations.
 3. The Contractor shall not wash any spilled material into streets, gutters, storm drains, creeks, or rivers and shall not bury spilled hazardous materials.
 4. The Contractor shall immediately report any hazardous materials spill to the Owner and Engineer for reporting to all applicable regulatory agencies.
- C. Vehicle/equipment cleaning:
1. The Contractor shall not perform vehicle or equipment cleaning on-site or in the street using soaps, solvents, degreasers, steam cleaning equipment, or equivalent methods.
 2. The Contractor shall perform vehicle or equipment cleaning, with water only, in a designated, bermed area that will not allow rinse water to run off-site or into streets, gutters, storm drains, creeks or rivers.
- D. Vehicle/equipment maintenance and fueling:
1. The Contractor shall perform maintenance and fueling of vehicles or equipment in designated, bermed area(s) or over a drip pan that will not allow run-on of stormwater or runoff of spills.
 2. The Contractor shall use secondary containment, such as a drip pan, to catch leaks or spills any time that vehicle or equipment fluids are dispensed, changed, or poured.
 3. The Contractor shall keep a stockpile of spill cleanup materials, such as rags or absorbents, readily accessible on-site.
 4. The Contractor shall clean up leaks and spills of vehicle or equipment fluids immediately and dispose of the waste and cleanup materials as hazardous waste, as described in section "Spill prevention and control" above.
 5. The Contractor shall not wash any spilled material into streets, gutters, storm drains, creeks, or rivers and shall not bury spilled hazardous materials.

6. The Contractor shall report any hazardous materials spill to the Owner and Engineer and all applicable regulatory agencies.
7. The Contractor shall inspect vehicles and equipment arriving on-site for leaking fluids and shall promptly repair leaking vehicles and equipment. Drip pans shall be used to catch leaks until repairs are made.
8. The Contractor shall recycle waste oil and antifreeze, to the maximum extent practicable.
9. The Contractor shall comply with Federal, State, and City requirements for aboveground storage tanks.

E. Contractor training and awareness:

1. Contractor's QSP shall train all employees/subcontractors on the stormwater pollution prevention requirements contained in these specifications.
2. Contractor's QSP shall inform subcontractors of the stormwater pollution prevention contract requirements and include appropriate subcontract provisions to ensure that these requirements are met.
3. Contractor shall post warning signs in areas treated with chemicals.
4. Contractor shall paint new, reset or raised catch basins, constructed as part of the project, with a "No Dumping" stencil.

3.02 SPECIFIC REQUIREMENTS

A. Paving operations:

1. Project site management:
 - a. When rain is forecast within 24 hours or during wet weather, the Engineer may prevent the Contractor from paving.
 - b. The Engineer may direct the Contractor to protect drainage courses by using control measures, such as earth dike, straw bale, and sand bag, to divert runoff or trap and filter sediment in addition to those already shown on the construction plan sheets.
 - c. The Contractor shall place drip pans or absorbent material under paving equipment when not in use.
 - d. The Contractor shall cover catch basins and manholes when paving or applying seal coat, tack coat, slurry seal, or fog seal.
 - e. If the paving operation includes an on-site mixing plant, the Contractor shall comply with applicable Federal, State, and local General Industrial Activities Stormwater Permit requirements.
2. Paving waste management:
 - a. The Contractor shall not sweep or wash down excess sand (placed as part of a sand seal or to absorb excess oil) into gutters, storm drains, or creeks:
 - 1) Instead, the Contractor shall either collect the sand and return it to the stockpile, or dispose of it in a trash container.
 - b. The Contractor shall not use water to wash down fresh asphalt concrete pavement.

B. Saw cutting:

1. During saw cutting, the Contractor shall cover or barricade catch basins using control measures, such as filter fabric, straw bales, sand bags, and fine gravel dams, to keep slurry out of the storm drain system. When protecting a catch basin, the Contractor shall ensure that the entire opening is covered.

2. The Contractor shall vacuum saw cut slurry and pick up the waste prior to moving to the next location or at the end of each working day, whichever is sooner.
 3. If saw cut slurry enters catch basins, the Contractor shall remove the slurry from the storm drain system immediately.
- C. Concrete, grout, and mortar waste management:
1. Material management: The Contractor shall store concrete, grout, and mortar away from drainage areas and ensure that these materials do not enter the storm drain system.
 2. Concrete truck/equipment washout:
 - a. The Contractor shall not washout concrete trucks or equipment into streets, gutters, storm drains, creeks, or rivers:
 - 1) Washout areas should be located at least 50 feet from storm drains, open ditches, or water bodies.
 - b. The Contractor shall perform washout of concrete trucks or equipment in a designated area:
 - 1) Washout site should be lined so there is no discharge into the underlying soil.
 3. Exposed aggregate concrete wash water:
 - a. The Contractor shall avoid creating runoff from washing of exposed aggregate concrete. The Contractor shall collect and return sweepings from exposed aggregate concrete to a stockpile or dispose of the waste in a trash container.

END OF SECTION

SECTION 01410

REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Regulatory requirements:
 - 1. Building code.
 - 2. Electrical code.
 - 3. Energy code.
 - 4. Fire code.
 - 5. Mechanical code.
 - 6. Plumbing code.

1.02 REFERENCES

- A. California Code of Regulations, Title 24:
 - 1. 2016 California Building Code (CBC).
 - 2. 2016 California Electrical Code (CEC).
 - 3. 2016 California Energy Code (CEC).
 - 4. 2016 California Fire Code (CFC).
 - 5. 2016 California Mechanical Code (CMC).
 - 6. 2016 California Plumbing Code (CPC).

1.03 SYSTEM DESCRIPTION

- A. Design requirements:
 - 1. Building code:
 - a. 2016 California Building Code.
 - 2. Electrical code:
 - a. 2016 California Electrical Code.
 - 3. Energy conservation code:
 - a. 2016 California Energy Code.
 - 4. Fire code:
 - a. 2016 California Fire Code.
 - 5. Mechanical code:
 - a. 2016 California Mechanical Code.
 - 6. Plumbing code:
 - a. 2016 California Plumbing Code.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END OF SECTION

SECTION 01424

ABBREVIATIONS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Abbreviations and meanings.

1.02 INTERPRETATIONS

- A. Interpret abbreviations by context in which abbreviations are used.

1.03 ABBREVIATIONS

- A. Abbreviations used to identify Reference Standards:

AA	Aluminum Association
AAMA	Architectural Aluminum Manufacturers Association
AAN	American Association of Nurserymen
AASHTO	American Association of State Highway and Transportation Officials
ABC	Associated Air Balance Council
ABPA	Acoustical and Board Products Association
ACI	American Concrete Institute
ACIL	American Council of Independent Laboratories
ADC	Air Diffusion Council
ABMA	American Bearing Manufacturers' Association (formerly AFBMA, Anti-Friction Bearing Manufacturers' Association)
AGA	American Gas Association
AGC	Associated General Contractors
AGMA	American Gear Manufacturers' Association
AHRI	Air-Conditioning Heating and Refrigeration Institute
AI	Asphalt Institute
AIA	American Institute of Architects
AIMA	Acoustical and Insulating Materials Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
APA	American Plywood Association
API	American Petroleum Institute
ASAHC	American Society of Architectural Hardware Consultants
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	ASTM International (Former name American Society for Testing and Materials. Still used in specifications.)

AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers Association
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWSC	American Welding Society Code
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Institute of America
BSI	Building Stone Institute
CLFMI	Chain Link Fence Manufacturers Institute
CPSC	U.S. Consumer Product Safety Commission
CRA	California Redwood Association
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standards
CSI	Construction Specifications Institute
DHI	Door and Hardware Institute
EIFS	Exterior Insulation and Finish System
EJCDC	Engineers Joint Contract Documents Committee
FGMA	Flat Glass Marketing Association
FIA	Factory Insurance Association
FM	Factory Mutual
FS	Federal Specifications
FTI	Facing Tile Institute
GA	Gypsum Association
IAPMO	International Association of Plumbing and Mechanical Officials
IBC	International Building Code
ICBO	International Conference of Building Officials
ICC	International Code Council
IEEE	Institute of Electrical and Electronics Engineers
ML/SFA	Metal Lath/Steel Framing Association
NAAMM	National Association of Architectural Metal Manufacturers
NAPA	National Asphalt Pavement Association
NBHA	National Builders Hardware Association
NCMA	National Concrete Masonry Association
NEC	National Electrical Code
NECA	National Electrical Contractors Association
NETA	International Electrical Testing Association
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NIST	National Institute of Standards and Technology
NMWIA	National Mineral Wood Insulation Association
NPCA	National Paint and Coatings Association

NRCA	National Roofing Contractors Association
NWMA	National Woodwork Manufacturer's Association
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PDCA	Paint and Decorating Contractors of America
PDI	Plumbing and Drainage Institute
PS	Product Standard
SDI	Steel Door Institute
SIGMA	Sealed Insulating Glass Manufacturers Association
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SSPC	Society for Protective Coatings-Steel Structures Painting Council
UBC	Uniform Building Code (ICBO)
UL	Underwriters Laboratories, Inc.
UNS	Unified Numbering System
USDA	United States Department of Agriculture
WCLA	West Coast Lumberman's Association
WCLIB	West Coast Lumber Inspection Bureau
WPOA	Western Plumbing Officials Association
WRC	Welding Research Council
WSCPA	Western States Clay Products Association
WWPA	Western Wood Products Association

B. Abbreviations used in Specifications:

a	year or years (metric unit)
A	ampere or amperes
am	ante meridian (before noon)
ac	alternating current
ac-ft	acre-foot or acre-feet
atm	atmosphere
AWG	American Wire Gauge
bbl	barrel or barrels
bd	board
bhp	brake horsepower
bil gal	billion gallons
Btu	British thermal unit or units
Btuh	British thermal units per hour
bu	bushel or bushels
C	degrees Celsius
cal	calorie or calories
cap	capita
cd	candela or candelas
cfm	cubic feet per minute
Ci	curie or curies
cm	centimeter or centimeters

cmu	concrete masonry unit
CO	carbon monoxide
Co.	Company
CO ₂	carbon dioxide
Corp.	Corporation
counts/min	counts per minute
cu	cubic
cu cm	cubic centimeter or centimeters
cu ft	cubic foot or feet
cu ft/day	cubic feet per day
cu ft/hr	cubic feet per hour
cu ft/min	cubic feet per minute
cu ft/sec	cubic feet per second
cu in	cubic inch or inches
cu m	cubic meter or meters
cu yd	cubic yard or yards
d	day (metric units)
day	day (English units)
db	decibels
DB	dry bulb (temperature)
dc	direct current
diam	diameter
emf	electromotive force
fpm	feet per minute
F	degrees Fahrenheit
ft	feet or foot
fc	foot-candle or foot candles
ft/day	feet per day
ft/hr	feet per hour
ft/min	feet per minute
ft/sec	feet per second
g	gram or grams
G	gravitational force
gal	gallon or gallons
gal/day	gallons per day
gal/min	gallons per minutes
gal/sec	gallons per second
gfd	gallons per square foot per day
g/L	grams per liter
gpd	gallons per day
gpd/ac	gallons per day per acre
gpd/cap	gallons per day per capita
gpd/sq ft	gallons per day per square foot
gph	gallons per hour
gpm	gallons per minute
gps	gallons per second
h	hour or hours (metric units)

ha	hectare or hectares
hp	high point
hp	horsepower
hp-hr	horsepower-hour or horsepower-hours
hr	hour or hours (English units)
Hz	hertz
ID	inside diameter
ihp	indicated horsepower
Inc.	Incorporated
inch	inch
inches	inches
inches/sec	inches per second
J	joule or joules
k	kips
K	kelvin
K	thermal conductivity
kcal	kilocalorie or kilocalories
kcmil	thousand circular mils
kg	kilogram or kilograms
km	kilometer or kilometers
kN	kilonewton or kilonewtons
kPa	kilopascal or kilopascals
ksi	kips per square inch
kV	kilovolt or kilovolts
kVA	kilovolt-ampere or kilovolt-amperes
kW	kilowatt or kilowatts
kWh	kilowatt hour
L	liter or liters
lb/1000 cu ft	pounds per thousand cubic foot
lb/acre-ft	pounds per acre-foot
lb/ac	pounds per acre
lb/cu ft	pounds per cubic foot
lb/day/cu ft	pounds per day per cubic foot
lb/day/acre	pounds per day per acre
lb/sq ft	pounds per square foot
lin	linear, lineal
lin ft	linear foot or feet
lm	lumen or lumens
log	logarithm (common)
ln	logarithm (natural)
lx	lux
m	meter or meters
mA	milliampere or milliamperes
max	maximum
mCi	millicurie or millicuries
meq	milliequivalent
μF	microfarad or microfarads

MFBM	thousand feet board measure
mfr	manufacturer
mg	milligram or milligrams
mgd/ac	million gallons per day per acre
mgd	million gallons per day
mg/L	milligrams per liter
µg/L	micrograms per liter
µm	micrometer or micrometers
mile	mile
mil. gal	million gallons
miles	miles
min	minimum
min	minute or minutes
mm	millimeter or millimeters
mol wt	molecular weight
mol	mole
Mpa	megapascal or megapascals
mph	miles per hour
MPN	most probable number
mR	milliroentgen or milliroentgens
Mrad	megarad or megarads
mV	millivolt or millivolts
MW	megawatt or megawatts
N	newton or newtons
N	normal (concentration)
No.	number
Nos	numbers
NRC	noise reduction coefficient
oc	on center
OD	outside diameter
oz	ounce or ounces
oz/sq ft	ounces per square foot
Pa	pascal or pascals
pl	plate or property line
pm	post meridiem (afternoon)
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
pr	pair
psf/hr	pounds per square foot per hour
psf	pounds per square foot
psi	pounds per square inch
psia	pounds per square inch absolute
psig	pounds per square inch gauge
PVC	polyvinyl chloride
qt	quart or quarts
R	radius
R	roentgen or roentgens

rad	radiation absorbed dose
RH	relative humidity
rpm	revolutions per minute
rps	revolutions per second
s	second (metric units)
S	Siemens (mho)
sec	second (English units)
SI	International System of Units
sp	static pressure
sp gr	specific gravity
sp ht	specific heat
sq	square
cm ² or sq cm	square centimeter or centimeters
sq ft	square feet or foot
sq inch	square inch
sq inches	square inches
km ² or sq km	square kilometer or kilometers
m ² or sq m	square meter or meters
mm ² or sq mm	square millimeter or millimeters
sq yd	square yard or yards
STC	Sound Transmission Class
TLM	median tolerance limit
U	U Factor/U Value
U	Coefficient of Heat Transfer
U	heat transfer coefficient
UNS	Uniform Numbering System
US	United States
V	volt or volts
VA	volt-ampere or volt-amperes
W	watt or watts
WB	wet bulb
wg	water gauge
wk	week or weeks
wt	weight
yd	yard or yards
yr	year or years (English unit)

C. Abbreviations used on Drawings: As listed on Drawings or in Specifications.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01450
QUALITY CONTROL

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Quality control requirements and procedures for products and workmanship and includes the following:
 - 1. Sampling and testing of materials.
 - 2. Testing of equipment.
 - 3. Requirements for testing laboratories.
 - 4. Procedures and limitations of inspection.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. E 329 - Standard for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.

1.03 PRODUCTS AND WORKMANSHIP

- A. When specified, products will be tested and inspected either at point of origin or at Work site:
 - 1. Notify ENGINEER in writing well in advance of when products will be ready for testing and inspection at point of origin.
 - 2. Do not construe that satisfactory tests and inspections at point of origin is final acceptance of products. Satisfactory tests or inspections at point of origin do not preclude retesting or reinspection at Work site.
- B. Do not ship products which require testing and inspection at point of origin prior to testing and inspection.

1.04 SAMPLING AND TESTING

- A. General:
 - 1. Prior to delivery and incorporation in the Work, submit listing of sources of materials, when specified in Sections where materials are specified.
 - 2. When specified in Sections where products are specified:
 - a. Submit sufficient quantities of representative samples of character and quality required of materials to be used in the Work for testing or examination.
 - b. Test materials in accordance with standards of national technical organizations.
- B. Sampling:
 - 1. Furnish specimens of materials when requested.
 - 2. Do not use materials which are required to be tested until testing indicates satisfactory compliance with specified requirements.

3. Specimens of materials will be taken for testing whenever necessary to determine quality of material.
 4. Assist ENGINEER in preparation of test specimens at site of Work, such as soil samples and concrete test cylinders.
- C. Testing:
1. When protesting failed tests of material in place or to be used, take additional specimens and have specimens tested:
 - a. When original test proves to have been in error, file claim for reimbursement of direct costs for sampling and testing.
- D. Test Standards:
1. Perform sampling, specimen preparation, and testing of materials in accordance with specified standards, and when no standard is specified, in accordance with standard of nationally recognized technical organization.
 2. Physical characteristics of materials not particularly specified shall conform to standards published by ASTM, where applicable.
 3. Standards and publication references in Contract Documents shall be edition or revision in effect on date stipulated in Document 00700.

1.05 TESTING LABORATORY SERVICES

- A. Qualification of Laboratory:
1. Meets "Recommended Requirements for Independent Laboratory Qualification," published by American Council of Independent Laboratories.
 2. Meets requirements of ASTM E 329.
 3. Has authorization to operate in state in which Project is located.
 4. Will submit copy of report of inspection of facilities made by Materials Reference Laboratory of NBS during most recent tour of inspection, with memorandum of remedies of deficiencies reported by inspection.
 5. Has testing equipment calibrated at reasonable intervals by devices of accuracy traceable to NBS or accepted values of natural physical constants.
- B. Laboratory Duties:
1. Cooperate with ENGINEER and CONTRACTOR.
 2. Provide qualified personnel.
 3. Notify ENGINEER and CONTRACTOR, in writing, of response time needed to schedule testing or inspections after receipt of notice.
 4. Perform specified inspections, sampling, and testing of materials and methods of construction in accordance with specified standards to ascertain compliance of materials with requirements of Contract Documents.
 5. Promptly notify ENGINEER and CONTRACTOR of observed irregularities or deficiencies of construction.
 6. Promptly submit written report of each test and inspection; one copy each to ENGINEER, OWNER, CONTRACTOR, and one copy to file of Project Record Documents. Each report shall include:
 - a. Date issued.
 - b. Project title and number.
 - c. Testing laboratory name, address, and telephone number.
 - d. Name and signature of laboratory inspector.
 - e. Date and time of sampling or inspection.
 - f. Record of temperature and weather conditions.

- g. Date of test.
- h. Identification of product and Specification Section.
- i. Location of sample or test in Project.
- j. Type of inspection or test.
- k. Results of tests and compliance with Contract Documents.
- l. Interpretation of test results, when requested by ENGINEER.

- C. Limitations of Authority of Testing Laboratory: Laboratory is not authorized to:
 - 1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Approve or accept portion of Work.
 - 3. Perform duties of CONTRACTOR.

1.06 CONTRACTOR'S RESPONSIBILITIES

- A. Cooperate with laboratory personnel and provide access to construction and manufacturing operations.
- B. Secure and deliver to laboratory adequate quantities of representative samples of materials proposed to be used and which require testing.
- C. Provide to laboratory preliminary mix design proposed to be used for concrete, and other materials mixes which require control by testing laboratory.
- D. Furnish copies of product test reports.
- E. Furnish Incidental Labor and Facilities:
 - 1. To provide access to construction to be tested.
 - 2. To obtain and handle samples at Work site or at source of product to be tested.
 - 3. To facilitate inspections and tests.
 - 4. For storage and curing of test samples.
- F. Notify laboratory in advance of when observations, inspections and testing is needed for laboratory to schedule and perform in accordance with their notice of response time.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01455

SPECIAL TESTS AND INSPECTIONS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: This Section describes the requirements for providing special tests and inspections.
- B. Related sections:
 - 1. Section 01450 - Quality Control.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. C140 - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
 - 2. C270 - Standard Specification for Mortar for Unit Masonry.
 - 3. C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
 - 4. C1019 - Standard Test Method for Sampling and Testing Grout.
 - 5. C1314 - Standard Test Method for Compressive Strength of Masonry Prisms.
- B. California Building Code (CBC), 2016 Edition (with City of Marina amendments).

1.03 DESCRIPTION

- A. This Section describes special tests and inspections of structural assemblies and components to be performed in compliance with CBC and City of Marina amendments.
- B. These special tests and inspections are in addition to the requirements specified in Section 01450, and by the individual Sections.
- C. The Owner will employ 1 or more inspectors who will provide special inspections during construction.

1.04 INSPECTION

- A. Duties of Special Inspector:
 - 1. General: Required duties of the Special Inspector are described in CBC.

1.05 TESTS

- A. Selection of the material required to be tested shall be by the Owner's Testing Laboratory and not the Contractor.

1.06 SPECIAL TESTING AND INSPECTIONS

- A. Testing laboratory: Special tests will be performed by the Owner's testing laboratory as specified in Section 01450.
- B. Owner reserves the right to positive material identification tests.
 - 1. Contractor must make materials available for testing.
- C. The following types of work require special inspection as described in CBC, Refer to the following verification, testing and inspection schedules.
 - 1. Appendix A, Cast-In-Place Concrete Special Inspection Schedule.
 - 2. Appendix B, Essential Mechanical and Electrical Inspection Schedule.
 - 3. Appendix C, Soils Verification and Inspection Schedule.
 - 4. Appendix D, Welded Steel Reservoir Schedule.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 SCHEDULE

- A. The Contractor shall allow time necessary for Special Inspections as listed above.
- B. Sufficient notice shall be given so that the Special Inspections can be performed. This includes time for off-site Special Inspectors to plan the inspection and travel to site.

3.02 PROCEDURE

- A. The Special Inspector will immediately notify the Engineer of any corrections required and follow notification with appropriate documentation.
- B. The Contractor shall not proceed until the work is satisfactory to the Engineer.

END OF SECTION

**APPENDIX A
CAST-IN-PLACE CONCRETE SPECIAL INSPECTION SCHEDULE**

Verification and Inspection	Reference Standard	Frequency of Inspection	
		Continuous During Task Listed	Periodic During Task Listed
1. Inspection of reinforcing steel and placement.		–	X
2. Inspection of reinforcing steel welding.	CBC Table 1704.3, Item 5B	–	–
3. Inspect bolts to be installed in concrete prior to and during placement of concrete.		X	–
4. Verifying use of required design mix.		–	X
5. At the time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.		X	–
6. Inspection of concrete placement for proper application techniques.		X	–

**APPENDIX B
ESSENTIAL MECHANICAL AND ELECTRICAL
INSPECTION SCHEDULE**

Verification and Inspection	Reference Standard	Frequency of Inspection	
		Continuous During Task Listed	Periodic During Task Listed
1. Anchorage of electrical or mechanical equipment over 1,000 lb. on floors or roofs.		–	X
2. Anchorage of pipelines greater than 8 inches in diameter.		–	X

**APPENDIX C
SOILS VERIFICATION AND INSPECTION SCHEDULE**

Verification and Inspection	Reference Standard	Frequency of Inspection	
		Continuous During Task Listed	Periodic During Task Listed
1. Verify materials below footings are adequate to achieve the design bearing capacity.		–	X
2. Verify excavations are extended to proper depth and have reached proper material.		–	X
3. Perform classification and testing of controlled fill materials.		–	X
4. Verify use of proper materials, densities, and lift thicknesses during placement and compaction of controlled fill.		X	–
5. Prior to placement of controlled fill, observe subgrade and verify that site has been prepared properly.		–	X

**APPENDIX D
WELDED STEEL RESERVOIR SPECIAL INSPECTION SCHEDULE**

Verification and Inspection	Reference Standard	Frequency of Inspection	
		Continuous During Task Listed	Periodic During Task Listed
1. Inspection of reservoir sheet welding:			
a) Complete and partial penetration groove welds.		X	-
b) Multi-pass fillet welds.			X
c) Single-pass fillet welds > 5/16".			X
d) Single-pass fillet welds ≤ 5/16".		-	X

SECTION 01500

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Furnishing, maintaining, and removing construction facilities and temporary controls, including temporary utilities, construction aids, barriers and enclosures, security, access roads, temporary controls, project sign, field offices and sheds, and removal after construction.
- B. Related Sections:
 - 1. Section 01140 - Work Restrictions: Utilities.

1.02 TEMPORARY UTILITIES

- A. Temporary Electrical Power:
 - 1. Arrange with local utility to provide adequate temporary electrical service.
 - 2. Provide and maintain adequate jobsite power distribution facilities conforming to applicable Laws and Regulations.
 - 3. Provide, maintain, and pay for electric power for performance of the Work except for power required for the final 7-day operational test:
 - a. When using permanent facilities, provide separate meter and reimburse OWNER for power used in connection with performance of the Work.
- B. Temporary Electrical Lighting:
 - 1. In work areas, provide temporary lighting sufficient to maintain lighting levels during working hours not less than lighting levels required by OSHA and state agency which administers OSHA regulations where Project is located.
 - 2. When available, permanent lighting facilities may be used in lieu of temporary facilities:
 - a. Prior to Substantial Completion of the Work, replace bulbs, lamps, or tubes used by CONTRACTOR for lighting.
- C. Temporary Heating, Cooling, and Ventilating:
 - 1. Heat and ventilate work areas to protect the Work from damage by freezing, high temperatures, weather, and to provide safe environment for workers.
 - 2. Permanent heating system may be utilized when sufficiently completed to allow safe operation.
- D. Temporary Water:
 - 1. Pay for and construct facilities necessary to furnish potable water for human consumption.
 - 2. Remove temporary piping and connections and restore affected portions of the facility to original condition before Substantial Completion.

3. Construction water will be provided by the District. The Contractor is responsible for obtaining hydrant meters and paying applicable fees and deposits.
- E. Temporary Sanitary Facilities:
1. Provide suitable and adequate sanitary facilities that are in compliance with applicable Laws and Regulations.
 2. Sanitary facilities shall include trash collection per Appendix B, Mitigation Monitoring, and Reporting Plan, part 4.4-R22.
 3. At completion of the Work, remove sanitary facilities and leave site in neat and sanitary condition.
- F. Temporary Fire Protection: Provide sufficient number of fire extinguishers of type and capacity required to protect the Work and ancillary facilities.
- G. First Aid: Post first aid facilities and information posters conforming to requirements of OSHA and other applicable Laws and Regulations in readily accessible locations.
- H. Utilities in Existing Facilities: See Section 01140 - Work Restrictions.

1.03 CONSTRUCTION AIDS

- A. Provide railings, kick plates, enclosures, safety devices, and controls required by Laws and Regulations and as required for adequate protection of life and property.
- B. Use construction hoists, elevators, scaffolds, stages, shoring, and similar temporary facilities of ample size and capacity to adequately support and move loads.
- C. Design temporary supports with adequate safety factor to assure adequate load bearing capability:
1. When requested, submit design calculations by professional registered engineer prior to application of loads.
 2. Submitted design calculations are for information and record purposes only.
- D. Accident Prevention:
1. Exercise precautions throughout construction for protection of persons and property.
 2. Observe safety provisions of applicable Laws and Regulations.
 3. Guard machinery and equipment, and eliminate other hazards.
 4. Make reports required by authorities having jurisdiction, and permit safety inspections of the Work.
 5. Before commencing construction Work, take necessary action to comply with provisions for safety and accident prevention.
- E. Barricades:
1. Place barriers at ends of excavations and along excavations to warn pedestrian and vehicular traffic of excavations.
 2. Provide barriers with flashing lights after dark.
 3. Keep barriers in place until excavations are entirely backfilled and compacted.
 4. Barricade excavations to prevent persons from entering excavated areas in streets, roadways, parking lots, treatment plants, or other public or private areas.

- F. Warning Devices and Barricades: Adequately identify and guard hazardous areas and conditions by visual warning devices and, where necessary, physical barriers:
 - 1. Devices shall conform to minimum requirements of OSHA and State agency which administers OSHA regulations where Project is located.
- G. Hazards in Public Right-of-Way:
 - 1. Mark at reasonable intervals, trenches and other continuous excavations in public right-of-way, running parallel to general flow of traffic, with traffic cones, barricades, or other suitable visual markers during daylight hours:
 - a. During hours of darkness, provide markers with torches, flashers, or other adequate lights.
 - 2. At intersections or for pits and similar excavations, where traffic may reasonably be expected to approach head on, protect excavations by continuous barricades:
 - a. During hours of darkness, provide warning lights at close intervals.
- H. Hazards in Protected Areas: Mark or guard excavations in areas from which public is excluded, in manner appropriate for hazard.
- I. Below Grade Protection: Provide safety protection that meets requirements of OSHA and State agency which administers OSHA regulations where Project is located.
- J. Protect existing structures, trees, shrubs, and other items to be preserved on Project site from injury, damage or destruction by vehicles, equipment, worker or other agents with substantial barricades or other devices commensurate with hazards.
- K. Fences:
 - 1. Enclose temporary offices and storage areas with fence adequate to protect temporary facilities against acts of theft, violence and vandalism.
 - 2. When entire or part of site is to be permanently fenced, permanent fence may be built to serve for both permanent and temporary protection of the Work site, provided that damaged or defaced fencing is replaced prior to Substantial Completion.
 - 3. Protect temporary and permanent openings and close openings in existing fences to prevent intrusion by unauthorized persons. Bear responsibility for protection of plant and material on site of the work when openings in existing fences are not closed.
 - 4. During night hours, weekends, holidays, and other times when no work is performed at site, provide temporary closures or enlist services of security guards to protect temporary openings.
 - 5. Fence temporary openings when openings are no longer necessary.

1.04 SECURITY

- A. Make adequate provision for protection of the Work area against fire, theft, and vandalism, and for protection of public against exposure to injury.

1.05 ACCESS ROADS

- A. General:
 - 1. Build and maintain access roads to and on site of the Work to provide for delivery of material and for access to existing and operating plant facilities on site.
 - 2. Build and maintain dust free roads which are suitable for travel at 20 miles per hour.
- B. Off-Site Access Roads:
 - 1. Build and maintain graded earth roads.
 - 2. Build roads only in public right-of-way or easements obtained by OWNER.
 - 3. Obtain rights-of-way or easements when electing to build along other alignment.
- C. On-Site Access Roads:
 - 1. Maintain access roads to storage areas and other areas to which frequent access is required.
 - 2. Maintain similar roads to existing facilities on site of the Work to provide access for maintenance and operation.
 - 3. Protect buried vulnerable utilities under temporary roads with steel plates, wood planking, or bridges.
 - 4. Maintain on-site access roads free of mud. Under no circumstances shall vehicles leaving the site track mud off the site onto the public right-of-way.

1.06 TEMPORARY CONTROLS

- A. Dust Control:
 - 1. Prevent dust nuisance caused by operations, unpaved roads, excavation, backfilling, demolition, or other activities.
 - 2. Control dust by sprinkling with water, use of dust palliatives, modification of operations, or other means acceptable to agencies having jurisdiction.
- B. Noise Control:
 - 1. In inhabited areas, particularly residential, perform operations in manner to minimize noise.
 - 2. In residential areas, take special measures to suppress noise during night hours.
- C. Mud Control:
 - 1. Prevent mud nuisance caused by construction operations, unpaved roads, excavation, backfilling, demolition, or other activities.

1.07 PROJECT SIGN

- A. Submit a digital rendering of the project sign for review and approval prior to sign fabrication.
- B. Project signs shall be installed a minimum 1 week prior to construction.
- C. Provide and maintain Project identification sign consisting of painted 8 foot wide by 4 foot high exterior grade plywood and minimum 10 foot long 4 by 4 lumber posts,

set in ground at least 3 feet, with exhibit lettering by professional sign painter using no more than 5 sign colors:

1. List at least the title of the Project, and names of the OWNER, ENGINEER, and CONTRACTOR.
- D. Provide Project Sign with project name as indicated on the Drawings; Text of Second Line of Lettering on Sign Painted to Read:
1. Estimated Completion Date: [insert month and year from contract].
- E. On the third line of printing, paint appropriate dollar amounts.
- F. On the fourth line, list the state agency administering the state revolving fund loan for the project - coordinate with OWNER for this information. Include the EPA and state agency logo on the sign.
- G. Additional signage requirements may be needed to comply with State Revolving Fund requirements.
- H. Erect Project identification sign where directed by Engineer, but not less than every 2,500 linear feet of pipe.

1.08 FIELD OFFICES AND SHEDS

- A. CONTRACTOR's Field Office:
1. Maintain on Project Site weathertight space in which to keep copies of Contract Documents, progress schedule, shop drawings, and other relevant documents.
 2. Provide field office with adequate space to examine documents, and provide lighting and telephone service in that space.

1.09 REMOVAL

- A. Remove temporary buildings and furnishings before inspection for Substantial Completion or when directed.
- B. Clean and repair damage caused by installation or use of temporary facilities.
- C. Remove underground installations to minimum depth of 24 inches and grade to match surrounding conditions.
- D. Restore existing facilities used during construction to specified or original condition.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01570
TRAFFIC REGULATION

PART 1 GENERAL

1.01 DESCRIPTION

- A. All construction activities and traffic control measures shall be performed in accordance with the Contract Documents and as indicated on the traffic control plan (to be prepared by the Contractor and submitted to the Engineer). At a minimum, the traffic control plan shall conform to the provisions in the State of California Department of Transportation (Caltrans) Standard Plans and Standard Specification (dated 2015), and these special provisions. From this point forward, the Caltrans Standard Plans and Standard Specifications (dated 2015) will be referred to as the "Standard Plans and Standard Specifications."

1.02 SUMMARY

- A. Section Includes: All labor, material, equipment, tools and services used in the regulation of construction traffic to and from the project site.
- B. The Contractor shall provide for the protection of the traveling public, pedestrians and workers within the area covered by the limits of construction at all times when the area is affected by the construction facilities or activities.
- C. The Contractor shall so conduct his operations as to cause the least possible obstruction and inconvenience to the public and area residents, and shall have under construction no greater length of work than set forth in the specifications, and than he can execute properly with due regard to the rights of the public and area residents.
- D. Related Sections:
1. Section 01100 - Summary of Work.
 2. Section 01140 - Work Restrictions.
 3. Section 01500 - Temporary Facilities and Controls.
 4. Encroachment permits included elsewhere herein.
- E. Contractor shall be responsible for preparing traffic control plans for all phases and segments of the project. All traffic control plans shall be prepared, stamped, and signed by a Registered Traffic Engineer. They shall be of equal or greater quality and detail than those included in the Caltrans Standard Plans and shall be in accordance with the Contract Documents. All traffic control plans will be subject for approval by the appropriate jurisdictional agency (either the City of Marina, City of Seaside, County of Monterey, Caltrans, or any combination of these). The conceptually approved traffic control measures for the various segments of the project are shown in Appendix D of the Contract Documents.

1.03 REFERENCES

- A. Caltrans Standard Specifications, 2015, Section 12: Construction Area Traffic Control Devices.
- B. Caltrans Standard Specifications, 2015, Section 7-1.03: Public Convenience.
- C. Caltrans Standard Specifications, 2015, Section 7-1.04: Public Safety.
- D. 2014 California Manual on Uniform Traffic Control Devices (CA MUTCD), Revision 1.
- E. In addition to compliance with this specification, the Contractor shall comply with all applicable requirements of the latest editions of the following:
 - 1. California Vehicle Code.
 - 2. Other applicable government regulations.

1.04 SUBMITTALS

- A. Submit in accordance with Section 01330, Submittals.
- B. The project engineer shall be defined as the City of Marina engineer or his representative, City of Seaside engineer or his representative, County of Monterey engineer or his representative, or Caltrans resident engineer, depending on the project segment.
- C. The engineer shall have the right to demand the installation of additional traffic control devices or modifications to these plans and notes, as he deems necessary, to promote the safe and orderly flow of traffic and pedestrians through the construction work zone. The contractor shall comply with these additional requests or modification with due diligence.

PART 2 PRODUCTS

2.01 SIGNS, SIGNALS, AND DEVICES

- A. Construction area signs shall be furnished, installed, maintained, and removed when no longer required in accordance with the provisions in Section 12, "Construction Area Traffic Control Devices", of the Caltrans Standard Specifications. The Contractor shall notify the appropriate regional notification center for operators of subsurface installations at least two (2) working days, but not more than fourteen (14) calendar days, prior to commencing any excavation for construction area signposts. The regional notification centers include, but are not limited to the following:

Notification Center Underground Service Alert - Northern California 1 (800) 227-2600 or 811

All excavations required to install construction area signs shall be performed by hand methods, without the use of power equipment, except that power equipment may be used if it is determined there are no utility facilities in the area of the proposed post holes.

- B. K-rail barrier used on the project shall be in good condition, free of significant damage. Significant damage will consist of large checks, spalls, chips or structural failure. The barrier sections shall be painted white. The Contractor shall maintain the white paint while the barrier is in use. All graffiti shall be painted over or otherwise removed immediately, within 24 hours of its appearance. The Engineer will be the sole judge of the acceptability of individual barrier sections.
- C. Flashing beacons, portable changeable message signs and warning lights shall be used as directed by the engineer.
- D. All existing traffic control signs and street signs shall be maintained in visible locations during construction, unless prior written approval is obtained from the engineer. The contractor shall restore any striping or signing damaged during construction operations, including raised pavement markers, to the satisfaction of the engineer.
- E. The use of delineators shall be done in accordance with 2006 CA MUTCD.
- F. All temporary metal plate bridging shall be tack welded, wedged to prevent rattling and ramped. The trench should be adequately shored, if necessary, to support the bridging and traffic. Advanced warning signs shall be used when steel plates are used in the traveled way. Any dislodged plate shall be corrected by the Contractor immediately.

2.02 FLAG PERSONS

- A. Flag person equipment shall be in accordance with the provisions in Section 12, "Construction Area Traffic Control Devices", of the Caltrans Standard Specifications.
- B. Flag persons shall maintain a neat, clean and respectable appearance while directing traffic on the job site.

2.03 PREQUALIFIED AND TESTED SIGNING AND DELINEATION MATERIALS

- A. The Department of Transportation (Caltrans) maintains list of Prequalified and Tested Signing and Delineation Materials identified in Paragraphs 2.04 through 2.19. The Engineer shall not be precluded from sampling and testing products on the list of Prequalified and Tested Signing and Delineation Materials.
- B. The manufacturer of products on the list of Prequalified and Tested Signing and Delineation Materials shall furnish the Engineer a Certificate of Compliance in conformance with the provisions in Section 6-1.07, "Certificates of Compliance," of the Standard Specifications for each type of traffic product supplied.
- C. For those categories of materials included in the list of Prequalified and Tested Signing and Delineation Materials, only those products shown within the listing may be used in the work. Other categories of products, not included in the list of Prequalified and Tested Signing and Delineation Materials, may be used in the work provided they conform to the requirements of the Standard Specifications.

2.04 PAVEMENT MARKERS, PERMANENT TYPE

- A. Retroreflective With Abrasion Resistant Surface (ARS):
 - 1. Apex, Model 921AR (4 by 4 inches).
 - 2. Avery Dennison (formerly Stimsonite), Models C88 (4 by 4 inches), 911 (4 by 4 inches) and 953 (2.8 by 4.5 inches).
 - 3. Ray-O-Lite, Model AA ARS (4 by 4 inches).
 - 4. 3M Series 290 (3.5 by 4 inches).

- B. Retroreflective With Abrasion Resistant Surface (ARS) (for recessed applications only):
 - 1. Avery Dennison (formerly Stimsonite), Model 948 (2.3 by 4.7 inches).
 - 2. Avery Dennison (formerly Stimsonite), Model 944SB (2 by 4 inches).
 - a. For use only in 4-1/2 inch wide (older) recessed slots.
 - 3. Ray-O-Lite, Model 2002 (2.3 by 4.6 inches).
 - 4. Ray-O-Lite, Model 2004 ARS (2 by 4 inches).
 - a. For use only in 4-1/2 inch wide (older) recessed slots.

- C. Non-Reflective For Use With Epoxy Adhesive, 4 inches round:
 - 1. Apex Universal (Ceramic).

- D. Non-Reflective For Use With Bitumen Adhesive, 4 inches round:
 - 1. Alpine Products, D-Dot and ANR (ABS).
 - 2. Apex Universal (Ceramic).
 - 3. Apex Universal, Models 929 (ABS) and 929PP (Polypropylene).
 - 4. Elgin Molded Plastics, Empco-Lite Model 900 (ABS).
 - 5. Hi-Way Safety, Inc., Models P20-2000W and 2001Y (ABS).
 - 6. Interstate Sales, Diamond Back (ABS) and (Polypropylene).
 - 7. Novabrite Models Adot-w (White) Adot-y (Yellow), (ABS).
 - 8. Road Creations, Model RCB4NR (Acrylic).
 - 9. Zumar Industries, Titan TM40A (ABS).

2.05 PAVEMENT MARKERS, TEMPORARY TYPE

- A. Temporary Markers For Long Term Day/Night Use (6 months or less):
 - 1. Apex Universal, Model 924 (4 by 4 inches).
 - 2. Elgin Molded Plastics, Empco-Lite Model 901 (4 by 4 inches).
 - 3. Road Creations, Model R41C (4 by 4 inches).
 - 4. Vega Molded Products Temporary Road Marker (3 by 4 inches).

- B. Temporary Markers For Short Term Day/Night Use (14 days or less) (For seal coat or chip seal applications, clear protective covers are required):
 - 1. Apex Universal, Model 932.
 - 2. Bunzl Extrusion, Models T.O.M., T.R.P.M., and HH (High Heat).
 - 3. Hi-Way Safety, Inc., Model 1280/1281.

2.06 STRIPING AND PAVEMENT MARKING MATERIAL

- A. Permanent Traffic Striping and Pavement Marking Tape:
 - 1. Advanced Traffic Marking, Series 300 and 400.
 - 2. Brite-Line, Series 1000.
 - 3. Brite-Line, DeltaLine XRP.

4. Swarco Industries, Director 35 (For transverse application only).
 5. Swarco Industries, Director 60.
 6. F.3M, Stamark Series 380 and 5730.
 7. 3M, Stamark Series 420 (For transverse application only).
- B. Temporary (Removable) Striping and Pavement Marking Tape (6 months or less):
1. Advanced Traffic Marking, Series 200.
 2. Brite-Line, Series 100.
 3. Garlock Rubber Technologies, Series 2000.
 4. .P.B. Laminations, Aztec, Grade 102.
 5. Swarco Industries, Director-2.
 6. Trelleborg Industri, R140 Series.
 7. 3M, Series 620 CR, and Series A750.
 8. 3M, Series A145, Removable Black Line Mask.
 - a. Black Tape: for use only on Asphalt Concrete Surfaces.
 9. Advanced Traffic Marking Black Hide-A-Line.
 - a. Black Tape: for use only on Asphalt Concrete Surfaces.
 10. Brite-Line BTR Black Removable Tape.
 - a. Black Tape: for use only on Asphalt Concrete Surfaces.
 11. Trelleborg Industri, RB-140.
 - a. Black Tape: for use only on Asphalt Concrete Surfaces.
- C. Preformed Thermoplastic (Heated in place):
1. Avery Dennison, Hotape.
 2. Flint Trading, Premark and Premark 20/20 Flex.
- D. Ceramic Surfacing Laminate, 6 by 6 inches:
1. Safeline Industries/Highway Ceramics, Inc.

2.07 CLASS 1 DELINEATORS

- A. One Piece Driveable Flexible Type, 68-inch:
1. Bunzl Extrusion, Flexi-Guide Models 400 and 566.
 2. Carsonite, Curve-Flex CFRM-400.
 3. Carsonite, Roadmarker CRM-375.
 4. FlexStake, Model 654 TM.
 5. GreenLine Models HWD1-66 and CGD1-66.
 6. J. Miller Industries, Model JMI-375 (with soil anchor).
- B. Special Use Flexible Type, 68-inch:
1. Bunzl Extrusion, Model FG 560 (with 18 inch U-Channel base).
 2. Carsonite, Survivor (with 18 inch U-Channel base).
 3. Carsonite, Roadmarker CRM-375 (with 18 inch U-Channel base).
 4. FlexStake, Model 604.
 5. GreenLine Models HWDU and CGD (with 18 inch U-Channel base).
 6. Safe-Hit with 8 inch pavement anchor (SH248-GP1).
 7. Safe-Hit with 15 inch soil anchor (SH248-GP2) and with 18 inch soil anchor (SH248-GP3).
- C. Surface Mount Flexible Type, 48-inch:
1. Bent Manufacturing Company, Masterflex Model MF-180EX-48.
 2. Carsonite, Super Duck II.
 3. FlexStake, Surface Mount, Models 704 and 754 TM.

2.08 CHANNELIZERS

- A. Surface Mount Type, 36-inch:
 - 1. Bent Manufacturing Company, Masterflex Models MF-360-36 (Round) and MF-180-36 (Flat).
 - 2. Bunzl Extrusion, Flex-Guide Models FG300LD and FG300UR.
 - 3. Carsonite, Super Duck (Flat SDF-436, Round SDR-336.)
 - 4. Carsonite, Super Duck II Model SDCF203601MB The Channelizer.
 - 5. FlexStake, Surface Mount, Models 703 and 753 TM.
 - 6. GreenLine, Model SMD-36.
 - 7. Hi-Way Safety, Inc. "Channel Guide Channelizer" Model CGC36.
 - 8. Repo, Models 300 and 400.
 - 9. Safe-Hit, Guide Post, Model SH236SMA.
 - 10. The Line Connection, Dura-Post Model DP36-3 (Permanent).
 - 11. The Line Connection, Dura-Post Model DP36-3C (Temporary).

2.09 CONICAL DELINEATORS, 42-INCH

- A. For 28-inch Traffic Cones, see Standard Specifications.
- B. Bent Manufacturing Company T-Top.
- C. Plastic Safety Systems Navigator-42.
- D. Radiator Specialty Company Enforcer.
- E. Roadmaker Company Stacker.
- F. TrafFix Devices Grabber.

2.10 OBJECT MARKERS

- A. Type K, 18-inch:
 - 1. Carsonite, Model SMD 615.
 - 2. FlexStake, Model 701 KM.
 - 3. Repo, Models 300 and 400.
 - 4. Safe-Hit, Model SH718SMA.
 - 5. The Line Connection, Model DP21-4K.
- B. Type K-4 / Q Object Markers, 24\inch":
 - 1. Bent Manufacturing Masterflex Model MF-360-24.
 - 2. Bunzl Extrusion, Model FG324PE.
 - 3. Carsonite, Super Duck II.
 - 4. FlexStake, Model 701KM.
 - 5. Repo, Models 300 and 400.
 - 6. Safe-Hit, Models SH8 24SMA_WA and SH8 24GP3_WA.
 - 7. The Line Connection, Model DP21-4Q.

2.11 CONCRETE BARRIER MARKERS AND TEMPORARY RAILING (TYPE K) REFLECTORS

- A. Impactable Type:
 - 1. ARTUK, FB.
 - 2. Bunzl Extrusion, Model PCBM-12.
 - 3. Duraflex Corp., Flexx 2020 and Electriflexx.
 - 4. Hi-Way Safety, Inc., Model GMKRM100.
 - 5. Sun-Lab Technology, Safety Guide Light Model TM-5.
- B. Non-Impactable Type:
 - 1. ARTUK, JD Series.
 - 2. Vega Molded Products, Models GBM and JD.

2.12 THRIE BEAM BARRIER MARKERS

- A. For use to the left of traffic:
 - 1. Bunzl Extrusion, Mini (3 by 10 inches).
 - 2. Duraflex Corp., Railrider.

2.13 CONCRETE BARRIER DELINEATORS, 16-INCH

- A. For use to the right of traffic:
 - 1. Bunzl Extrusion, Model PCBM T-16.
 - 2. Safe-Hit, Model SH216RBM.
 - 3. Sun-Lab Technology, Safety Guide Light, Model TM16, 3 by 12 inches.

2.14 CONCRETE BARRIER-MOUNTED MINI-DRUM (10 BY 14 INCH BY 22.5 INCH)

- A. Stinson Equipment Company SaddleMarker.

2.15 SOUND WALL DELINEATOR

- A. Applied vertically. Place top of 3 by12-inch reflective element at 48 inches above roadway:
 - 1. A.Bunzl Extrusion, PCBM S-36.
 - 2. Sun-Lab Technology, Safety Guide Light, Model SM12, 3 by12-inch.

2.16 GUARD RAILING DELINEATOR

- A. Place top of reflective element at 48 inches above plane of roadway.
- B. Wood Post Type, 27-inch:
 - 1. Bunzl Extrusion, FG 427 and FG 527.
 - 2. Carsonite, Model 427.
 - 3. FlexStake, Model 102 GR.
 - 4. GreenLine GRD 27.
 - 5. J. Miller Model JMI-375G.
 - 6. Safe-Hit, Model SH227GRD.
- C. Steel Post Type:
 - 1. Carsonite, Model CFGR-327 with CFGRBK300 Mounting Bracket.

2.17 RETROREFLECTIVE SHEETING

- A. Channelizers, Barrier Markers, and Delineators:
 - 1. Avery Dennison T-6500 Series (Formerly Stimsonite, Series 6200) (For rigid substrate devices only).
 - 2. Nippon Carbide, Flexible Ultralite Grade (ULG) II.
 - 3. Reflexite, PC-1000 Metalized Polycarbonate.
 - 4. Reflexite, AC-1000 Acrylic.
 - 5. Reflexite, AP-1000 Metalized Polyester.
 - 6. Reflexite, Conformalight, AR-1000 Abrasion Resistant Coating.
 - 7. 3M, High Intensity.

- B. Traffic Cones, 13-inch Sleeves:
 - 1. Reflexite SB (Polyester), Vinyl or TR (Semi-transparent).

- C. Traffic Cones, 4-inch and 6-inch Sleeves:
 - 1. Nippon Carbide, Flexible Ultralite Grade (ULG) II.
 - 2. Reflexite, Vinyl, TR (Semi-transparent) or Conformalight.
 - 3. 3M Series 3840.

- D. Barrels and Drums:
 - 1. Avery Dennison W-6100.
 - 2. Nippon Carbide, Flexible Ultralite Grade (ULG) II.
 - 3. Reflexite, Conformalight, Super High Intensity or High Impact Drum Sheeting.
 - 4. 3M Series 3810.

- E. Barricades: Type I, Medium-Intensity (Typically Enclosed Lens, Glass-Bead Element):
 - 1. American Decal, Adcolite.
 - 2. Avery Dennison, T-1500 and T-1600 series.
 - 3. 3M Engineer Grade, Series 32070.

- F. Barricades: Type II, Medium-High-Intensity (Typically Enclosed Lens, Glass-Bead Element):
 - 1. Avery Dennison, T-2500 Series.
 - 2. Kiwalite Type II.
 - 3. Nikkalite 1800 Series.

- G. Signs: Type II, Medium-High-Intensity (Typically Enclosed Lens, Glass-Bead Element):
 - 1. Avery Dennison, T-2500 Series.
 - 2. Kiwalite, Type II.
 - 3. Nikkalite 1800 Series.

- H. Signs: Type III, High-Intensity (Typically Encapsulated Glass-Bead Element):
 - 1. Avery Dennison, T-5500 Series.
 - 2. Nippon Carbide, Nikkalite Brand Ultralite Grade II.
 - 3. 3M Series 3870.

- I. Signs: Type IV, High-Intensity (Typically Unmetallized Microprismatic Element):
 - 1. Avery Dennison, T-6500 Series (Formerly Stimsonite Series 6200).

- J. Signs: Type VI, Elastomeric (Roll-Up) High-Intensity, without Adhesive:
 - 1. Reflexite Vinyl (Orange).
 - 2. Reflexite SuperBright (Fluorescent orange).
 - 3. Reflexite "Marathon" (Fluorescent orange).
 - 4. 3M Series RS34 (Orange) and RS20 (Fluorescent orange).

- K. Signs: Type VII, Super-High-Intensity (Typically Unmetallized Microprismatic Element):
 - 1. 3M LDP Series 3970.

- L. Signs: Type VIII, Super-High-Intensity (Typically Unmetallized Microprismatic Element):
 - 1. Avery Dennison, T-7500 Series.

2.18 SPECIALTY SIGNS

- A. All Sign Products, STOP Sign (All Plastic), 750 mm.

- B. Reflexite Endurance Work Zone Sign.

2.19 SIGN SUBSTRATE

- A. Fiberglass Reinforced Plastic (FRP):
 - 1. Fiber-Brite.
 - 2. Sequentia, Polyplate.

PART 3 EXECUTION

3.01 TRAFFIC CONTROLS

- A. Redirecting traffic: All channelizing, shifting of traffic lanes, traffic detours, and barricading of traffic in connection with the project will be subject to approval of the appropriate jurisdictional agency (either the City of Marina, City of Seaside, County of Monterey, Caltrans, or a combination of these). Existing local standards for signing and marking of construction areas will apply in addition to the requirements in Section 12 of Caltrans Standard Specifications.

- B. Temporary closing: Prior to temporary closing to traffic part of any street, sidewalk, or other access or to changing construction traffic routing from the routes indicated on the Plans, obtain approval from the appropriate jurisdictional agency, and comply with imposed conditions, at least two weeks before such closures or changes are made. Deviations will be for an emergency condition affecting life and property only, and the Contractor will immediately notify the Inspector and the appropriate jurisdictional agency of any such emergency changes. Copies of all approvals shall be received by the Inspector.

- C. Roadway restoration: At the end of every working day, all trenches shall be backfilled, all areas within the roadway shall be temporarily paved with asphalt, and the roadway shall be reopen to traffic during non-working hours. The temporary asphalt shall be regularly maintained by the Contractor. All areas shall be completely restored, including placement of permanent paving, within ten (10)

working days after the work has been completed at that location unless otherwise approved in writing by the governing agency.

- D. Contractor shall maintain all traffic control devices installed in the field. This shall include patrolling the devices at least daily to ensure that they are in the correct locations and in good condition. This shall include keeping all construction signs clean and readable.
- E. Contractor shall designate in writing a representative in charge of all traffic control on the project site. This representative shall be responsible for the care and maintenance of all devices.
- F. Access to all businesses shall be maintained 100% of the time. Access to residential driveways adjacent to the construction work zone shall be maintained at all times if at all possible, but shall not be restricted for more than 30 minutes at any time. Additional cones or delineators and flaggers may be required to delineate the driveway access route through the construction work zone. A minimum of one travel lane shall be maintained across the driveways unless prior written approval is obtained from the Engineer. If access to adjacent properties cannot be provided, all property owners with restricted access shall be notified in advance within a time frame set by the governing agency and adequate nearby parking shall be provided and maintained until direct access can be restored. The Contractor shall provide for safe pedestrian traffic through or around work areas at all times. If pedestrian traffic cannot be maintained on the construction side of the street, the Contractor shall provide adequate pedestrian crossings (i.e. temporary A.D.A. compliant access ramps) so that pedestrians can safely cross the street and use the sidewalk on the other side of the street. Contractor shall supply adequate signage warning of sidewalk closure and directing pedestrians to temporary crossings.
- G. At locations where one or more travel lanes are maintained open through the construction area, the contractor shall maintain at least 10-foot travel lanes, 12-foot travel lanes are preferable.
- H. If multiple crew headings are utilized, no two construction zones shall be on adjacent segments and simultaneous construction of multiple segments utilizing the same detour route will not be allowed. For each construction zone there will be a maximum of 200 feet of open trench.
- I. Between the dates of October 15 through April 15, the Contractor shall limit the activities of roadway paving to those days of acceptable paving weather, as determined by the Engineer.

3.02 CONSTRUCTION OPERATIONS UNDER TRAFFIC

- A. When in traffic lanes, all vehicles and equipment shall be operated at safe traffic speeds. If this is not practicable, a slow moving vehicle emblem shall be displayed in accordance with the Motor Vehicle Code. Construction equipment or haul/delivery trucks shall not be parked in any lane intended for use by normal traffic. Equipment parked or stored at the work site shall be behind a guard rail, barrier, curb, or other protective device.

- B. One-way traffic: No construction equipment shall be operated in traffic lanes, except in the designated direction of travel for respective lanes. Flag persons controlling this operation shall be fitted with two-way radios to assist in coordinating their efforts.
- C. No construction equipment other than that designated and used for general highway transportation shall be moved on streets during hours of darkness or periods of adverse weather conditions.
- D. Any construction equipment or material required in construction, which exceeds the maximum vehicle dimensions enumerated in the Motor Vehicle Code, shall be moved only in accordance with the established State and local regulations. No such oversize load shall be moved over the streets of the local jurisdictional agency without first obtaining the approval of the appropriate agency.
- E. Adequate queue storage space for construction vehicles shall be provided within the work zone to prevent queuing outside of the work zone.
- F. The Contractor shall maintain access to intersecting side streets. Construction activities and roadway closures along a street segment shall extend to the mid-point of intersecting side streets. Once the roadway on this segment has been backfilled and restored, then the other half of the intersection can be closed for construction. Side street traffic shall be able to pass through the intersection during all phases of construction. Similar construction activities shall be implemented at commercial and residential driveways, such as gas stations, apartment complexes, trailer parks, etc.
- G. Spillage resulting from hauling operations along or across any public traveled way shall be cleaned up and removed immediately by the Contractor at his expense.

3.03 CONSTRUCTION PARKING CONTROL

- A. The Contractor shall designate vehicular parking for construction employees that is contained entirely outside of City or State rights of way. The contractor shall ensure that employees utilize only appropriate employee parking lots and designated routes of travel.
- B. Monitor parking of construction personnel's vehicles. Vehicular access to and through parking areas should be maintained.
- C. Prevent parking on or adjacent to access roads or in non-designated areas.

3.04 FLAG PERSONS

- A. Provide a sufficient number of trained and equipped flag persons as required to regulate traffic when construction operations or traffic encroach on public traffic lanes. The flaggers shall be properly equipped and trained in accordance with "Instructions to Flaggers," published by the California Department of Transportation. Where flaggers are not visible to each other, additional flaggers shall be added as required by the Project Engineer, or the flaggers shall use radios.

3.05 HOURS OF OPERATION

- A. Temporary pavement requirements and allowable hours of operation shall be as specified in Section 01140, Work Restrictions.
- B. For all segments of the project, at the end of every working day, the contractor shall backfill all trenches, install temporary asphalt on roadways, and reopen all affected roadways to traffic.
- C. Intersections are defined as the area within the curb returns and sections of the street where any loop detectors are present. At intersections where loop detectors will be removed by construction activities, the contractor will be allowed three (3) weeks from the removal of any loop detectors to complete the construction and return the intersection to its prior condition or better including the restoration of all loop detectors and returning the signal to actuated signal timing control.

3.06 HAUL ROUTES

- A. Regional access will be from State Route 1.
- B. Confine construction traffic to the selected haul routes.
- C. Contractor shall provide daily street sweeping and cleaning of all local streets used by construction vehicles to remove any debris generated by construction activities.
- D. Contractor shall submit proposed haul routes to the appropriate governing agency(ies) for the various segments of the project. Contractor shall procure appropriate permits and provide appropriate bonds for restoration of any haul roads damaged as a result of construction activities. Materialmen bringing material to the site shall have copies of approved haul routes.

3.07 TRAFFIC SIGNALS AND SIGNS

- A. The Contractor shall actively work with the appropriate agencies, departments, and maintenance staff to ensure efficient and adequate operations of the traffic signals within the limits of the work.
- B. The Contractor shall restore any and all traffic signal equipment damaged or removed by construction operations within five working days of removal of traffic control in the area. The Contractor shall not wait until the end of all construction to restore damaged or removed traffic signal equipment. Special attention is directed to removal and replacement of traffic signal poles. The lead time for ordering and obtaining certain types of traffic signal poles can be up to twenty weeks. New traffic signal poles should be ordered well in advance of the removal of existing signal poles in order to restore the affected intersection to its original working condition.
- C. Contractor shall not use spray paint or tape to create signs used for traffic control. All signs shall be constructed of high performance reflective sheeting meeting the standards for permanent roadway signing.
- D. At least 48 hours, but not more than 28 days prior to commencing any work within the immediate vicinity of a traffic signal controlled intersection, the Contractor shall contact Underground Service Alert (800-227-2600) as well as the appropriate

governing agency (City of Marina, City of Seaside, or a combination of these) to coordinate the location and marking of underground traffic signal conduit and traffic signal loop detectors prior to construction. Traffic signal equipment damaged during construction shall be repaired by the Contractor within 24 hours at the contractor's expense, per the Engineer's satisfaction.

- E. At traffic signal controlled intersections where construction efforts necessitate the removal of one or more traffic signal loop detectors, the Contractor shall work with the Engineer to ensure that an appropriate signal timing plan is developed and implemented during the period in which the loop detectors are out of service. The contractor will be responsible for the cost of the engineer's time in completing this task. Upon completion of construction at the intersection, the Contractor shall restore the loop detectors and restore the intersection to its previous operating state within 48 hours.
- F. The Contractor shall ensure that all turning lanes affected by his/her construction are accompanied by a downstream travel lane to receive the traffic. With the Engineer's permission, the Contractor may close an exclusive turning lane.

3.08 REMOVAL

- A. Remove temporary traffic control equipment and devices at the completion of the construction activities. The construction site and neighboring areas shall be returned to their original or better condition. This does not relieve the contractor of any restoration of the pavement due to damage related to construction.
- B. Repair damage caused by installation.
- C. Remove post settings to a minimum depth of 2 feet and fill holes to the surface.

END OF SECTION

SECTION 01600
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Product requirements; product selection; product options and substitutions; quality assurance; shipping, delivery, handling, and storage; and instructions for spare parts, maintenance products, and special tools.
- B. Related sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 01756 - Testing, Training, and Facility Startup.
 - 3. Section 01782 - Operation and Maintenance Data.
 - 4. Section 09974 - Coating for Welded Steel Water Storage Tanks.

1.02 REFERENCES

- A. American National Standards Institute (ANSI).
- B. California Health and Safety Code.
- C. NSF International (NSF):
 - 1. 61 - Drinking Water System Components - Health Effects.
 - 2. 372 - Drinking Water System Components – Lead Content.

1.03 DEFINITIONS

- A. Products: Inclusive of raw materials, finished goods, equipment, systems, and shop fabrications.
- B. Special tools: Tools that have been specifically made for use on a product for assembly, disassembly, repair, or maintenance.

1.04 SUBMITTALS

- A. As specified in Section 01330.
- B. Calculations/certifications in accordance with NSF 61 and 372 for materials in contact with drinking water.

1.05 GENERAL REQUIREMENTS

- A. Comply with Specifications and referenced standards as minimum requirements.
- B. Provide products by same manufacturer when products are of similar nature, unless otherwise specified.
- C. Provide like parts of duplicate units that are interchangeable.

- D. Provide equipment that has not been in service prior to delivery, except as required by tests.
- E. When necessary, modify manufacturer's standard product to conform to specified requirements or requirements indicated on the Drawings.

1.06 SUBSTITUTIONS

- A. Formal substitution request procedure:
 - 1. Submit a written formal substitution request to Engineer for each proposed substitution within 30 days of effective date of Contract.
 - 2. Engineer will return initial opinion and request for additional information within 30 days.
 - 3. Engineer will notify Contractor in writing of decision to accept or reject the substitution request within 30 days of receiving required information.
- B. Formal substitution request contents:
 - 1. Provide Substitution Request Form as specified in this Section.
 - 2. Manufacturer's literature including:
 - a. Manufacturer's name and address.
 - b. Product name.
 - c. Product description.
 - d. Reference standards.
 - e. Certified performance and test data.
 - f. Operation and maintenance data.
 - 3. Samples, if applicable.
 - 4. Shop drawings, if applicable.
 - 5. Reference projects where the product has been successfully used:
 - a. Name and address of project.
 - b. Year of installation.
 - c. Year placed in operation.
 - d. Name of product installed.
 - e. Point of contact: Name and phone number.
 - 6. Itemized comparison of the proposed substitution with product specified including a list of significant variations:
 - a. Design features.
 - b. Design dimensions.
 - c. Installation requirements.
 - d. Operations and maintenance requirements.
 - 7. Define impacts:
 - a. Impacts to construction schedule.
 - b. Impacts to other contracts.
 - c. Impacts to other work or products.
 - d. Impact to Contract Sum:
 - 1) Do not include costs under separate contracts.
 - 2) Do not include Engineer's costs for redesign or revision of Contract Documents.
 - 3) Required license fees or royalties.
 - e. Availability of maintenance services and sources of replacement materials.

8. Contractor represents the following:
 - a. Contractor shall pay associated costs for the Engineer to evaluate the substitution.
 - b. Contractor bears the burden of proof of the equivalency of the proposed substitution.
 - c. Proposed substitution does not change the design intent and will have equal performance to the specified product.
 - d. Proposed substitution is equal or superior to the specified product.
 - e. Contractor will provide the warranties or bonds that would be provided on the specified product on the proposed substitution, unless Owner requires a Special Warranty.
 - f. Contractor will coordinate installation of accepted substitution into the Work and will be responsible for the costs to make changes as required to the Work.
 - g. Contractor waives rights to claim additional costs caused by proposed substitution which may subsequently become apparent.
- C. Substitutions will not be considered for acceptance under the following conditions:
 1. No formal substitution request is made.
 2. The substitution is simply implied or indicated on shop drawings or product data submittals.
 3. The formal substitution request is submitted by a subcontractor or supplier.
- D. Substitution requests submitted after the deadline will not be considered unless the following evidence is submitted to the Engineer:
 1. Proof that the specified product is unavailable for reasons beyond the control of the Contractor:
 - a. Reasons may include manufacturing discontinued, bankruptcy, labor strikes, or acts of God.
 - b. Contractor placed or attempted to place orders for the specified products within 10 days after the effective date of the Agreement.
 - c. The formal substitution request is submitted to Engineer within 10 days of the Contractor discovering the specified product cannot be obtained.
- E. Engineer's decision on a substitution requests will be final and binding:
 1. Approved substitutions will be incorporated into the Contract Documents with a Change Order.
 2. Requests for time extensions and additional costs based on submission of, approval of, or rejection of substitutions will not be allowed.

PART 2 PRODUCTS

2.01 GENERAL

- A. Material requirements:
 1. Materials: Provide corrosion resistance suitable for project conditions.
 2. Dissimilar metals: Separate contacting surfaces with dielectric material.
- B. Edge grinding:
 1. Sharp projections of cut or sheared edges of ferrous metals which are not to be welded shall be ground to a radius required to ensure satisfactory paint adherence.

2.02 PRODUCTS IN CONTACT WITH DRINKING WATER

- A. Materials in contact with drinking waters: In accordance with NSF 61 and NSF 372:
 - 1. Certification by an independent ANSI accredited third party, including, but not limited to, NSF International, as being lead free.
- B. Materials in contact with drinking waters: In accordance with California Health and Safety Code, Section 116875.

2.03 PRODUCT SELECTION

- A. When products are specified by standard or specification designations of technical societies, organizations, or associations only, provide products that meet or exceed reference standard and Specifications.
- B. When products are specified with names of manufacturers but no model numbers or catalog designations, provide:
 - 1. Products by one of named manufacturers that meet or exceed Specifications.
 - 2. Engineer deemed "or equal" evidenced by an approved shop drawing or other written communication.
- C. When products are specified with names of manufacturers and model numbers or catalog designations, provide:
 - 1. Products with model numbers or catalog designations by one of named manufacturers.
 - 2. Engineer deemed "or equal" evidenced by an approved shop drawing or other written communication.
- D. When products are specified with names of manufacturers, but with brand or trade names, model numbers, or catalog designations by one manufacturer only, provide:
 - 1. Products specified by brand or trade name, model number, or catalog designation.
 - 2. Products by one of named manufacturers proven, in accordance with requirements for an "or equal", to meet or exceed quality, appearance and performance of specified brand or trade name, model number, or catalog designation.
 - 3. Engineer deemed "or equal" evidenced by an approved shop drawing or other written communication.
- E. When Products are specified with only one manufacturer followed by "or Equal," provide:
 - 1. Products meeting or exceeding Specifications by specified manufacturer.
 - 2. Engineer deemed "or equal" evidenced by an approved shop drawing or other written communication.

2.04 SHIPMENT

- A. Mandatory requirements prior to shipment of equipment:
 - 1. Engineer approved shop drawings.
 - 2. Engineer approved Manufacturer's Certificate of Source Testing as specified in Section 01756, when required by specifications.
 - 3. Draft operations and maintenance manuals, as specified in Section 01782, when required by specifications.

- B. Prepare products for shipment by:
 - 1. Tagging or marking products to agree with delivery schedule or shop drawings.
 - 2. Including complete packing lists and bills of material with each shipment.
 - 3. Packaging products to facilitate handling and protection against damage during transit, handling, and storage.
 - 4. Securely attach special instructions for proper field handling, storage, and installation to each piece of equipment before packaging and shipment.
- C. Transport products by methods that avoid product damage.
- D. Deliver products in undamaged condition in manufacturer's unopened containers or packaging.

2.05 SPARE PARTS, MAINTENANCE PRODUCTS, AND SPECIAL TOOLS

- A. Provide spare parts and maintenance products as required by Specifications.
- B. Provide one set of special tools required to install or service the equipment.
- C. Box, tag, and clearly mark items.
- D. Contractor is responsible for spare parts, maintenance products, and special tools until acceptance by Owner.
- E. Store spare parts, maintenance products, and special tools in enclosed, weather-proof, and lighted facility during the construction period:
 - 1. Protect parts subject to deterioration, such as ferrous metal items and electrical components with appropriate lubricants, desiccants, or hermetic sealing.
- F. Provide spare parts and special tools inventory list, see Appendix A:
 - 1. Equipment tag number.
 - 2. Equipment manufacturer.
 - 3. Subassembly component, if appropriate.
 - 4. Quantity.
 - 5. Storage location.
- G. Store large items individually:
 - 1. Weight: Greater than 50 pounds.
 - 2. Size: Greater than 24 inches wide by 18 inches high by 36 inches long.
 - 3. Clearly labeled:
 - a. Equipment tag number.
 - b. Equipment manufacturer.
 - c. Subassembly component, if appropriate.
- H. Store in spare parts box smaller items:
 - 1. Weight: Less than 50 pounds.
 - 2. Size: Less than 24 inches wide by 18 inches high by 36 inches long.
 - 3. Clearly labeled:
 - a. Equipment tag number.
 - b. Equipment manufacturer.
 - c. Subassembly component, if appropriate.

- I. Spare parts and special tools box:
 1. Wooden box:
 - a. Size: 24 inches wide by 18 inches high by 36 inches long.
 2. Hinged wooden cover:
 - a. Strap type hinges.
 - b. Locking hasp.
 - c. Spare parts inventory list taped to underside of cover.
 3. Clearly labeled:
 - a. The words "Spare Parts and/or Special Tools".
 - b. Equipment tag number.
 - c. Equipment manufacturer.

PART 3 EXECUTION

3.01 DELIVERY AND HANDLING

- A. Handle equipment in accordance with manufacturer's instructions.
- B. Provide equipment and personnel to handle products by methods to prevent soiling or damage.
- C. Upon delivery, promptly inspect shipments:
 1. Verify compliance with Contract Documents, correct quantities, and undamaged condition of products.
 2. Acceptance of shipment does not constitute final acceptance of equipment.

3.02 STORAGE AND PROTECTION

- A. Immediately store and protect products and materials until installed in Work.
- B. Store products with seals and legible labels intact.
- C. Maintain products within temperature and humidity ranges required or recommended by manufacturer.
- D. Protect painted surfaces against impact, abrasion, discoloration, and other damage:
 1. Repaint damaged painted surfaces.
- E. Exterior storage of fabricated products:
 1. Place on aboveground supports that allow for drainage.
 2. Cover products subject to deterioration with impervious sheet covering.
 3. Provide ventilation to prevent condensation under covering.
- F. Store moisture sensitive products in watertight enclosures.
- G. Furnish covered, weather-protected storage structures providing a clean, dry, noncorrosive environment for mechanical equipment, valves, architectural items, electrical and instrumentation equipment and special equipment to be incorporated into this project:
 1. Storage of equipment shall be in strict accordance with the "instructions for storage" of each equipment supplier and manufacturer including connection of heaters, placing of storage lubricants in equipment, etc.

2. The Contractor shall furnish a copy of the manufacturer's instructions for storage to the Engineer prior to storage of all equipment and materials.
- H. Store loose granular materials on solid surfaces in well-drained area:
1. Prevent materials mixing with foreign matter.
 2. Provide access for inspection.
- I. Payment will not be made for equipment and materials improperly stored or stored without providing Engineer with the manufacturer's instructions for storage.
- J. Provide an Equipment Log including, as a minimum, the equipment identification, date stored, date of inspection/maintenance, date removed from storage, copy of manufacturer's recommended storage guidelines, description of inspection/maintenance activities performed, and signature of party performing inspection/maintenance.

3.03 PROTECTION AFTER INSTALLATION

- A. Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations:
1. Remove covering when no longer needed.
 2. Replace corroded, damaged, or deteriorated equipment and parts before acceptance of the project.
- B. Update Equipment Log on a monthly basis with description of maintenance activities performed in accordance with the manufacturer's recommendation and industry standards and signature of party performing maintenance.

3.04 QUALITY ASSURANCE

- A. Employ entities that meet or exceed specified qualifications to execute the Work.
- B. Verify project conditions are satisfactory before executing subsequent portions of the Work.

3.05 COMMISSIONING

- A. As specified in Section 01756.

3.06 CLOSEOUT ACTIVITIES

- A. Owner may request advanced delivery of spare parts, maintenance products, and special tools:
1. Deduct the delivered items from the inventory list and provide transmittal documentation.
- B. Immediately prior to the date of Substantial Completion, arrange to deliver spare parts, maintenance products, and special tools to Owner at a location on site chosen by the Owner:
1. Provide itemized list of spare parts and special tools that matches the identification tag attached to each item.
 2. Owner and Engineer will review the inventory and the itemized list to confirm it is complete and in good condition prior to signing for acceptance.

3.07 ATTACHMENTS

- A. Appendix A - Spare Parts, Maintenance Products, and Special Tools Inventory List.
- B. Appendix B - Sample Substitution Request Form.

END OF SECTION

APPENDIX A
SPARE PARTS, MAINTENANCE PRODUCTS, AND SPECIAL TOOLS INVENTORY LIST

Owner: _____ Date: _____
 Contractor: _____ Project No.: _____
 Project Name: _____

Inventory List				
Spec Number: _____		Spec Title _____		
Equipment Tag No.: _____		Equipment Manufacturer: _____		
Quantity	Subassembly Component	Description	Manufacturer's Part Number	Storage Location

APPENDIX B
SUBSTITUTION REQUEST FORM

**DOCUMENT 01600
SUBSTITUTION REQUEST FORM**

Owner: _____ **Date:** _____
Contractor: _____ **Project No.:** _____
Project Name: _____
To: _____ **From:** _____
Re: _____
Contract For: _____
Engineering Project Number: _____ **Substitution Request Number:** _____

Specification Information		
Title: _____		
Number: _____	Page: _____	Article/Paragraph: _____
Description: _____		

Proposed Substitution				
Product: _____				
Manufacturer: _____				
Address: _____		Phone: _____		
Trade Name: _____		Model No.: _____		
Installer: _____				
Address: _____		Phone: _____		
History:	New Product	2-5 years old	5-10 years old	More than 10 years old
Differences between proposed substitution and specified product:				
Point-by-point comparative data and impacts attached – REQUIRED BY ENGINEER				

Reason For Not Providing Specified Item

Reason: _____
Similar Installation: _____
Project: _____
Address: _____ Date Installed: _____
Owner: _____ Architect: _____
Proposed substitution affects other parts of Work:
_____ No _____ Yes, Explain: _____

Benefit to Owner For Accepting Substitution

Savings: _____ (\$)
Proposed substitution changes Contract Time:
_____ No _____ Yes **(Add)** **(Deduct)** _____ days

Supporting Data Attached

_____ Drawings _____ Product Data _____ Samples _____ Tests _____ Reports
_____ Reference Projects Other: _____

Certifications

The undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product, unless Owner requires a Special Warranty.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including Engineer design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Certifications	
Submitted by:	_____
Signed by:	_____
Firm Name	_____
Firm Address:	_____

Phone:	_____
Attachments:	_____

Engineer's Review And Action	
<input type="checkbox"/>	Substitution accepted - Make submittals in accordance with Specification Section 01330.
<input type="checkbox"/>	Substitution accepted as noted - Make submittals in accordance with Specification Section 01330.
<input type="checkbox"/>	Substitution rejected - Use specified materials.
<input type="checkbox"/>	Substitution Request received too late - Use specified materials.
Signed by:	_____ Date: _____

Additional Comments	
Additional Comments:	
<input type="checkbox"/>	Contractor
<input type="checkbox"/>	Subcontractor
<input type="checkbox"/>	Supplier
<input type="checkbox"/>	Manufacturer
<input type="checkbox"/>	Engineer
Other:	_____
Comments:	_____

SECTION 01612

SEISMIC DESIGN CRITERIA

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Seismic design criteria for the following:
 - 1. Anchorage of mechanical and electrical equipment.
 - 2. Other structures or items as specified or indicated on the Drawings.
- B. Related sections:
 - 1. Section 01410 - Regulatory Requirements.

1.02 REFERENCES

- A. American Society of Civil Engineers (ASCE):
 - 1. 7-10 - Minimum Design Loads for Buildings and Other Structures.

1.03 SYSTEM DESCRIPTION

- A. Design in accordance with the requirements of the building code as specified in Section 01410.
- B. Design spectral acceleration at short period, S_{DS} : 0.981 g.
- C. Design spectral acceleration at a period of 1 second, S_{D1} : 0.527 g.
- D. Design of non-structural components and their connections to structures:
 - 1. Component amplification factor, a_p : In accordance with ASCE 7, Tables 13.5-1 and 13.6-1.
 - 2. Component response modification factor, R_p : In accordance with ASCE 7, Tables 13.5-1 and 13.6-1.
 - 3. Component importance factor, I_p :

Table 1: Component importance factor, I_p		
Component	Description	I_p
Electrical	Equipment and appurtenances provided and installed under Division 16.	1.5
Mechanical	Equipment and appurtenances provided and installed under Division 15.	1.5

- E. Seismic Design Category (SDC): D.
- F. Design requirements: Anchorage of equipment to structures:
 - 1. Do not use friction to resist sliding due to seismic forces. Do not design or provide connections that use friction to resist seismic loads. Resist seismic forces through direct tension and/or shear on anchors and fasteners.

2. Do not use more than 70 percent of the weight of the mechanical and electrical equipment for designing anchors for resisting overturning due to seismic forces.
3. Do not use more than 70 percent of the weight of the tank for resisting overturning due to seismic forces.

1.04 SUBMITTALS

- A. Shop drawings and calculations: Complete shop drawings and seismic calculations.
- B. Calculations shall be signed and stamped by a civil or structural engineer licensed in the state of California.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01614

WIND DESIGN CRITERIA

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Wind design criteria.
- B. Related section:
 - 1. Section 01410 - Regulatory Requirements.

1.02 SYSTEM DESCRIPTION

- A. Design requirements:
 - 1. Building code criteria: Design for wind in accordance with building code as specified in Section 01410:
 - a. Risk category: IV.
 - b. Wind speed, V_{ult} : 115 miles per hour.
 - c. Wind speed, V_{asd} : 89 miles per hour.
 - d. Exposure category: C.
 - e. Topographic factor, K_{zt} : 1.
 - 2. Resist wind forces through direct bearing on anchors and fasteners. Do not design or provide connections that use friction to resist wind loads.

1.03 SUBMITTALS

- A. Shop drawings and calculations: Complete shop drawings and wind design calculations.
- B. Calculations shall be signed and stamped by a civil or structural engineer licensed in the state where the Project is located.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01722
FIELD ENGINEERING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Field engineering to establish lines and grades for the Work.
- B. Related Sections:
 - 1. Section 01770 - Closeout Procedures.

1.02 QUALITY ASSURANCE

- A. Qualifications of Surveyor or Engineer: Registered civil engineer or land surveyor in California.
- B. Accuracy of stakes, alignments, and grades may be checked randomly by ENGINEER:
 - 1. Notice of when checking will be conducted will be given.
 - 2. When notice of checking is given, postpone parts of the Work affected by stakes, alignments or grades to be checked until checking is complete.
 - 3. Do not assume that ENGINEER's check substitutes or complements required field quality control procedures.

1.03 CONSTRUCTION STAKES, LINES, AND GRADES

- A. Execute the Work in accordance with the lines and grades indicated.
- B. Make distances and measurements on horizontal planes, except elevations and structural dimensions.

1.04 SURVEY REFERENCE POINTS

- A. Basic reference line, a beginning point on basic reference line, and a bench mark will be provided, by OWNER.
- B. From these reference points, establish other control and reference points as required to properly lay out the Work.
- C. Locate and protect control points prior to starting sitework, and preserve permanent reference points during construction:
 - 1. Make no changes or relocations without prior written notice.
 - 2. Replace Project control point, when lost or destroyed, in accordance with original survey control.
 - 3. All bench marks and control points shall be replaced by a surveyor licensed in California.

- D. Set monuments for principal control points and protect them from being disturbed and displaced:
 - 1. Re-establish disturbed monuments.
 - 2. When disturbed, postpone parts of the Work that are governed by disturbed monuments until such monuments are re-established.

1.05 PROJECT SURVEY REQUIREMENTS

- A. Establish minimum of 2 permanent bench marks on site referenced to data established by survey control points.
- B. Record permanent bench mark locations with horizontal and vertical data on Project Record Documents.
- C. Assume responsibility for accuracy of stakes, alignments, and grades by performing verifications and checking in accordance with standard surveying practice.

1.06 RECORD DOCUMENTS

- A. Prepare and submit Record Documents as specified in Section 01770.
- B. Maintain complete, accurate log of control points and survey.
- C. Affix civil engineer's or land surveyor's signature and registration number to Record Drawing to certify accuracy of information shown.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01734

WORK WITHIN PUBLIC RIGHT-OF-WAY

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Requirements for maintenance, support, protection, relocation, reconstruction and adjusting-to-grade, restoration, construction of temporary and new facilities, and abandonment of existing utilities affected by construction work within the public right-of-way.

1.02 DEFINITIONS

- A. Utility: For purpose of this Section, utility means any public or private service, such as electric light and power systems; gas distribution systems; telephone, telegraph, cable television and other communication services; water distribution; storm drain and sanitary sewer services; police and fire communication systems; street lighting and traffic signs and signals; parking meters; and steam distribution systems.
- B. Trenching:
 - 1. Open trench:
 - a. General: Includes excavation, pipe laying, backfilling, and pavement replacement.
 - 2. Any excavated areas shall be considered as "open trench" until all pavement replacement has been made, or until all trenches outside of pavement replacement areas have been backfilled and compacted in accordance with these Contract Documents.

1.03 DESIGN REQUIREMENTS

- A. Trenching:
 - 1. Except where otherwise specified, indicated on the Drawings, or accepted in writing by the Engineer, the maximum length of open trench, where construction is in any stage of completion, shall not exceed the linear footage as set forth below. Descriptions under following area designations are general in nature and may be amended in writing by the Engineer due to particular or peculiar field conditions:
 - a. Business District Areas maximum 100 linear feet: Store front areas.
 - b. Commercial Areas maximum 400 linear feet: Industrial, shopping centers, churches, schools, hotels, motels, markets, gas stations, government and private office buildings, hospitals, fire and police stations, and nursing homes.
 - c. Residential Areas maximum 1 Block or 600 linear feet, whichever is the least: Single and multi-family residences, apartments, and condominiums.
 - d. Undeveloped Areas maximum 1,000 linear feet: Parks, golf courses, farms, undeveloped subdivided land.
 - 2. Completely backfill trenches across streets and install temporary or permanent pavement as soon as possible after pipe laying.

- B. Site conditions:
1. Use substantial steel plates with adequate trench bracing to bridge across trenches at street and alley crossings, commercial driveways, and residential driveways where trench backfill and temporary patch have not been completed during regular working hours.
 2. Provide safe and convenient passage for pedestrians.
 3. Maintain access to fire stations, fire hydrant, and hospitals at all times.
 4. Provide traffic control devices, barricades, and signage as required by the regulating agency.

1.04 SUBMITTALS

- A. Traffic control plan: Submit detailed traffic control plan for acceptance by jurisdictional agency.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01756

TESTING, TRAINING, AND FACILITY START-UP

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Requirements for equipment and system testing and facility start-up, including the following:
 - 1. Start-up Plan.
 - 2. Performance Testing.
 - 3. General Start-up and Testing Procedures.
 - 4. Functional Testing.
 - 5. Operational Testing.
 - 6. Certificate of Proper Installation.
 - 7. Services of manufacturer's representatives.
 - 8. Training of OWNER's personnel.
 - 9. Final testing requirements for the complete facility.

- B. Related Sections:
 - 1. Section 01324A - Progress Schedules and Reports.
 - 2. Section 15211 - Ductile Iron Pipe: AWWA C151
 - 3. Section 15958 - Mechanical Equipment Testing.
 - 4. Section 16950 - Field Electrical Acceptance Tests.
 - 5. Section 17950 - Testing, Calibration, and Commissioning.

1.02 GENERAL TESTING, TRAINING, AND START-UP REQUIREMENTS

- A. Contract Requirements: Testing, training, and start-up are requisite to the satisfactory completion of the Contract.

- B. Complete testing, training, and start-up within the Contract Times.

- C. Allow realistic durations in the Progress Schedule for testing, training, and start-up activities.

- D. Furnish labor, power, chemicals, tools, equipment, instruments, and services required for and incidental to completing functional testing, performance testing, and operational testing.

- E. Provide competent, experienced technical representatives of equipment manufacturers for assembly, installation and testing guidance, and operator training.

1.03 START-UP PLAN

- A. Submit start-up plan for each piece of equipment and each system not less than 3 weeks prior to planned initial start-up of equipment or system.

- B. Provide detailed sub-network of Progress Schedule with the following activities identified:
 - 1. Manufacturer's services and source testing.
 - 2. Installation certifications.
 - 3. Operator training.
 - 4. Submission of Operation and Maintenance Manual.
 - 5. Functional testing.
 - 6. Performance testing.
 - 7. Operational testing.
- C. Provide testing plan with test logs for each item of equipment and each system when specified. Include testing of alarms, control circuits, capacities, speeds, flows, pressures, vibrations, sound levels, and other parameters.
- D. Provide summary of shutdown requirements for existing systems which are necessary to complete start-up of new equipment and systems.
- E. Revise and update start-up plan based upon review comments, actual progress, or to accommodate changes in the sequence of activities.

1.04 SOURCE TESTING

- 1. Also referred to as factory testing or factory acceptance testing (FAT).
- 2. Test components, devices, and equipment/system for proper performance at point of manufacture or assembly as specified in the technical Sections.
- 3. Notify the Engineer in writing when the equipment/system is ready for source inspection and testing.
- 4. Source Test Plan:
 - a. As specified in this Section and other technical Sections.
 - b. Source testing requirements as specified in technical Sections.
 - 1) Non-witnessed: Provide Manufacturer's Certificate of Source Testing.
 - 2) Witnessed: Owner and Engineer attendees as specified and provide Manufacturer's Certificate of Source Testing.
 - c. Prepared by Contractor or manufacturer.
 - d. Provide the following items for each Source Test:
 - 1) Purpose and goals of the test.
 - 2) Identification of each item of equipment/system, including system designation, location, tag number, control loop identifier, etc.
 - 3) Description of the pass/fail criteria that will be used.
 - 4) Listing of pertinent reference documents (Contract Documents and industry standards or Sections applicable to the testing).
 - 5) Complete description, including drawings or photographs, of test stands and/or test apparatus.
 - 6) Credentials of test personnel.
 - 7) Descriptions of test equipment to be used, product information, and all appropriate calibration records for the test equipment.
 - 8) Test set-up procedures.
 - 9) Detailed step-by-step test procedures.
 - a) The level of detail shall be sufficient for any witness with a rudimentary technical aptitude to be able to follow the steps and develop confidence that the tests were being performed as planned.

- b) All steps are significant, and all steps shall be included in the procedures.
 - 10) Sample data logs and data recording forms.
 - 11) Sample computations or analyses with the results in the same format as the final report to demonstrate how data collected will be used to generate final results.
 - a) Complete disclosure of the calculation methodologies.
 - b) Include a sample for each type of computation required for the test and analysis of the results.
 - 12) Detailed outline of the Source Test report.
 - 13) Sample test reports.
 - e. Submit Source Test Plan and forms as specified in the technical Sections.
 - 1) Submit a copy of the Source Test Plan at least 21 days before any scheduled test date.
 - 2) Engineer approval of Source Test Plan required prior to beginning source testing.
 - 3) Schedule the testing after approval of the test procedures submittal.
 - f. Indicate the desired dates for source inspection and testing.
 - 1) Notify the Engineer of the scheduled tests a minimum of 15 days before the date of the test.
5. Test results:
- a. Prepare and submit test results with collected data attached.
6. Contractor is responsible for costs associated with Owner's representatives and Engineer's representative witnessing Source Tests.
- a. Include costs for at least the following:
 - 1) Transportation:
 - a) Travel 1 day on commercial airline to site (if located more than 100 miles from project site) including air flight costs and \$1,600 allowance per person per day.
 - b) Rental car from hotel to and from the test site.
 - 2) If airline travel is required, Contractor shall provide hotel costs at a facility with an American Automobile Association 4 star rating or equivalent for single occupancy room per person per day.
 - 3) Meal allowance of \$75 per person per day.
 - 4) On-site time: 1 day at the site, unless specified otherwise, including \$1,600 allowance per person per day.
 - b. If Source Test is not ready when the witnesses arrive or if the Source Test fails, the witnesses will return home with Contractor responsible for costs associated with the trip including costs described above. Contractor is responsible for rescheduling the Source Test and witnesses' costs associated with the second trip including costs described above.
 - c. Contractor is responsible for witnesses' costs associated with retests including costs described above.
7. Contractor is responsible for providing fuel, chemicals, and other consumables needed for Source Testing.

1.05 PERFORMANCE TESTING

- A. Test equipment for proper performance at point of manufacture or assembly when specified.

- B. When source quality control testing is specified:
 - 1. Demonstrate equipment meets specified performance requirements.
 - 2. Provide certified copies of test results.
 - 3. Do not ship equipment until certified copies have received written acceptance from ENGINEER. Written acceptance does not constitute final acceptance.
 - 4. Perform testing as specified in the equipment specification sections.

- C. Include costs associated with witnessing performance tests in the bid price. Include costs for 1 OWNER's representative for travel, lodging, transportation to and from lodging, and 50 dollars meal allowance per person per day.

1.06 GENERAL START-UP AND TESTING PROCEDURES

- A. Mechanical Systems: As specified in the individual equipment specification sections and Sections 15050 and 15958:
 - 1. Remove rust preventatives and oils applied to protect equipment during construction.
 - 2. Flush lubrication systems and dispose of flushing oils. Recharge lubrication system with lubricant recommended by manufacturer.
 - 3. Flush fuel system and provide fuel for testing and start-up.
 - 4. Install and adjust packing, mechanical seals, O-rings, and other seals. Replace defective seals.
 - 5. Remove temporary supports, bracing, or other foreign objects installed to prevent damage during shipment, storage, and erection.
 - 6. Check rotating machinery for correct direction of rotation and for freedom of moving parts before connecting driver.
 - 7. Perform cold alignment and hot alignment to manufacturer's tolerances.
 - 8. Adjust V-belt tension and variable pitch sheaves.
 - 9. Inspect hand and motorized valves for proper adjustment. Tighten packing glands to insure no leakage, but permit valve stems to rotate without galling. Verify valve seats are positioned for proper flow direction.
 - 10. Tighten leaking flanges or replace flange gasket. Inspect screwed joints for leakage.
 - 11. Install gratings, safety chains, handrails, shaft guards, and sidewalks prior to operational testing.

- B. Electrical Systems: As specified in Section 16950 and the individual equipment specification sections:
 - 1. Perform insulation resistance tests on wiring except 120 volt lighting, wiring, and control wiring inside electrical panels.
 - 2. Perform continuity tests on grounding systems.
 - 3. Test and set switchgear and circuit breaker relays for proper operation.
 - 4. Perform direct current high potential tests on all cables that will operate at more than 2,000 volts. Obtain services of independent testing lab to perform tests.
 - 5. Check motors for actual full load amperage draw. Compare to nameplate value.

- C. Instrumentation Systems: As specified in Section 17950 and the individual equipment specification sections:
 - 1. Bench or field calibrate instruments and make required adjustments and control point settings.

2. Leak test pneumatic controls and instrument air piping.
3. Energize transmitting and control signal systems, verify proper operation, ranges and settings.

1.07 FUNCTIONAL TESTING

- A. Perform checkout and performance testing as specified in the individual equipment specification sections.
- B. Functionally test mechanical and electrical equipment, and instrumentation and controls systems for proper operation after general start-up and testing tasks have been completed.
- C. Demonstrate proper rotation, alignment, speed, flow, pressure, vibration, sound level, adjustments, and calibration. Perform initial checks in the presence of and with the assistance of the manufacturer's representative.
- D. Demonstrate proper operation of each instrument loop function including alarms, local and remote controls, instrumentation and other equipment functions. Generate signals with test equipment to simulate operating conditions in each control mode.
- E. Conduct continuous 8 hour test under full load conditions. Replace parts which operate improperly.

1.08 OPERATIONAL TESTING

- A. After completion of operator training, conduct operational test of the entire facility. Demonstrate satisfactory operation of equipment and systems in actual operation.
- B. Conduct operational test for continuous 7 day period.
- C. OWNER will provide operations personnel, power, fuel, and other consumables for duration of test.
- D. Immediately correct defects in material, workmanship, or equipment which became evident during operational test.
- E. Repeat operational test when malfunctions or deficiencies cause shutdown or partial operation of the facility or results in performance that is less than specified.

1.09 CERTIFICATE OF PROPER INSTALLATION

- A. At completion of Functional Testing, furnish written report prepared and signed by manufacturer's authorized representative, certifying equipment:
 1. Has been properly installed, adjusted, aligned, and lubricated.
 2. Is free of any stresses imposed by connecting piping or anchor bolts.
 3. Is suitable for satisfactory full-time operation under full load conditions.
 4. Operates within the allowable limits for vibration.
 5. Controls, protective devices, instrumentation, and control panels furnished as part of the equipment package are properly installed, calibrated, and functioning.
 6. Control logic for start-up, shutdown, sequencing, interlocks, and emergency shutdown have been tested and are properly functioning.

- B. Furnish written report prepared and signed by the electrical and/or instrumentation Subcontractor certifying:
1. Motor control logic that resides in motor control centers, control panels, and circuit boards furnished by the electrical and/or instrumentation subcontractor has been calibrated and tested and is properly operating.
 2. Control logic for equipment start-up, shutdown, sequencing, interlocks and emergency shutdown has been tested and is properly operating.
 3. Co-sign the reports along with the manufacturer's representative and subcontractors.

1.10 TRAINING OF OWNER'S PERSONNEL

- A. Provide operations and maintenance training for items of mechanical, electrical and instrumentation equipment. Utilize manufacturer's representatives to conduct training sessions.
- B. Coordinate training sessions to prevent overlapping sessions. Arrange sessions so that individual operators and maintenance technicians do not attend more than 2 sessions per week.
- C. Provide Operation and Maintenance Manual for specific pieces of equipment or systems 1 month prior to training session for that piece of equipment or system.
- D. Satisfactorily complete functional testing before beginning operator training.
- E. Provide training sessions for each work shift listed below during the time periods shown. Pooling of shifts will not be permitted unless accepted by OWNER.

Shift		
Day	Tuesday Wednesday, or Thursday, 7 a.m.-11:00 a.m.	Tuesday, Wednesday, or Thursday, 1 p.m.-4 p.m.

- F. Training Sessions: Provide training sessions for equipment as specified in the individual equipment specification sections.

Section Number	Section title	O&M Manual Required	Minimum Number of Days for Actual Training
11312D	Vertical Turbine Short Setting Centrifugal Pumps	X	1
13446	Valve and Gate Operators	X	-
15112	Butterfly Valves	X	-
15114	Check Valves	X	-
15115	Gate, Globe, and Angle Valves: Gate Valves Globe Valves Angle Valves Needle Valves	X X X X	- - - -
16222	Low Voltage Motors Up to 500HP	X	1

Section Number	Section title	O&M Manual Required	Minimum Number of Days for Actual Training
17206	Level Measurement: Ultrasonic	X	-
17302	Flow Measurement: Magnetic Flowmeters	X	-
Notes:			
X	O&M Manual required.		
-	Either no O&M Manual or no training required.		
*	Days per instrument.		

- G. The CONTRACTOR shall videotape all training sessions and provide a copy for the OWNER.
- H. The CONTRACTOR shall designate and provide one or more persons to be responsible for coordinating and expediting his/her training duties. The person or persons so designated shall be present at all training coordination meetings with the OWNER.
- I. The CONTRACTOR's coordinator shall coordinate the training periods with OWNER personnel and manufacturer's representatives, and shall submit a training schedule for each piece of equipment or system for which training is to be provided. Such training schedule shall be submitted not less than 21 calendar days prior to the time that the associated training is to be provided and shall be based on the current plan of operation.

1.11 RECORD KEEPING

- A. Maintain and submit following records generated during start-up and testing phase of Project:
 1. Daily logs of equipment testing identifying all tests conducted and outcome.
 2. Logs of time spent by manufacturer's representatives performing services on the job site.
 3. Equipment lubrication records.
 4. Electrical phase, voltage, and amperage measurements.
 5. Insulation resistance measurements.
 6. Data sheets of control loop testing including testing and calibration of instrumentation devices and setpoints.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01770
CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Contract closeout requirements including:
 - 1. Final cleaning.
 - 2. Waste disposal.
 - 3. Touch-up and repair.
 - 4. Disinfection of systems.
 - 5. Preparation and submittal of closeout documents.
 - 6. Certificate of Substantial Completion.

- B. Related sections:
 - 1. Section 01324A -Progress Schedules and Reports.

1.02 REFERENCES

- A. American Water Works Association (AWWA).

1.03 FINAL CLEANING

- A. Perform final cleaning prior to inspections for Substantial Completion.
- B. Employ skilled workers who are experienced in cleaning operations.
- C. Use cleaning materials which are recommended by manufacturers of surfaces to be cleaned.
- D. Prevent scratching, discoloring, and otherwise damaging surfaces being cleaned.
- E. Clean roofs, gutters, downspouts, and drainage systems.
- F. Broom clean exterior paved surfaces and rake clean other surfaces of site work:
 - 1. Police yards and grounds to keep clean.
- G. Remove dust, cobwebs, and traces of insects and dirt.
- H. Clean grease, mastic, adhesives, dust, dirt, stains, fingerprints, paint, blemishes, sealants, plaster, concrete, and other foreign materials from sight-exposed surfaces, and fixtures and equipment.
- I. Remove non-permanent protection and labels.
- J. Probes, elements, sample lines, transmitters, tubing, and enclosures have been cleaned and are in like-new condition.

1.04 WASTE DISPOSAL

- A. Arrange for and dispose of surplus materials, waste products, and debris off-site:
 - 1. Prior to making disposal on private property, obtain written permission from Owner of such property.
- B. Do not fill ditches, washes, or drainage ways which may create drainage problems.
- C. Do not create unsightly or unsanitary nuisances during disposal operations.
- D. Maintain disposal site in safe condition and good appearance.
- E. Complete leveling and cleanup prior to Final Completion of the Work.

1.05 TOUCH-UP AND REPAIR

- A. Touch-up or repair finished surfaces on structures, equipment, fixtures, and installations that have been damaged prior to inspection for Substantial Completion.
- B. Refinish or replace entire surfaces which cannot be touched-up or repaired satisfactorily.

1.06 FINAL CLEANING AND STERILIZATION OF SYSTEMS OF RECYCLED WATER FACILITIES

- A. Clean channels, pipe, basins, reservoirs, and tanks [before running of 7-day test, or before facility goes on stream when 7-day test is not required] [related to the membrane system before the membrane system functional testing. Membranes are to be installed after the sub-system function testing and before the membrane system functional testing.
- B. Wash, wherever practicable, or broom sweep channels, pipe, basins, reservoirs, and tanks.
- C. Sterilize filter basins, reservoirs, clear wells, tanks, channels, and piping intended to carry potable water as follows or in accordance with AWWA Standards.
- D. Provide ample sampling outlets in pipe for testing.
- E. Fill pipe and other plant facilities with chlorine solution of sufficient strength to retain residual of not less than 10 parts per million at end of 24 hours.
- F. When reservoirs and basins are too large to be economically [sterilized] [disinfected] by filling with chlorine solution, spray reservoirs and basins with solution containing 100 parts per million of chlorine.
- G. After sterilization, rinse entire potable water system with potable water sufficient to reduce chlorine residual to not more than 0.6 parts per million throughout system before system is put into service.

1.07 FINAL CLEANING AND DISINFECTION OF SYSTEMS OF POTABLE WATER MAINS

- A. Clean interior of pipe and fittings.
- B. When pipe contains dirt that cannot be removed by flushing, swab pipe interiors with solution containing not less than 500 parts per million of chlorine until clean.
- C. Flush 12-inch in diameter and smaller pipe as thoroughly as available water sources will permit.
- D. Fill pipe with chlorine solution of sufficient strength to provide 10 parts per million chlorine residual at end of 24 hours.
- E. Flush pipes with potable water until chlorine residual is less than 0.6 parts per million before pipe are put into service.

1.08 CLOSEOUT DOCUMENTS

- A. Submit following Closeout Submittals before Substantial Completion:
 - 1. Punchlist of items to be completed or corrected with the request for issuance of Substantial Completion.
 - 2. Evidence of Compliance with Requirements of Governing Authorities.
 - 3. Project Record Documents.
 - 4. Approved Operation and Maintenance Manuals.
 - 5. Approved Warranties and Bonds.
 - 6. Keys and Keying Schedule.
 - 7. Completed contract requirements for commissioning and process start-up.
- B. Submit following Closeout Submittals before final completion of the Work and at least 7 days prior to submitting Application for Final Payment:
 - 1. Punchlist of items have been completed and Engineer and Owner are satisfied that all deficiencies are corrected.
 - 2. Evidence of Payment and Release of Liens or Stop Payment Notices as outlined in Conditions of the Contract.
 - 3. Release of claims as outlined in Conditions of the Contract.
 - 4. Submit certification of insurance for products and completed operations, as specified in the General Conditions.
 - 5. Final statement of accounting.

1.09 NOT USED

1.10 PROJECT RECORD DOCUMENTS

- A. Maintain at Project site, available to Owner and Engineer, 1 copy of the Contract Documents, shop drawings, and other submittals in good order:
 - 1. Mark and record field changes and detailed information contained in submittals and change orders.
 - 2. Record actual depths, horizontal and vertical location of underground pipes, duct banks, and other buried utilities. Reference dimensions to permanent surface features.
 - 3. Identify specific details of pipe connections, location of existing buried features located during excavation, and the final locations of piping, equipment, electrical conduits, manholes, and pull boxes.

4. Identify location of spare conduits including beginning, ending, and routing through pull boxes and manholes. Record spare conductors, including number and size, within spare conduits and filled conduits.
5. Provide schedules, lists, layout drawings, and wiring diagrams.
6. Make annotations in hardcopy format with erasable colored pencil conforming to the following color code:

Additions:	Red
Deletions:	Green
Comments	Blue
Dimensions:	Graphite

- B. Maintain documents separate from those used for construction:
 1. Label documents "RECORD DOCUMENTS."
- C. Keep documents current:
 1. Record required information at the time the material and equipment is installed and before permanently concealing.
 2. Engineer will review Record Documents weekly to ascertain that changes have been recorded.
- D. Affix civil engineer's or professional land surveyor's signature and registration number to Record Drawings to certify accuracy of information shown.
- E. Deliver Record Documents with transmittal letter containing date, Project title, Contractor's name and address, list of documents, and signature of Contractor.
- F. Record Documents will be reviewed monthly to determine the percent complete for the monthly pay application.
- G. Updated Record Documents are a condition for Engineer's recommendation for progress payment.
- H. Final Schedule Submittal as specified in Section 01324A.

1.11 MAINTENANCE SERVICE

- A. Maintenance service as specified in technical specifications.

1.12 SUBSTANTIAL COMPLETION

- A. Obtain Certificate of Substantial Completion.

1.13 FINAL COMPLETION

- A. When Contractor considers the Work is complete, submit written certification that:
 1. Work has been completed in accordance with the Contract Document.
 2. Punch list items have been completed or corrected.
 3. Work is ready for final inspection.
- B. Engineer will make an inspection to verify the status of completion with reasonable promptness.

- C. Should the Engineer consider that the Work is incomplete or defective:
 - 1. Engineer will promptly notify the Contractor in writing, listing the incomplete or defective work.
 - 2. Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to the Engineer that the Work is complete.
 - 3. Engineer shall re-inspect the Work.

1.14 FINAL ADJUSTMENT OF ACCOUNTS

- A. Submit a final statement of accounting to the Engineer at least 7 days prior to final Application for Payment.
- B. Statement shall reflect all adjustments to the Contract amount:
 - 1. The original Contract amount.
 - 2. Additions and deductions resulting from:
 - a. Change Orders.
 - b. Units installed and unit prices.
 - c. Set-offs for uncorrected or incomplete Work.
 - d. Set-offs for liquidated damages.
 - e. Set-offs for reinspection payments.
 - f. Extended engineering and/or inspection services and inspection overtime.
 - g. Excessive shop drawings review cost by the Engineer.
 - h. Other adjustments.
 - 3. Total Contract amount, as adjusted.
 - 4. Previous payments.
 - 5. Remaining payment due.
- C. Engineer will prepare a final Change Order reflecting approved adjustments to the Contract amount which were not previously made by Change Orders.

1.15 FINAL APPLICATION FOR PAYMENT

- A. Contractor shall submit the final Application for Payment reflecting the agreed upon information provided in the final statement of accounting.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01782

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Preparation and submittal of Operation and Maintenance Manuals.

1.02 SUBMITTALS

- A. Submit Operation and Maintenance Manuals before field quality control testing and before training of each piece of equipment or system.
- B. Submit 4 Manuals for each piece of equipment or system.
- C. Make manuals available at project site for use by construction personnel and ENGINEER.
- D. Make additions and revisions to the Manuals in accordance with ENGINEER's review comments.

1.03 OPERATION AND MAINTENANCE MANUALS

- A. Preparation:
 - 1. Provide Operations and Maintenance Manuals in 3-ring binders with rigid covers. Utilize tab sheets to organize information.
- B. Contents of Operation And Maintenance Manuals:
 - 1. Cover Page: Equipment name, equipment tag number, project name, OWNER's name, appropriate date.
 - 2. Table of Contents: General description of information provided within each tab section.
 - 3. Lubrication Information: Required lubricants and lubrication schedules.
 - 4. Control Diagrams:
 - a. Internal and connection wiring, including logic diagrams, wiring diagrams for control panels, ladder logic for computer based systems, and connections between existing systems and new additions, and adjustments such as calibrations and set points for relays, and control or alarm contact settings.
 - 5. Start-Up Procedures: Recommendations for installation, adjustment, calibration, and troubleshooting.
 - 6. Operating Procedures: Step-by-step procedures for starting, operating, and stopping equipment under specified modes of operation:
 - a. Include safety precautions and emergency operating shutdown instructions.
 - 7. Preventative Maintenance Procedures: Recommended steps and schedules for maintaining equipment.

8. Overhaul Instructions: Directions for disassembly, inspection, repair and reassembly of the equipment; safety precautions; and recommended tolerances, critical bolt torques, and special tools that are required.
9. Parts List: Generic title and identification number of each component part of equipment; include bearing manufacturer, model and ball or roller pass frequencies for every bearing.
10. Spare Parts List: Recommended number of parts to be stored at the site and special storage precautions.
11. Drawings: Exploded view or plan and section views with detailed callouts.
12. Provide electrical and instrumentation schematic record drawings.
13. Source (Factory) Quality Control Test Results: Provide copies of factory test reports as specified in Sections 15958 or the equipment section.
14. Field Quality Control Test Results: After field-testing is completed, insert field test reports as specified in Sections 15958 or the equipment section.
15. Equipment Summary Form: Completed form in the format attached at the end of this Section. Insert Equipment Summary Form after the tab sheet of each equipment section. The manufacturer's standard form will not be acceptable.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

EQUIPMENT SUMMARY FORM

1. EQUIPMENT ITEM _____

2. MANUFACTURER _____

3. EQUIPMENT IDENTIFICATION NUMBER(S) _____
(maps equipment number)

4. LOCATION OF EQUIPMENT _____

5. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS) _____

NAMEPLATE DATA -

Horsepower _____

Amperage _____

Voltage _____

Service Factor (S.F.) _____

Speed _____

ENC Type _____

Capacity _____

Other _____

7. MANUFACTURER'S LOCAL REPRESENTATIVE

Name _____

Address _____

Telephone Number _____

8. MAINTENANCE REQUIREMENTS _____

9. LUBRICANT LIST _____

10. SPARE PARTS (recommendations) _____

11. COMMENTS _____

SECTION 02222

STRUCTURE DEMOLITION

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Demolition of structures at the Blackhorse Reservoir location.

1.02 SUBMITTALS

- A. Hazardous materials testing plan.
- B. Hazardous materials testing report and findings.
- C. Demolition plan, means, location(s), and schedule.
- D. Disposal certificates from disposal location (such as landfill).

1.03 PROJECT CONDITIONS

- A. Environmental requirements:
 - 1. Conform to existing environmental requirements and regulations regarding noise, dust, and vibration.
- B. Existing conditions:
 - 1. Facilities scheduled for demolition are generally indicated on the Drawings. As-built information is not available for the facilities scheduled for demolition.
 - 2. For bidding purposes, the following shall be assumed for the major above ground structures at the site:
 - a. Existing concrete reservoir.
 - 1) Diameter = 134 ft.
 - 2) Height = 30 ft.
 - 3) Floor Thickness = 3 ft.
 - 4) Wall Thickness = 2 ft.
 - 5) Roof Thickness = 1 ft.
 - 6) Concrete is reinforced with rebar throughout.
 - 7) Piping and appurtenances associated with water storage reservoirs are located in and adjacent to the reservoir.
 - b. Existing building:
 - 1) Length = 25 ft.
 - 2) Width = 15 ft.
 - 3) Wall = Cement masonry unit (reinforced).
 - 4) Floor = 1 ft thick reinforced concrete, 1 ft wider than building dimensions on all sides.
 - 5) Building has electrical and communication equipment throughout.
 - c. Antenna Pole:
 - 1) Height = 50 ft.
 - 2) Foundation = 4 ft diameter reinforced concrete to a depth of 10 ft.

- d. Chemical Storage Tank:
 - 1) Diameter = 8 ft.
 - 2) Height = 10 ft.
 - 3) Material = Plastic (such as HDPE).
 - 4) Foundation = 10 ft diameter, 1 ft thick reinforced concrete.
 - 5) Residual chemical is location inside tank that requires disposal. Assume chlorine.
- 3. For bidding purposes, the following shall be assumed for the below ground structures at the site:
 - a. 300 feet of 24-inch diameter pipe with associate valve and appurtenances.
 - b. 500 feet of cabling, wiring, and conduits.

1.04 SEQUENCING AND SCHEDULING

- A. Hazardous Materials testing shall be completed before commencing demolition activities.
- B. All demolition activities shall be completed before commencing with any other part of the work at the Blackhorse Reservoir site.
- C. Coordinate timing of demolition with Owner to ensure there is no impact to owner Operation of existing, in service facilities at the Blackhorse Reservoir site.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Prior to commencing work, verify all existing conditions, existing structure thicknesses and sizes, and verify that all utility services are disconnected and the facility is de-energized. Notify the Engineer if there are discrepancies between the existing conditions and the project conditions identified in Part 1.03-B of this specification.
- B. Prepare a hazardous material testing plan for all materials scheduled to be demolished for approval. Once approved, complete hazardous materials testing. Preparation of the hazardous materials plan and testing shall be completed by persons and laboratories certified by the State of California to perform such activities.

3.02 PREPARATION

- A. Utilities:
 - 1. Disconnect any remaining utility services.
 - 2. Plug or cap cut pipes and conduits with removable plugs or caps acceptable to Engineer.

- B. Protection:
 - 1. Use saw cutting and other methods acceptable to Engineer to protect adjacent facilities.
 - 2. Provide berms and other means acceptable to Engineer to keep drainage from demolition areas.

3.03 DEMOLITION

- A. Completely remove from project site structures specified or indicated on the Drawings to be demolished:
 - 1. Unless otherwise specified or indicated on the Drawings, demolition includes removal of slabs, footings, and foundations, support structures, valving, piping, cabling, wiring, conduits, appurtenances. Piping and conduit that extend beyond the limit of demolition shall be secured and capped in a water-tight manner.

END OF SECTION

SECTION 02240

DEWATERING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Installation and maintenance of dewatering systems.
 - 2. Disposal of water entering excavation or other parts of the work.
- B. Related Sections:
 - 1. Section 03300 - Cast-in-Place Concrete.
 - 2. Section 03600 - Grouts.

1.02 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Keep excavations reasonably free from water. The static water level shall be drawn down a minimum of 2 feet below the bottom of excavations.
 - 2. The analysis shall include an evaluation of the anticipated subsurface conditions, required well spacing, diameter of wells, depth screen interval, backfill and filter pack, pump size, drawdown duration, drawdown and steady state flow rates, desilting tank, and settlements.
 - 3. Dewatering calculations shall include water drawdown curves.
 - 4. Dewatering design shall be coordinated with excavation and shoring design. The shoring and excavation design shall recognize the changes in groundwater conditions and earth pressures.
 - 5. Do not place concrete or masonry foundations or floors in water, nor allow water to rise over them until concrete or mortar has set at least 24 hours.
 - 6. Maintain operation of the dewatering system until the complete structure including walls, slabs, beams, struts, and all other structural elements have been constructed and the concrete has attained specified strength, and backfill has been completed to 3 feet above the normal static groundwater level.
 - 7. Provide standby power to ensure continuous dewatering in case of power failure.
- B. Secure written permission from the ENGINEER before locating wells, well points, or drain lines for purposes of dewatering within limits of structure foundation.
- C. Locate dewatering facilities where they will not interfere with utilities and construction work to be performed by others.
- D. Open manholes will not be allowed for discharge piping. Approval of each discharge location shall be obtained from the ENGINEER.

1.03 SUBMITTALS

- A. Dewatering Plan:
 - 1. Arrangement, location, depths of system components.
 - 2. Type and sizes of filters.
 - 3. Required permits.
- B. Well Construction Logs Which Include:
 - 1. Descriptions of actual materials encountered.
 - 2. Construction details.
 - 3. Well development procedures and results.
 - 4. Deviations from original design.
- C. Laboratory test results.
- D. Identify the proposed alignment of the discharge pipe and method of for the pipe to enter the manhole. Provide details of the pipe entering the manhole.
- E. Qualifications:
 - 1. Dewatering contractor.
 - 2. Dewatering design engineer.
 - 3. Testing laboratory.

1.04 QUALITY ASSURANCE

- A. Qualifications of a Dewatering Design Engineer:
 - 1. Dewatering Plan and Dewatering System Analysis:
 - a. Prepared by a registered Civil Engineer, registered in the state where the Project is located. The Civil Engineer shall have at least 8 years of experience in designing similar systems.
 - b. Submit qualifications of the dewatering contractor, the Dewatering Design Engineer, sampling service, and testing laboratory.
- B. Regulatory Requirements:
 - 1. Assume responsibility for obtaining water discharge permits that are required.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Provide and Maintain During Construction: Ample means and devices with which to promptly remove and properly dispose of water entering excavation or other parts of the work, whether water is surface water or underground water.
- B. Intercept and divert precipitation and surface water away from excavations through the use of dikes, curb walls, ditches, pipes, sumps, or other means.

- C. Disposing of Water:
 - 1. Dispose of water from the work in suitable manner without damage to adjacent property.
 - 2. Do not drain water into work built or under construction.
 - 3. Dispose of water in such manner as not to be a menace to public health.

- D. Wells, Well Points, and Drain Lines for Dewatering:
 - 1. Locate after receiving ENGINEER's written permission.
 - 2. Fill dewatering wells, pipes, and French drains to be left in place within structure foundation limits with Class "C" concrete as specified in Section 03300 or grout as specified in Section 03600.

3.02 CONSTRUCTION

- A. Interface with Other Work:
 - 1. Prior to Release of Groundwater to Its Static Level:
 - a. All groundwater pressure relief devices for the structure shall be fully operational.
 - b. Construction of structure shall be complete and the concrete shall have reached specified strength.
 - c. Backfill of structure shall be complete.
 - d. Release of groundwater to its static level shall be controlled to prevent disturbance of the natural foundation soils or compacted backfills and fills and to prevent flotation or movement of structures or pipelines.

END OF SECTION

SECTION 02260

EXCAVATION SUPPORT AND PROTECTION

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Requirements for designing, furnishing and installing, maintaining, and removing excavation support and protection.
- B. Related Sections:
 - 1. Section 01410 - Regulatory Requirements.

1.02 REFERENCES

- A. American Institute of Steel Construction, Inc. (AISC):
 - 1. Manual of Steel Construction Allowable Stress Design.
- B. American Society of Civil Engineers:
 - 1. Guidelines of Engineering Practice for Braced and Tied-Back Excavations.
- C. California Code of Regulations (CCR):
 - 1. Title 8 - Construction Safety Orders.
- D. California Labor Code Sections 6705 to 6707 (CLC).
- E. Department of the Navy Naval Facilities Engineering Command (NAVFAC):
 - 1. NAVFAC Design Manual 7.2 - Foundations and Earth Structures.
 - 2. NAVFAC Design Manual 7.3 - Soil Dynamics Deep Stabilization and Special Geotechnical Construction.
- F. State of California Department of Transportation (Caltrans):
 - 1. Caltrans California Trenching and Shoring Manual.
- G. United States Steel Corporation (USS):
 - 1. USS Steel Sheet Piling Design Manual.

1.03 DEFINITIONS

- A. General Engineering Design Practice: General engineering design practice in area of the Project, performed in accordance with recent engineering literature on subject of shoring and stability of excavations.
- B. Shoring: A temporary structural system designed to support vertical faces, or nearly vertical faces, of soil or rock for purposes of excavation. Shoring includes cantilevered sheet piling, internally braced sheet piling, slurry walls, soldier piles and lagging, and other similar shoring systems. Sloping of the soil is not shoring.

1.04 SYSTEM DESCRIPTION

- A. Where General Engineering Design Practice is specified, provide drawings and signed calculations and have design performed by civil or structural engineer registered in State where the Project is located:
1. Provide design calculations that clearly disclose assumptions made, criteria followed, and stress values used for the materials being used.
 2. Furnish references acceptable to ENGINEER substantiating appropriateness of design assumptions, criteria, and stress values.
- B. Design Requirements:
1. General:
 - a. Design means for safe and stable excavations in accordance with general engineering design practice:
 - 1) The preceding requirement shall not apply to trench excavation support conforming to standards set forth in CCR Title 8 - Construction Safety Orders.
 - b. Design steel members in accordance with the Uniform Building Code and the AISC Manual of Steel Design.
 - c. Design shoring involving materials other than steel in accordance with Uniform Building Code.
 - d. Perform design in accordance with soil characteristics and design recommendations contained in a written geotechnical report issued and signed by a geotechnical engineer hired by CONTRACTOR. Geotechnical engineer shall be registered in the state where the Project is located:
 - 1) Make copy of geotechnical report available at project site for ENGINEER's review.
 - 2) Retain and pay for geotechnical engineer's services.
 - 3) Obtain report based on soil samples, field and laboratory tests, and borings performed for the geotechnical report for the design of stability of excavations by the geotechnical engineer hired by CONTRACTOR.
 - e. When electing to design with material stresses for temporary construction higher than allowable stresses prescribed in the Manual of Steel Construction and the Uniform Building Code, increase in such stresses shall not exceed 10 percent of value of prescribed stresses.
 - f. Minimum safety factor used for design shall not be less than 1.5.
 - g. The calculated minimum depth of penetration of shoring below the bottom of the excavation shall be increased not less than 30 percent if the full value of passive pressure is used in the design.
 - h. The maximum height of cantilever shoring above the bottom of excavation shall not exceed 15 feet. Use braced shoring when the height of shoring above the bottom of excavation exceeds 15 feet.
 - i. The location of the point of fixity for shoring shall not be less than half the calculated minimum embedment depth below the bottom of the excavation.
 - j. Generally acceptable references for the design of shoring and excavations are as follows:
 - 1) CALTRANS California Trenching and Shoring Manual.
 - 2) NAVFAC Design Manual 7.2 - Foundations and Earth Design.
 - 3) NAVFAC Design Manual 7.3 - Soil Dynamics Deep Stabilization and Special Geotechnical Construction.

- 4) USS Steel Sheet Piling Design Manual.
- 5) Guidelines of Engineering Practice for Braced and Tied-Back Excavations published by American Society of Civil Engineers.
- k. The maximum total deflection at any point on the shoring shall not be more than 1/2 inch.
- l. Refer to Specification 00800 for terms of insurance.
- 2. Soldier Piles and Lagging:
 - a. Provide lagging over the full face of the excavation. Joints between pieces of lagging shall be tight to prevent loss of soil.
 - b. Provide full face lagging all around penetrations through the lagging.
 - c. If the soldier piles are installed in predrilled holes, the predrilled holes shall be filled with control density backfill after the soldiers piles are installed.
 - d. The effective width of driven soldier piles for passive soil resistance shall not exceed 2 times the width of the pile. The effective width of concrete encased soldier piles for passive soil resistance shall not exceed 2 times the width of the concrete encasement.
 - e. Fill voids behind lagging with gravel or other material acceptable to the ENGINEER.
 - f. Apply loads from tie back soil, rock, or deadman anchors concentrically to soldier piles or wales spanning between soldier piles. Wales shall be back-to-back double channels or other members acceptable to the ENGINEER. Eccentrically loaded with section soldier piles or wales are not acceptable.
 - g. Design soldier piles for downward loads including vertical loads from tie back anchors.

C. Performance Requirements:

- 1. General:
 - a. Support faces of excavations and protect structures and improvements in vicinity of excavations from damage and loss of function due to settlement or movement of soils, alterations in ground water level caused by such excavations, and related operations.
 - b. Herein Specified Provisions:
 - 1) Complement, but do not substitute or diminish, obligations of CONTRACTOR for the furnishing of a safe place of work pursuant to provisions of the Occupational Safety and Health Act of 1970 and its subsequent amendments and regulations and for protection of the Work, structures, and other improvements.
 - 2) Represent minimum requirement for:
 - a) Number and types of means needed to maintain soil stability.
 - b) Strength of such required means.
 - c) Methods and frequency of maintenance and observation of means used for maintaining soil stability.
- 2. Provide safe and stable excavations by means of sheeting, shoring, bracing, sloping, and other means and procedures, such as draining and recharging groundwater and routing and disposing of surface runoff, required to maintain the stability of soils and rock.
- 3. Provide support for trench excavations for protection of workers from hazard of caving ground.

4. Provide Shoring:
 - a. Where, as result of excavation work and analysis performed pursuant to general engineering design practice, as defined in this Section:
 - 1) Excavated face or surrounding soil mass may be subject to slides, caving, or other types of failures.
 - 2) Stability and integrity of structures and other improvements may be compromised by settlement or movement of soils, or changes in soil load on structures and other improvements.
 - b. For trenches 5 feet and deeper.
 - c. For trenches less than 5 feet in depth, when there is a potential for cave-in.
 - d. Where indicated on the Drawings.
5. For safe and stable excavations, use appropriate design and procedures for construction and maintenance to minimize settlement of supported ground and to prevent damage to structures and other improvements, including:
 - a. Using stiff support systems.
 - b. Following appropriate construction sequence.
 - c. Preventing soil loss through or under support system:
 - 1) Provide support system that is tight enough to prevent loss of soil and extend deep enough to prevent heave or flow of soils from supported soil mass into the excavation.
 - d. Providing surface runoff routing and discharge away from excavations.
 - e. Where dewatering is necessary, recharge groundwater as necessary to prevent settlement in area surrounding excavation.
 - f. Where sheet piling is used, use interlocking type sheets. The sheet piles shall be continuous and driven in interlock. If the bottom of the excavation is located below the water table, use "thumb and finger" type interlock.
 - g. Not applying shoring loads to existing structures and other improvements.
 - h. Not changing existing soil loading on existing structures and other improvements.
 - i. Provide welded steel packing between soil retaining members such as sheet piles and wales and similar members when the gap exceeds 1/2 inch before the wales are loaded.

1.05 SUBMITTALS

- A. Shop Drawings and Calculations:
 1. In accordance with requirements in California Labor Code for trench excavations 5 feet or more in depth and for trenches less than 5 feet in depth when there is potential for cave-in. Submit in advance of excavation work, detailed drawings showing means for safe and stable excavations:
 - a. Where such drawings vary from excavation support standards set forth in California Code of Regulations Title 8 - Construction Safety Orders, submit design calculations pursuant to general engineering design practice.
 - b. Provide means for safe and stable excavations that are not less effective than required in CCR Title 8 - Construction Safety Orders.

2. For excavations other than trenches, submit, in advance of excavation work, design calculations as performed pursuant to general engineering design practice, as specified in this Section, and detail drawing showing means for safe and stable excavations. In design calculations and detail drawing, cover, as a minimum:
 - a. Excavations adjacent to structures and other improvements.
 - b. Excavations 5 feet or more in depth, or less than 5 feet in depth when there is potential for cave-in, at other locations.
 3. Submit Following:
 - a. Provide calculations for the different load, support, and other conditions that occur during the sequence of installation of shoring, construction of facilities protected by the shoring, and sequence of removal of shoring.
 - b. Provide sketches showing the condition at various stages of installation and removal of shoring.
 - c. Show structures, pipelines, and other improvements located near the shoring, and the shoring on a plan.
 - d. When utilities penetrate the shoring, submit an elevation of all sides of the shoring showing the locations of the penetrations. Submit details on ground support and sealing around utility penetrations.
- B. Written geotechnical report on soil characteristics and design recommendations, as specified in this Section.
- C. Control Points and Schedule of Measurements:
 1. Submit location and details of control points and method and schedule of measurements in accordance with requirements of this Section.
 2. Promptly upon constructing control points and making measurements at such control points, as specified in this Section, submit copy of field notes with such measurements. The field notes shall show the current measurement and the change in measurement from the first measurement taken.
- D. Detailed Sequence of Installation and Removal of Shoring:
 1. Consider effects of ground settlement in the sequence of installation and removal of shoring.
 2. Provide sketches showing the conditions at various stages in the sequence of installation and removal of shoring.
- E. Submit submittals for stability of excavations as a complete package and include all items required in this section. Incomplete submittals will not be reviewed and will be returned for resubmittal as a complete package.

1.06 SEQUENCING AND SCHEDULING

- A. Do not begin work on excavations, trenches, and means for providing stability of excavation and trenches until submittals have been accepted by ENGINEER and until materials necessary for installation are on site.
- B. Submit submittals a minimum of 60 days prior to the scheduled date to begin excavation work.

- C. Do not begin construction of any shoring or excavation operations until:
 - 1. Control points as specified in this Section and as indicated on the Drawings on existing structures and other improvements have been established and surveyed to document initial elevations and locations.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 INSTALLATION AND REMOVAL

- A. Install means for providing safe and stable excavations as indicated in the submittals.
- B. Except for concrete encased soldier piles, slurry walls, and similar shoring systems, remove shoring by completion of the Work. Select shoring system and method of removal, which will minimize soil that sticks to shoring from creating large voids and causing settlement. To prevent settlement caused by pulling shoring, fill voids with sand, pea gravel, or pressure injected grout. The methods used shall prevent settlement. Pressure preservative treated wood lagging may be left in place when acceptable to the ENGINEER.

3.02 MAINTENANCE

- A. Where loss of soil occurs, plug gap in shoring and replace lost soil with fill material acceptable to ENGINEER.
- B. Where measurements and observations indicate possibility of failure or excessive movement of excavation support, determined in accordance with general engineering design practice, take appropriate action immediately.

3.03 CONTROL POINTS

- A. Establish control points on shoring and on structures and other improvements in vicinity of excavation for measurement of horizontal and vertical movement:
 - 1. Set Control Points On Shoring Support System:
 - a. Set points at distances not exceeding 25 feet at each support level.
 - b. Support levels shall be levels of tie-backs, wales, bottom of excavation, and other types of supports.
 - 2. Set control points in corners of existing structures and on curbs, manholes, and other improvements indicated on the Drawings.
- B. Provide plumb bobs with horizontal targets indicating original position of plumb bobs in relation to shoring at control points located on shoring.
- C. Perform horizontal and vertical survey and measurement of control points at least once every week.

END OF SECTION

SECTION 02300

EARTHWORK

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Loosening, excavating, filling, grading, borrow, hauling, preparing subgrade, compacting in final location, wetting and drying, and operations pertaining to site grading for buildings, basins, reservoirs, boxes, roads, and other structures.
 - 2. Pumping and draining of excavations.
 - 3. Backfilling and compacting around structures.

- B. Related Sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 02240 - Dewatering.
 - 3. Section 02318 - Trenching.
 - 4. Section 02722 - Aggregate Base Course.
 - 5. Section 03300 - Cast-In-Place Concrete.

1.02 REFERENCES

- A. Associated General Contractors (AGC):
 - 1. Manual of Accident Prevention in Construction (Section 9).

- B. American Society for Testing and Materials (ASTM):
 - 1. C 131 - Test Method for Resistance to Degradation of Small-Size Course Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - 2. C 136 - Test Method for Sieve Analysis of Fine and Course Aggregates.
 - 3. D 1556 - Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method.
 - 4. D 1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m).
 - 5. D 2419 - Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 - 6. D 2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 7. D 3017 - Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
 - 8. D 4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

- C. Division of Industrial Safety (DIS).

- D. Institute of Makers of Explosives (IOMOE).

- E. Occupational Safety and Health Act (OSHA).

- F. State of California Department of Transportation (Caltrans).

1.03 DEFINITIONS

- A. Excavation: Consists of satisfactory loosening, removing, loading, transporting, depositing, and compacting in final location, wet and dry materials, necessary to be removed for purposes of construction, or as required for ditches, grading, roads, and such other purposes as are indicated on the Drawings.
- B. Backfill Adjacent to Structure: Is backfill within volume bounded by the exterior surfaces of structure, the surface of undisturbed soil in the excavation around structure, and finish grade around structure.
- C. In-Place Density of Compacted Backfill: Is density determined in accordance with ASTM D 1557, or with ASTM D 2922 and ASTM D 3017.
- D. Maximum Density: Is density obtained in laboratory when tested in accordance with ASTM D 1557.
- E. Small at-grade Concrete Structures is defined as those structures requiring excavations of not more and 1-foot below grade or more than 2 cubic yards of concrete.

1.04 SYSTEM DESCRIPTION

- A. Performance Requirements:
 - 1. Where mud or other soft or unstable material is encountered, remove such material and refill space with select material or gravel which can be compacted with no perceptible movement under roller.
 - 2. Obtain acceptable material from other sources if surplus or borrow materials obtained within project site do not conform to specified requirements or are not sufficient in quantity for structural backfill.
 - 3. No extra compensation will be made for hauling of fill materials nor for water required to compact fills.
 - 4. Structural Backfill:
 - a. Material for Backfill:
 - 1) Unless otherwise specified or indicated on the Drawings, material for backfill, adjacent to structures, slabs, or wall shall consist of select imported material, or other materials acceptable to the ENGINEER.
 - 2) Backfill material under concrete structures, under pavement, or where heavy compaction equipment, such as a pneumatic tired roller, cannot be used satisfactorily shall consist of aggregate base course, except areas indicated on the Drawings as control density fill or concrete encasement.
 - 3) Backfill in any area under concrete structures, shall extend from undisturbed native soil or rock to the bottom surface of the structure.
 - 5. Embankments and Roadway Fills:
 - a. Material for Fills: Unless otherwise specified or indicated on the Drawings, material shall be Caltrans Class 2 aggregate base within roadways and may be surplus material from excavation for structures or other construction for embankments or, if accepted by the OWNER, borrow material excavated from source within Project site may be used for embankments.
 - b. Whatever source is used, provide fill material conforming with specified requirements.

- c. Obtain acceptable material from other sources if surplus or borrow materials obtained within Project site do not conform to specified requirements or are not sufficient in quantity for construction of embankments.
- 6. Compacted Fills:
 - a. Provide specified compaction for backfill, fill, and other earthwork.
 - b. Perform confirmation tests to verify and confirm that work has complied, and is complying at all times, with requirements specified in this Section concerning initial compaction demonstration, and field quality control testing.
- 7. Borrow Area:
 - a. No borrow area has been indicated on the Drawings.
 - b. Where borrow material is required, provide such material from source selected by the CONTRACTOR, subject to acceptance by the ENGINEER, but not necessarily from within project site.
 - c. Use of imported borrow shall not cause additional cost to the Contract.

1.05 SUBMITTALS

- A. General: Submit in accordance with Section 01330.
- B. Property Owner's Permission Agreements: Submit copy of property owner's agreements to allow placement of surplus material on their property.
- C. Product Data: Submit material source, gradation, and testing data for all materials, including imported and on-site materials.
- D. Excavation Plan: Submit proposed excavation plan.
- E. Testing Lab: OWNER shall select the testing laboratory.
- F. Test Reports: Submit certified test reports of all tests specified to be performed by the CONTRACTOR. Test reports shall be signed and sealed by a registered geotechnical engineer in the State of California.

1.06 QUALITY ASSURANCE

- A. Initial Compaction Demonstration:
 - 1. Adequacy of Compaction Equipment and Procedures: Demonstrate adequacy of compaction equipment and procedures before exceeding any of following amounts of earthwork quantities:
 - a. 200 linear feet of trench backfill.
 - b. 50 cubic yards of structural backfill.
 - c. 100 cubic yards of embankment work.
 - d. 50 cubic yards of base material.
 - 2. Compaction Sequence Requirements: Until specified degree of compaction on previously specified amounts of earthwork is achieved, do not perform additional earthwork of the same kind.
 - 3. After satisfactory conclusion of initial compaction demonstration and at any time during construction, provide confirmation tests as specified under "FIELD QUALITY CONTROL."

1.07 SEQUENCING AND SCHEDULING

- A. Schedule earthwork operations to meet requirements as provided in this Section for excavation and uses of excavated material.
- B. If necessary, stockpile excavated material in order to use it in specified locations.
- C. Excavation and Filling: Perform excavation and filling, during construction, in manner and sequence that provides drainage at all times.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Fill Materials:
 - 1. General:
 - a. Provide sand, aggregate base course, gravel, Class 2 permeable, drain rock, select material, and native material, where required for fill and backfill.
 - b. Obtain material for fills from cut sections or from borrow source.
 - c. Provide material having maximum particle size not exceeding 4 inches and that is free of trash, lumber, debris, leaves, grass, roots, stumps, and other vegetable matter.
 - d. Materials derived from processing demolished or removed asphalt concrete are not acceptable.
 - 2. Aggregate Base Course: As specified in Section 02722.
 - 3. Class 2 Permeable:
 - a. Consist of hard, durable particles of stone or gravel, screened or crushed to the specified size and gradation.
 - b. Provide free of organic matter, lumps or balls of clay, and other deleterious matter.
 - c. Durability Index: Percentage of wear not greater than 40 percent when tested in accordance with ASTM C 131.
 - d. Sand Equivalent: Not less than 75 when tested in accordance with ASTM D 2419.
 - e. Conform to size and grade within the limits as follows when tested in accordance with ASTM C 136:

Sieve Size (Square Openings)	Percent by Weight Passing Sieve
1 inch	100
3/4 inch	90-100
3/8 inch	40-100
Number 4	25-40
Number 8	18-33
Number 30	5-15
Number 50	0-7
Number 200	0-3

4. Native Material:
 - a. Sound, earthen material passing 1 inch sieve.
 - b. Percent of material by weight passing Number 200 sieve shall not exceed 30 when tested in accordance with ASTM C 136.
 - c. Expansion index less than 35.
 5. Sand:
 - a. Clean, coarse, natural sand.
 - b. Nonplastic when tested in accordance with ASTM D 4318.
 - c. 100 percent shall pass a 1/2 inch screen.
 - d. No more than 20 percent shall pass a Number 200 screen.
 6. Select Imported Material: Predominantly granular material for which sum of plasticity index shall not exceed 15 and liquid limit less than 40 percent when tested in accordance with ASTM D 4318. The percent of material by weight passing Number 200 sieve shall not exceed 15 when tested in accordance with ASTM C 136. Organic content shall not be greater than 3 percent by volume.
- B. Geotextile:
1. Geotextile shall have the minimum value when tested in accordance with the ASTM method listed below:
 - a. ASTM D 6767.
 2. Geotextile shall be Mirafi 500X or equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions:
1. Character and Quantity of Material:
 - a. Verify character and quantity of rock, gravel, sand, silt, water, and other inorganic or organic materials to be encountered in work to be performed.
 - b. Determine gradation and shrinkage of excavation and fill material, and suitability of material for use intended in work to be performed.
 - c. Determine quantity of material, and cost thereof, required for construction of excavations and fills, whether from on-site excavations, borrow areas, or imported materials. Include in cost of work to be performed.
 - d. Include wasting of excess material, if required, in cost of work to be performed.

3.02 PREPARATION

- A. Surface Preparation:
1. Preparing Ground Surfaces for Fill or Small At-grade Concrete Structures:
 - a. After clearing is completed, scarify entire areas which underlie fill sections or structures to a depth of 6 inches and until surface is free of ruts, hummocks, and other features which would prevent uniform compaction by equipment to be used.
 - b. Recompact areas to density specified in "Compacted Fills" before placing of fill material or concrete.
 - c. Where cemented rock, cobbles, or boulders compose a large portion of foundation material underlying structures, slabs, or paved areas, it may not be advisable to scarify the top 6 inches prior to compaction. If the ENGINEER deems it advisable not to scarify existing natural ground, then

- moisten the native soil and compact it as specified in "Compaction of Coarse Fill."
2. Preparing Sloped Surfaces for Fill or Foundations:
 - a. Foundations for Fill Having Slopes in Excess of One Vertical to Four Horizontal:
 - 1) Bench or terrace to adequately key existing ground and fill built thereon.
 - b. Slopes of Original Hillides and Old Fills: Bench minimum of 4 feet horizontally as fill is placed.
 - c. Provision of New Benches:
 - 1) Start new bench wherever vertical cut of next lower bench intersects existing ground.
 - 2) Recompect material thus cut out along with new embankment material at no additional cost to the Contract.
 3. Preparing for Structural Backfill:
 - a. After completion of foundation footings and walls and other construction below the elevation of the final grades and prior to backfilling, all forms shall be removed and excavation shall be cleaned of all trash and debris.
 - b. After inspection of foundation, walls, and pipes, backfill shall be placed symmetrically to prevent eccentric loading upon or against structures.
 - c. To prevent damage to structures, structural backfill shall be placed with equipment which does not exceed H-20 loading, within a distance of $1/2$ to $1/3$ h (h being the vertical distance from the level being compacted down to the surface on the opposite side of the wall). Outside this distance, normal compaction equipment may be used.
 - d. All backfill shall be compacted per Compaction of this specification.

3.03 APPLICATION

- A. General:
 1. Dispose of excavated materials which are not required or unsuitable for fill and backfill in lawful manner.
 2. Dispose of surplus material on private property only when written permission agreement is furnished by owner of property. Submit copies of such agreements.
 3. Obtain material required for fills in excess of that produced by excavation from borrow areas subject to the fill material requirements specified herein.
 4. Rocks, broken concrete, or other solid materials larger than 4 inches in greatest dimension shall not be placed in fill areas, but removed from project site at no additional cost to the Contract.
 5. Stabilization of Subgrade: Provide materials used or perform work to stabilize subgrade so it can withstand loads which may be placed upon it by CONTRACTOR's equipment.
- B. Excavation:
 1. Excavations for Buildings and Structures:
 - a. Dimensions and Elevations of Excavations: Provide excavations conforming to dimensions and elevations indicated on the Drawings for each building and structure, including trenching for adjacent piping and all work incidental thereto.
 - b. After clearing is complete, excavate area of the structure, plus five feet on each side to the elevation indicated on the Drawings, or eight inches if not indicated, below the elevation of the bottom of the structure. Remove all

loose material using hand equipment or a flat edged backhoe bucket. Place geotextile fabric over the area and fill the excavation to the bottom of the structure with Structural Backfill.

- c. Compact Structural Backfill to densities specified in "Compacted Fills" before placement of concrete.
 - d. Soil of Unsuitable Bearing Value: Where soil is encountered having unsuitable bearing value, ENGINEER may direct in writing that excavation be carried to elevations above or below those indicated on the Drawings.
 - e. Unless directed by the ENGINEER, excavations shall not be carried below elevations indicated on the Drawings.
 - f. Where excavations are made below elevations indicated on the Drawings, adjust elevations of excavations in accordance with requirements following:
 - 1) Under Slabs and Footings: Restore to proper elevation in accordance with procedure specified for backfill in this Section.
 - g. Excavation Width: Extend excavations at least 24 inches clear from walls and footings to allow for placing and removal of forms, installation of services, and inspection. Undercutting of slopes will not be permitted.
 - h. Difficulty of Excavation: No extra compensation will be made for removal of rock or any other material due to difficulty of excavation.
2. Necessary Over Excavation:
- a. General:
 - 1) Where it becomes necessary to excavate beyond normal lines of excavation in order to remove boulders or other interfering objects, backfill voids remaining after removal as specified in Backfilling of Voids, or as acceptable to the ENGINEER.
 - 2) Perform necessary excavation beyond normal lines as specified above and backfill such voids.
 - b. Backfilling of Voids:
 - 1) Fill voids with suitable material acceptable to the ENGINEER, placed in manner and to same uniform density as surrounding material.
 - 2) With acceptance of the ENGINEER, concrete of same mix as used in concrete channel may be used.

C. Compaction:

1. Compacted Fills:
 - a. Lines and Grades:
 - 1) Construct fills, embankments, and backfills, designated herein as fills, at locations and to lines and grades indicated on the Drawings.
2. Borrow sources are not available within project site. Where required, CONTRACTOR shall provide necessary imported fill material from outside sources:
 - a. Compacted Fill Shape and Sections: Provide completed fill that corresponds to shape of typical sections indicated on the Drawings or that meets requirements for particular case.
 - b. Preparation of Areas Designated to Receive Fill Material: Scarify to minimum depth of 6 inches, unless otherwise indicated on the Drawings, and recompact to density of fill material as specified in following Article.
 - c. Fills and Backfills and Upper 6 Inches in Cuts: Compact to percentage of maximum density as follows:
 - 1) Backfill adjacent to structures: 95 percent.
 - 2) Under present and future structures: 95 percent.

- 3) Under roadways, parking and storage areas, curbs, and sidewalks: 90 percent.
- 4) Other areas: 85 percent.
- 5) Compacted embankments: 95 percent.
- 6) Spoil areas indicated on the Drawings: no minimum required.
- 7) Bottom of sludge beds: 90 percent.
- d. Placing Compacted Fills:
 - 1) Placement: Place loose material in successive layers that do not exceed 8 inches in depth after compaction.
 - 2) Moisture Content: Bring each layer to optimum moisture content for maximum density before compaction by rolling.
 - 3) Defective Compacted Fills: Remove and recompact.
- e. Placing Light Weight materials:
 - 1) When excavations extend into soft soils, backfill shall consist of light weight material from base of excavation to the top of the soft soil, above which, select material may be used.
 - 2) Where light weight material is used for backfill, it shall be separated from adjacent soils by the use of geotextile fabric specified in Part 2.
3. Compaction of Coarse Fill:
 - a. When materials are coarsely graded such that performance of field density tests are impossible:
 - 1) Placement and Compaction: Place material in lifts so as to obtain compacted thickness of 6 inches and roll with pneumatic roller or power roller.
 - 2) Moisture Content: Provide moisture content of fraction of material passing 3/4 inch sieve within plus or minus 2.0 percent of optimum moisture as determined in accordance with ASTM D 1557, Method C.

3.04 FIELD QUALITY CONTROL

- A. Tests:
 1. Confirmation Tests:
 - a. CONTRACTOR's Responsibilities:
 - 1) Accomplish specified compaction for backfill, fill, and other earthwork.
 - 2) Control operations by confirmation tests to verify that compaction work complies, and is complying at all times, with requirements specified in this Section concerning compaction, control, and testing.
 - 3) Cost Of Confirmation Tests: Paid for by the CONTRACTOR. Coordinate with District.
 - 4) Qualifications of CONTRACTOR's Testing Laboratory: Perform confirmation testing by soils testing laboratory acceptable to the ENGINEER.
 - 5) Copies of Confirmation Test Reports: Submit promptly to the ENGINEER.
 - b. Frequency of Confirmation Testing:
 - 1) Perform testing not less than as follows:
 - a) A minimum of every 2,000 linear feet of reclaimed water pipeline installation
 - b) A minimum of 3 tests every 2 feet of backfill placement below the Blackhorse Reservoir. The 3 test locations should be spaced approximately equally apart from each other.

2. Compliance Tests:
 - a. Frequency of Testing: Periodic compliance tests will be made by the ENGINEER to verify that compaction is meeting requirements previously specified.
 - b. Coordination with ENGINEER's Testing: Remove overburden above level at which the ENGINEER wishes to test and backfill and recompact excavation after testing is completed.
 - c. If compaction fails to meet specified requirements, perform remedial work by one of the following methods:
 - 1) Remove and replace backfill at proper density.
 - 2) Bring density up to specified level by other means acceptable to the ENGINEER.
 - d. Retesting:
 - 1) Costs of Retesting: Costs of retesting required to confirm and verify that remedial work has brought compaction within specified requirements shall be borne by the CONTRACTOR.

B. Tolerances:

1. Finish Grading of Excavations, Backfill and Fills:
 - a. Perform fine grading under concrete structures such that finished surfaces are never above established grade or approved cross section and are never more than 0.10 feet below.
 - b. Provide finish surface areas outside of structures that are not more than 0.10 feet above or below established grade or accepted cross section.
2. Of Excavation of Unlined Channels and Basins:
 - a. In Both Cut and Fill, and Levee and Access Road Side Slopes in Cut: Vertical tolerance of none above and 3 inches below specified grade will be allowed on bottom and side slopes.
 - b. On Top Surface of Levee and Access Road in Both Cut and Fill, and Levee and Access Road Side Slopes in Fill: Vertical tolerance of none below and 3 inches above specified grade will be allowed.
3. Of Areas Which Are Not under Structures, Concrete, Asphalt, Roads, Pavements, Walks, Dikes and Similar Type Items:
 - a. Provide finish graded surfaces of either undisturbed natural soil, or cohesive material not less than 6 inches deep.
 - b. Intent of preceding is to avoid sandy or gravelly areas.
4. Finished Grading Surfaces:
 - a. Reasonably smooth, compacted, and free from irregular surface changes.
 - b. Provide degree of finish that is ordinarily obtainable from blade grader operations, except as otherwise specified.
 - c. Uniformly grade areas which are not under concrete.
 - d. Finish gutters and ditches so that they drain readily.

3.05 ADJUSTING

A. Finish Grades of Excavations, Backfilling and Fill:

1. Repair and reestablish grades to required elevations and slopes due to any settlement or washing way that may occur from action of the elements or any other cause prior to final acceptance.

3.06 PROTECTION

- A. Finish Grades of Excavations, Backfilling and Fill:
 - 1. Protect newly graded areas from action of the elements.

- B. Ditches and Gutters:
 - 1. Maintain ditches and gutters excavated free from detrimental quantities of debris that might inhibit drainage until final acceptance.

END OF SECTION

SECTION 02312

CONTROLLED LOW STRENGTH MATERIAL

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Controlled Low Strength Material (CLSM).
- B. Related Sections:
 - 1. Section 03300 - Cast-in-Place Concrete.

1.02 REFERENCES

- A. American Society of Testing and Materials (ASTM):
 - 1. C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - 2. C 33 - Standard Specification for Concrete Aggregates.
 - 3. C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - 4. C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.
 - 5. C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 - 6. C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.
 - 7. C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
 - 8. D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³(2,700 kN-m/m³)).

1.03 SYSTEM DESCRIPTION

- A. Performance Requirements:
 - 1. Total Calculated Air Content: Not be less than 8.0 percent nor greater than 12.0 percent.
 - 2. Minimum Unconfined Compressive Strength: Not less than 50 pounds per square inch measured at 28 days.
 - 3. Maximum Unconfined Compressive Strength: Not greater than 150 pounds per square inch measured at 28 days.
 - 4. Wet Density: No greater than 132 pounds per cubic foot.

1.04 SUBMITTALS

- A. Product Data: Submit data completely describing products.
- B. Sieve Analysis: Submit sieve analyses of fine and coarse aggregates being used in triplicate. Resubmit at any time there is a significant change in grading of materials.
- C. Mix: Submit full details, including mix design calculations for mix proposed for use.

- D. Trial Batch Test Data:
 1. Submit data for each test cylinder.
 2. Submit data that identifies mix and slump for each test cylinder.
- E. Cement Mill Tests: Include alkali content, representative of each shipment of cement for verification of compliance with specified requirements.
- F. Pozzolan Certificate of Compliance: Identify source of pozzolan and certify compliance with requirements of ASTM C 618.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Portland Cement: Type II low alkali Portland Cement as specified in Section 03300.
- B. Fly Ash: Class F fly ash in accordance with ASTM C 618.
- C. Water: As specified in Section 03300.
- D. Admixture: Air entraining admixture in accordance with ASTM C 260.
- E. Fine Aggregate: Concrete sand, that does not need to be in accordance with ASTM C 33. No more than 12 percent of fine aggregate shall pass a No. 200 sieve, and no plastic fines shall be present.
- F. Coarse Aggregate: Pea gravel no larger than 3/8 inch.

2.02 MIXES

- A. Suggested Design Mix:

Material	Weight	Specific Gravity	Absolute Volume Cubic Foot
Cement	30 pounds	3.15	0.15
Fly Ash	300 pounds	2.30	2.09
Water	283 pounds	1.00	4.54
Coarse Aggregate	1,465 pounds	2.68	8.76
Fine Aggregate	1,465 pounds	2.68	8.76
Admixture	4-6 ounces	-	2.70
TOTAL	3,543 pounds	-	27.00

2.03 SOURCE QUALITY CONTROL

- A. Trial Batch:
 1. After mix design has been accepted by ENGINEER, have trial batch of the accepted mix design prepared by testing laboratory acceptable to ENGINEER.
 2. Prepare trial batches using specified cementitious materials and aggregates proposed to be used for the Work.

3. Prepare trial batch with sufficient quantity to determine slump, workability, consistency, and to provide sufficient test cylinders.
- B. Test Cylinders:
1. Prepare test cylinders in accordance with ASTM C 31 with the following exceptions:
 - a. Fill the concrete test cylinders to overflowing and tap sides lightly to settle the mix.
 - b. Do not rod the concrete mix.
 - c. Strike off the excess material.
 2. Place test cylinders in a moist curing room. Exercise caution in moving and transporting the cylinders since they are fragile and will withstand only minimal bumping, banging, or jolting without damage.
 3. Do not remove the test cylinder from mold until the cylinder is to be capped and tested.
 4. The test cylinders may be capped with standard sulfur compound or neoprene pads:
 - a. Perform the capping carefully to prevent premature fractures.
 - b. Use neoprene pads a minimum of 1/2 inch thick, and 1/2 inch larger in diameter than the test cylinders.
 - c. Do not perform initial compression test until the cylinders reach a minimum age of 3 days.
- C. Compression Test 8 Test Cylinders: Test 4 test cylinders at 3 days and 4 at 28 days in accordance with ASTM C 39 except as modified herein:
1. The compression strength of the 4 test cylinders tested at 28 days shall be equal to or greater than the minimum required compression strength, but shall not exceed maximum compression strength.
- D. If the trial batch tests do not meet the Specifications for strength or density, revise and resubmit the mix design, and prepare additional trial batch and tests. Repeat until an acceptable trial batch is produced that meets the Specifications:
1. All the trial batches and acceptability of materials shall be paid by the CONTRACTOR.
 2. After acceptance, do not change the mix design without submitting a new mix design, trial batches, and test information.
- E. Determine slump in accordance with ASTM C 143 with the following exceptions:
1. Do not rod the concrete material.
 2. Place material in slump cone in one semi-continuous filling operation, slightly overfill, tap lightly, strike off, and then measure and record slump.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Prior to placement, soils located below controlled low strength material placement shall be scarified to a depth of 8 inches, uniform moisture conditioned to or above the optimum moisture content, and compacted to a minimum of 95 percent relative compaction in accordance with ASTM D 1557.

- B. Place controlled low strength material by any method which preserves the quality of the material in terms of compressive strength and density:
 - 1. Limit lift heights of CLSM placed against structures and other facilities that could be damaged due to the pressure from the CLSM, to the lesser of 3 feet or the lift height indicated on the Drawings. Do not place another lift of CLSM until the last lift of CLSM has set and gained sufficient strength to prevent lateral load due to the weight of the next lift of CLSM.
 - 2. The basic requirement for placement equipment and placement methods is the maintenance of its fluid properties.
 - 3. Transport and place material so that it flows easily around, beneath, or through walls, pipes, conduits, or other structures.
 - 4. Use a slump of the placed material greater than 9 inches, and sufficient to allow the material to flow freely during placement:
 - a. After trial batch testing and acceptance, maintain slump developed during testing during construction at all times within plus or minus 1 inch.
 - 5. Use a slump, consistency, workability, flow characteristics, and pumpability (where required) such that when placed, the material is self-compacting, self-densifying, and has sufficient plasticity that compaction or mechanical vibration is not required.

3.02 FIELD QUALITY CONTROL

- A. General:
 - 1. Make provisions for and furnish all material for the test specimens, and provide manual assistance to assist the ENGINEER in preparing said specimens.
 - 2. Be responsible for the care of and providing curing condition for the test specimens.
- B. Tests by OWNER:
 - 1. During the progress of construction, the OWNER will have tests made to determine whether the controlled low strength material, as being produced, complies with the requirements specified hereinbefore. Test cylinders will be made and delivered to the laboratory by the ENGINEER and the testing expense will be borne by the OWNER.
 - 2. Test Cylinders:
 - a. Prepare test cylinders in accordance with ASTM C 31 with the following exceptions:
 - 1) Fill the concrete test cylinders to overflowing and tap sides lightly to settle the mix.
 - 2) Do not rod the concrete mix.
 - 3) Strike off the excess material.
 - b. Place the cylinders in a safe location away from the construction activities. Keep the cylinders moist by covering with wet burlap, or equivalent. Do not sprinkle water directly on the cylinders.
 - c. After 2 days, place the cylinders in a protective container for transport to the laboratory for testing. The concrete test cylinders are fragile and shall be handled carefully. The container may be a box with a Styrofoam or similar lining that will limit the jarring and bumping of the cylinders.
 - d. Place test cylinders in a moist curing room. Exercise caution in moving and transporting the cylinders since they are fragile and will withstand only minimal bumping, banging, or jolting without damage.

- e. Do not remove the test cylinder from mold until the cylinder is to be capped and tested.
- f. The test cylinders may be capped with standard sulfur compound or neoprene pads:
 - 1) Perform the capping carefully to prevent premature fractures.
 - 2) Use neoprene pads a minimum of 1/2 inch thick, and 1/2 inch larger in diameter than the test cylinders.
 - 3) Do not perform initial compression test until the cylinders reach a minimum age of 3 days.
- 3. Not less than 3 cylinder specimens will be tested for each 150 cubic yards of controlled low strength material and not less than 3 specimens for each half day's placement:
 - a. Test 1 cylinder at 3 days and 2 at 28 days in accordance with ASTM C 39 except as modified herein.
 - b. The compression strength of the cylinders tested at 28 days shall be equal to or greater than the minimum required compression strength, but shall not exceed maximum compression strength.
- 4. The OWNER will test the air content of the controlled low strength material. Test will be made immediately after discharge from the mixer in accordance with ASTM C 231.

C. Tests by CONTRACTOR:

- 1. Test the slump of controlled low strength material using a slump cone in accordance with ASTM C 143 with the following exceptions:
 - a. Do not rod the concrete material.
 - b. Place material in slump cone in one semi-continuous filling operation, slightly overfill, tap lightly, strike off, and then measure and record slump.
- 2. Test the slump at the beginning of each placement, as often as necessary to keep the slump within the specified range, and when requested to do so by the ENGINEER.

END OF SECTION

SECTION 02318

TRENCHING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Trench excavation, fine grading, pipe bedding, backfilling, and compaction for the following:
 - 1. Pipe and electrical conduits.
 - 2. Vaults, valves, or other accessories.
 - 3. Potable and recycled water pipe appurtenances.
- B. Related Sections:
 - 1. Section 01734 - Work Within Public Right-of-Way.
 - 2. Section 02260 - Excavation Support and Protection.
 - 3. Section 02722 - Aggregate Base Course.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. C 117 - Test Method for Material Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing.
 - 2. C 131 - Test Method for Resistance to Degradation of Small-Size Course Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - 3. C 136 - Test Method for Sieve Analysis of Fine and Course Aggregates.
 - 4. D 1556 - Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method.
 - 5. D 1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft. lbf/f₄³).
 - 6. D 2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 7. D 4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.03 SUBMITTALS

- A. Products Data: For all proposed bedding and backfill materials:
 - 1. Material source.
 - 2. Gradation.
 - 3. Testing data and testing lab qualifications including lab certification.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General:
 - 1. Provide material having maximum particle size not exceeding 4 inches and that is free of leaves, grass, roots, stumps, and other vegetable matter.

2. Materials derived from processing demolished or removed asphalt concrete are not acceptable.

B. Aggregate Base Course: As specified in Section 02722.

C. Gravel:

1. Consist of hard, durable particles of stone or gravel, screened or crushed to the specified sizes and gradations.
2. Free of vegetable matter, lumps or balls of clay, and other deleterious matter.
3. Crush or waste coarse material and add or waste fine material in order to meet the specified gradations.
4. Fraction of Material Passing Number 40 Sieve: Material having plasticity index not greater than 5 when tested in accordance with ASTM D 4318.
5. Durability Index: Percentage of wear not greater than 40 percent when tested in accordance with ASTM C 131.
6. Conform to sizes and grade within the limits as follows when tested in accordance with ASTM C 136:

Sieve Size (Square Openings)	Percent by Weight Passing Sieve		
	A	B	C
3 inch	100	--	--
1-1/2 inch	--	100	--
1 inch	--	--	100
Number 4	30-70	30-70	40-80
Number 200	0-15	0-15	5-20

D. Native Material:

1. Sound, earthen material passing the 1-inch sieve.
2. Percent of material passing the Number 200 sieve by weight shall not exceed 30 when tested in accordance with ASTM C 136.

E. Sand:

1. Clean, coarse, natural sand.
2. Nonplastic when tested in accordance with ASTM D 4318.
3. 100 percent shall pass a 1/2-inch screen.
4. No more than 20 percent shall pass a Number 200 screen.

F. Select Material: Sound earthen material for which the sum of the plasticity index when tested in accordance with ASTM D 4318 and the percent of material by weight passing the Number 200 sieve shall not exceed 23 when tested in accordance with ASTM C 136.

PART 3 EXECUTION

3.01 PREPARATION

A. General:

1. Trench Condition:
 - a. Install pipe and materials as specified herein.

2. Embankment Condition:
 - a. Exists where width of trench exceeds limits specified herein.
 - b. Before laying pipes or electrical conduits in fill, place fill and compact it to not less than 2 feet above top of pipe or conduit.
 - c. After placing and compacting fill, excavate through fill and fine grade as required in this Section.

B. Protection: Stabilize excavation as specified in Section 02260.

3.02 INSTALLATION

- A. Trench Excavation:
 1. See geotechnical reference reports identified in Section 00800 for existing soil information.
 2. General Requirements:
 - a. If, because of soil conditions, safety requirements or other reasons, trench width at top of pipe is increased beyond width specified in this Section, upgrade laying conditions or install stronger pipe designed in conformance with Specifications for increased trench width, without additional cost.
 - b. Pipe and Electrical Conduits:
 - 1) Lay pipe and electrical conduits in open trench.
 - 2) If bottom of excavation is found to consist of rock or any material that by reason of its hardness cannot be excavated to provide uniform bearing surface, remove such rock or other material to a depth of not less than 4 inches below bottom of pipe and refill to grade with bedding material or sand placed at uniform density, with minimum possible compaction, at no additional cost.
 - 3) If bottom of excavation is found to consist of soft or unstable material which is incapable of properly supporting pipe, remove such material to a depth and for the length required, as determined by the ENGINEER, and then refill trench to grade with bedding material or sand compacted to 90 percent of maximum density.
 - 4) Where indicated on the Drawings, cradle pipe in concrete.
 - c. Trench Widths:
 - 1) Minimum Clear Width of Trench for Pipe (Measured at Top of Pipe):
 - a) For Pipe Sizes 4 Inches to and Including 24 Inches: Not less than outside diameter of pipe plus 18 inches.
 - b) For Pipe Sizes Larger Than 24 Inches: Not less than outside diameter of pipe plus 24 inches.
 - 2) Maximum Clear Width of Trench for Pipe (Measured at Top of Pipe):
 - a) For Pipe Sizes 4 Inches to and Including 24 Inches: Not to exceed outside diameter of pipe plus 24 inches.
 - b) For Pipe Sizes Larger Than 24 Inches: Not to exceed outside diameter of pipe plus 36 inches.
 - d. For Vaults, Valves, or Other Accessories:
 - 1) Provide excavations sufficient to leave at least 12 inches clear between their outer surfaces and embankment or shoring which may be used to hold banks and protect them.
 - 2) Do not backfill with earth under manholes, vaults, tanks, or valves.

- 3) Fill any unauthorized excess excavation below elevation indicated on the Drawings for foundation of any structure with sand, aggregate base material, bedding material, or concrete at no additional cost.
 - 4) Backfilling of Manhole Excavation: Conform to backfilling requirements as specified for trenches in this Section.
 - e. Potable Water Pipe Appurtenances:
 - 1) Lay in trenches separate from those used for sewers.
 - 2) Unless otherwise specified or indicated on the Drawings, lay in trenches having cover of not less than 3 feet below surface of ground and located at distance of not less than 10 feet from any parallel sewer trench.
 - f. At Road Crossings or Existing Driveways:
 - 1) Make provision for trench crossings at these points, either by means of backfills, tunnels, or temporary bridges.
 - g. Amount of open trench limited to 200 feet, except in the following areas:
 - 1) Station 10 +00 to Station 121 + 00.
 - 2) Station 303+00 to Station 327+00.
 - 3) Station A25+00 to A48+40.
- B. Trench Fine Grading:
1. Fine grading material shall be as scheduled herein.
 2. For Pipes 16 Inches in Nominal Diameter and Under:
 - a. Unless otherwise specified, accurately grade bottom of trench to provide uniform bearing and support for each section of pipe, on undisturbed soil at every point along pipe's entire length, except for portions of pipe where it is necessary to excavate for bells and for proper sealing of pipe joints.
 3. For Pipe over 16 Inches in Diameter:
 - a. Overexcavate bottom of trench by at least 4 inches, or 1/12 outside diameter of pipe, whichever is greater.
 - b. Fill overcut with bedding material specified herein, and fine graded as specified.
 - c. Place bedding material at uniform density, with minimum possible compaction.
 - d. Where trench excavation is below grade of bedding material, restore trench bottom to proper grade by backfilling and compacting backfill to 95 percent of maximum density, at no additional cost. Use bedding material as specified in this Section.
 4. Bell or Coupling Holes:
 - a. Dig holes after trench bottom has been graded.
 - b. Provide holes of sufficient width to provide ample room for grouting, banding, or welding.
 - c. Excavate holes only as necessary in making joints and to ensure that pipe rests upon prepared trench bottom and not supported by any portion of the joint.
 5. Depressions for Joints, Other than Bell-and-Spigot:
 - a. Make in accordance with recommendations of joint manufacturer for particular joint used.
- C. Pipe Bedding:
1. Bedding material shall be as scheduled herein.

2. After Pipe Laid:
 - a. Place bedding material under and around pipe in maximum 6-inch lifts to level even with spring line of pipe, and compact to 90 percent of maximum density.
 - b. Fill section of trench from spring line to 12 inches above top of pipe in maximum 6-inch lifts with bedding material and water settle or mechanically compact to 90 percent of maximum density.
 3. Pipe Displacement:
 - a. Take necessary precautions in placement and compaction of bedding material to prevent displacement of piping.
 - b. In event there is movement or floating, re-excavate re-lay, and backfill the pipe.
 4. Consolidation:
 - a. Do not use water settling methods when backfill material is not sufficiently granular in nature to be self-draining during and after consolidation and when foundation materials may be softened or otherwise damaged by water.
 - b. When flooding, poling, or jetting methods are used, place and consolidate material used as backfill in layers not exceeding 4 feet in thickness.
 - c. Supplement flooding and poling, or jetting methods by use of vibratory or other compaction equipment when necessary to obtain required compaction.
- D. Trench Backfill Above Pipe Bedding:
1. Cuts Across Roadways and Paved Streets:
 - a. Backfill trench to underside of pavement with aggregate base course material compacted to 95 percent of maximum density.
 2. Under and Parallel to Roadways, Paved Areas, or Storage Areas:
 - a. Backfill trench up to within 2 feet of finish grade with native material compacted to 90 percent of maximum density.
 - b. Then backfill from 2 feet below finish grade to finish grade, or underside of aggregate base course or pavement as indicated on the Drawings with native material, aggregate base course material, or select material, compacted to 95 percent of maximum density.
 3. In Areas Outside the Improved Section of Roadways or in Open Country:
 - a. Backfill to finish grade with native material compacted to 90 percent of maximum density.
 4. Through Earth Slopes or Embankments Adjacent to, or Supporting Structures:
 - a. Backfill to finish grade with aggregate base course material or approved select material compacted to 95 percent of maximum density.
- E. Under Existing Intersecting Pipes or Conduits Larger than 3 Inches in Diameter:
1. Backfill from bottom of new pipe trench to spring line of intersecting pipe or conduit with aggregate base course material compacted to 90 percent of maximum density when tested in accordance with ASTM D 1556 or ASTM D 2922.
 2. Extend aggregate base course material 2 feet on either side of intersecting pipe or conduit to ensure that material remains in place while other backfill is placed.
 3. Backfill remainder of trench according to Paragraph D, above.

- F. Compacting Native Material:
 - 1. Assure that native material, when used as previously specified, is capable of being compacted to degree specified.
 - 2. If native material cannot be compacted to density as previously specified, remove and dispose of material whether it has been placed in trench as backfill or not, and utilize other backfill material from another source acceptable to the ENGINEER.

- G. Excess Material:
 - 1. Remove excess excavated material from the project site and dispose of legally off site, at a location approved by Owner.

3.03 FIELD QUALITY CONTROL

- A. Tests:
 - 1. Confirmation Tests:
 - a. Contractor's Responsibilities:
 - 1) Accomplish specified compaction of trench backfill.
 - 2) Control operations by confirmation tests in accordance with ASTM D2922 to verify and confirm that compaction work complies, and is complying at all times, with requirements specified in this Section concerning compaction, control, and testing.
 - 3) Cost of Confirmation Tests: Paid for by the CONTRACTOR.
 - 4) Copies of Confirmation Test Reports: Submit promptly to the ENGINEER.
 - b. Frequency of Confirmation Testing:
 - 1) Perform testing not less than as follows:
 - a) For Trenches: At each test location include tests for each type or class of backfill from bedding to finish grade.
 - b) Test a minimum of every 400 linear feet of reclaimed water pipeline installed.
 - 2. Compliance Tests:
 - a. Frequency of Testing: Periodic compliance tests will be made by the ENGINEER to verify that compaction is meeting requirements previously specified.
 - b. If Compaction Fails to Meet Specified Requirements: Perform remedial work by one of the following methods:
 - 1) Remove and replace backfill at proper density.
 - 2) Bring density up to specified level by other means acceptable to the ENGINEER.
 - c. Retesting:
 - 1) Costs of Retesting: Costs of retesting required to confirm and verify that remedial work has brought compaction within specified requirements shall be borne by the CONTRACTOR.
 - 2) Contractor's Confirmation Tests During Performance of Remedial Work:
 - a) Performance: Perform tests in manner acceptable to the ENGINEER.
 - b) Frequency: Double amount specified for initial confirmation tests.

3. Water Testing Pipe:
 - a. After Bedding the Pipe, CONTRACTOR Has the Following Option To:
 - 1) Water-test pipe.
 - 2) Backfill to surface, at his own risk, before water-testing pipe.
 - b. If pipe does not pass test, uncover pipe, locate leaks, repair and retest, repeating until pipe section under test passes.

3.04 SCHEDULES

- A. Fine Grading Materials:
 1. Where required, fine grading material shall be the same as bedding material.
- B. Bedding Materials:
 1. For Pipe less than 15 Inch Nominal Size: Except as otherwise specified, use approved native or aggregate base course.
 2. For Pipe from 16 Inch to 48 Inch Nominal Size: Except as otherwise specified, use approved native or aggregate base course.
 3. For Polyvinyl Chloride or Other Plastic Pipe less than 2 Inches in Diameter: Sand or approved select material.
- C. Backfill Materials:
 1. Aggregate base course as specified in Section 02722 or approved native or select material.

END OF SECTION

SECTION 02448

JACKING STEEL PIPE CASINGS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Requirements for boring and jacking of casing pipe, installation of carrier pipe, and sealing of annular space.
- B. Related Sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 02240 - Dewatering.
 - 3. Section 02260 - Excavation Support and Protection.
 - 4. Section 02300 - Earthwork.
 - 5. Section 02312 - Controlled Low Strength Material (CLSM).
 - 6. Section 03600 - Grouts.
 - 7. Section 15052 - Basic Piping Materials and Methods.
 - 8. Section 15211 - Ductile Iron Pipe: AWWA C151.
 - 9. Section 15956 - Piping Systems Testing.

1.02 REFERENCES

- A. American Society of Testing and Materials (ASTM):
 - 1. A 283 - Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
- B. American Welding Society (AWS):
 - 1. D1.1.

1.03 DEFINITIONS

- A. Carrier Pipe: Water pipe.
- B. Casing Pipe: Sleeve through which carrier pipe will be placed.
- C. Boring and Jacking: Method of installing casing pipe by cutting, hand mining, or boring an opening in soils material, and simultaneously forcing casing pipe through it with hydraulic jacks.
- D. Casing Spacer: Fabricated item for positioning a carrier pipe inside a casing pipe.
- E. Annular Space: The space between the outside of the carrier pipe and the inside of the casing pipe.
- F. Voids: The space between the outside of the casing pipe and the soil.

- G. End Seals: Creates a seal or barrier between the casing pipe and carrier pipe to ensure filling material is maintained within or foreign objects kept out of the annular space.
- H. Obstructions: Obstructions shall be defined as objects or portions of objects located wholly or partially within the cross-sectional area excavated by bore and jack operations that are larger than one-third (1/3) the outer diameter of the cutter head, and that prevent the forward motion of the auger.

1.04 SUBMITTALS

- A. Documentation of qualifications and experience of boring and jacking contractor including the name and telephone number of references for at least three projects of similar drive length, casing diameter, and soil conditions. Provide name of site safety representative and person responsible for gas testing and evidence of CalOSHA certification for each, respectively.
- B. Working drawings and written procedures describing in detail proposed bore and jack method and entire operation to be used, including, but not limited to:
 - 1. Casing installation schedules addressing excavation, casing and carrier pipe installation, and backfill operations.
 - 2. Detailed locations and sizes of all jacking and receiving pits.
 - 3. Shoring design drawings and calculations signed and stamped by a structural engineer licensed in California.
 - 4. Shaft base material.
 - 5. Type of cutter head.
 - 6. Size, capacity and arrangement of proposed equipment.
 - 7. Method of removing soils and method of installing the casing and carrier pipe.
 - 8. Casing details including diameter, thickness, class of steel and fabrication drawings from casing supplier.
 - 9. Catalog data for casing spacers and end seals.
 - 10. Guidance system and method of monitoring and controlling line and grade.
 - 11. Equipment, location and method of detecting surface movement.
 - 12. Groundwater control methods, drawings, details, and calculations.
 - 13. Equipment and method used for providing temporary ventilation.
 - 14. Contingency plan for:
 - a. Surface subsidence or heave.
 - b. Equipment failure.
 - c. Encountering obstructions.
 - d. Tunnel failure.
 - 15. Calculations for anticipated jacking forces.
 - 16. Jacking capacity of casing pipe indicating a safety factor of 2.0 or more.
 - 17. Grouting equipment, procedures, and proposed mixes for grouting the annular space and voids.
- C. Soils investigation program and report.
- D. Design calculations indicating external earth and live loadings on steel casing pipe and required wall thickness.

- E. Steel pipe welding procedures.
- F. Certifications: The CONTRACTOR shall furnish a certified affidavit of compliance for all pipe and other products or materials furnished under this Section and the following supplemental requirements:
 - 1. Physical and chemical properties of all steel.

1.05 QUALITY ASSURANCE

- A. Installation Qualifications: Successfully completed at least 3 projects of similar diameter, length, soil, and installation conditions.
- B. Notify the ENGINEER a minimum of 3 days in advance of the start of boring operations.

1.06 SAFETY

- A. The District has obtained from the State of California, Department of Industrial Relations, Division of Occupational Safety and Health Administration (CalOSHA) an underground classification of "Potentially Gassy" for these crossings. The classification is included at the end of this Section. Perform work in conformance with all applicable federal, state, and local safety requirements.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Casing pipe:
 - 1. Type: Steel conforming to ASTM A 283, Grade C. Shop and field joints shall be butt welded.
 - 2. Internal Diameter: As indicated on the Drawings and be within 1-1/2 percent of being true circle.
 - 3. Wall Thickness: Minimum of 3/8 inch, or as indicated on the Drawings, or in accordance with the design calculations in 1.04D, whichever is thickest.
- B. Carrier pipe: See Section 15211.
- C. Casing Spacers:
 - 1. Band: Minimum 14-gauge steel band:
 - a. 8-inch minimum width.
 - 2. Finish:
 - a. Rust inhibiting paint.
 - b. Fusion Bonded PVC Coating:
 - 1) 10-16 mils.
 - 2) Durometer - shore A2 (10 sec, ASTM D1706-61T): 80.
 - 3. Runners:
 - a. Painted 2-inch Wide Glass Reinforced Polymer:
 - 1) Tensile Strength (ASTM D638): 17,600 psi minimum.
 - 2) Flexural Strength (ASTM D790): 25,300 psi minimum.
 - 4. Liner: Polyvinyl Chloride:
 - a. Thickness: 0.09-inch minimum.
 - b. Hardness Durometer "A": 85-90.

5. Risers: 10 gauge steel MIG welded to band.
 6. Manufacturers: One of the following or approved equal:
 - a. Pipeline Seal and Insulator, Inc.
 - b. Advance Products & Systems.
 - c. Cascade Waterworks Manufacturing Company.
- D. Material for Filling of Annular Space: CLSM conforming to Section 02312.
- E. Material for Filling of Voids: Grout or CLSM:
 1. Grout shall conform to Section 03600 2.01D.
 2. CLSM shall conform to Section 02312.
- F. Casing End Seals:
 1. Materials:
 - a. Seal: 1/8 inch thick synthetic rubber.
 - b. Bands and Clamps: Stainless steel.
 2. Manufacturers: One of the following or approved equal:
 - a. Pipeline Seal and Insulator, Inc., Model S or C.
 - b. Advance Products & Systems, Model AC.
 - c. Maloney Technical Products, MULTIFLEX End Seal.

2.02 EQUIPMENT

- A. Use boring and jacking equipment compatible with the geologic conditions described in the Geotechnical Report.
- B. Jacks: Of adequate capacity to push the casing through the soil as required to complete the crossing. Provide a suitable jacking frame and thrust block to carry out the work.
- C. Horizontal Boring Machine: Capable of boring to diameter and length as required, maintaining grade and alignment within tolerances as indicated on the Drawings.
- D. Bracing: Capable of withstanding pressure generated by jacks without displacement when jacking pipe for pipe's total length.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify Soil Conditions. Report variations from geotechnical report.

3.02 JACKING AND RECEIVING PIT CONSTRUCTION

- A. Locate jacking and boring pits where indicated on the Drawings or as submitted and approved by the ENGINEER.
- B. The jacking and receiving pits shall be designed and stamped by a structural engineer licensed in the State of California.
- C. The shoring system shall be in accordance with Section 02260.

- D. Excavate jacking and receiving pits in accordance with Section 02300.
- E. Construct pits in accordance with working drawings submitted to and approved by the ENGINEER.

3.03 INSTALLATION OF STEEL CASING

- A. The following tolerances apply to the installation of the casing and the carrier pipe:
 - 1. Horizontal Line Tolerance: 2 inches.
 - 2. Vertical Grade Tolerance: 2 inches.
- B. When personnel are working inside the casing provide a temporary ventilation system and air monitoring system conforming to the requirements of CalOSHA and OSHA. Operate and maintain a ventilation system that provides a sufficient supply of fresh air and maintains an atmosphere free of toxic or flammable gasses in all underground work areas.
- C. Use removable auger and cutting head arrangement.
- D. Set the casing to be jacked on guide rails, properly braced to support the casing, and direct it in the proper line and grade. Line up the jacking assembly in the direction and grade of the tunnel.
- E. Securely anchor leading edges of casings with steel jacking heads to prevent wobble or alignment variation during jacking operations.
- F. Weld each casing joint completely prior to jacking.
- G. Jack casing pipe with auger rotating within pipe to remove spoils.
- H. Control the application of the jacking pressure and excavation of materials ahead of the casing as it advances to prevent the casing from becoming earthbound or from deviating from the required line and grade. Check line and grade using surveying methods from inside the casing, or other method approved by the ENGINEER, at least every 60 feet or every third casing section, whichever is less, unless permitted otherwise by the ENGINEER.
- I. To minimize voids outside the casing, excavation shall be carried out entirely within the jacking head and not in advance of the head. Coordinate the advance of the casing and boring rate to avoid over excavation. Maintain a soil plug inside the jacking head and steel casing as required to minimize loss of ground. Restrict the excavation of the materials to the least clearance necessary to prevent binding in order to avoid loss of ground and consequent settlement or possible damage to overlying pavements, utilities, or structures.
- J. Obstructions:
 - 1. The auger head selected for use by the CONTRACTOR shall have the capability to advance past objects smaller than one-third the outer diameter of the auger head. The CONTRACTOR shall receive no additional compensation for removing, clearing, or otherwise making it possible for the auger head to advance past objects consisting of cobbles, boulders, reinforced or nonreinforced concrete, and other non-metallic objects or debris with

- maximum lateral dimensions less than one-third (1/3) the outer diameter of the auger head.
2. The CONTRACTOR shall remove, clear, or otherwise make it possible for the auger and jacked pipe to advance past any and all objects or obstructions that halt forward progress of the auger head.
 3. The CONTRACTOR will receive compensation for removal of objects defined above as obstructions larger than one-third (1/3) the outer diameter of the auger head. Payment will be negotiated with the DISTRICT on a case-by-case basis subject to the following procedures:
 - a. The CONTRACTOR shall notify the ENGINEER immediately upon encountering an obstruction that prevents forward progress of the machine.
 - b. Upon written notification of the ENGINEER, the CONTRACTOR shall immediately proceed with removal of the obstruction by means of an obstruction removal shaft or by other approved means, as submitted by the CONTRACTOR in favorably reviewed submittals. However, any removal process that does not allow direct inspection of the nature and position of the obstruction will not be considered for payment negotiation. An obstruction removal shaft shall consist of a small excavation for the purpose of removing the obstruction. The obstruction removal shaft shall be constructed in accordance with Sections 02260 Excavation Support and Protection and 02300 Earthwork.
- K. Excavated materials shall be removed from the casing as the boring and jacking operation progresses. No accumulation of excavated materials within the casing shall be permitted.
- L. The CONTRACTOR shall be fully responsible for correcting all pavement settlement and any other damage that occurs as a result of installation of the casing.
- M. Provide grout connections on steel casing with 36 inch or larger inside diameter at a maximum of 6 feet on center:
 1. CLSM maybe used in lieu of grout.
 2. Upon completion of the jacking operation, grout voids around outside face of steel casing.
 3. Have grouting equipment and material on the job site before the jacking operations are completed so that grouting may be started immediately.
 4. Place grout by pumps capable of pressures up to 100 pounds per square inch unless otherwise accepted by the ENGINEER.
 5. Control grouting pressure to approximately 10 pounds per square inch to avoid movement of the ground around steel casing.
 6. After grouting has been completed, close the grouting connections with threaded steel plugs.
- N. When not ready to place the carrier pipe immediately following completion of the jacking or tunneling operation, protect the ends with temporary bulkheads.

3.04 INSTALLATION OF CARRIER PIPE

- A. Install carrier pipe as shown on the Drawings in accordance with specified tolerances.

- B. Remove all loose soil from casing.
- C. Provide casing insulators as specified by the casing insulator manufacturer to provide a straight and even grade at inverts and to prevent flotation, movement, or damage to the pipe during installation.
- D. Push carrier pipe through casing pipe and make each joint as pipe is being inserted:
 - 1. All joints of the carrier pipe within the casing shall be completed in accordance with Sections 15052 and 15251.
- E. Hydrostatic testing of the carrier pipe shall be completed prior to filling of the annular space between the casing and carrier pipe. Pressure testing shall be performed in accordance with Section 15956.
- F. Hold Down Method in Casing Pipe:
 - 1. Watermains, force mains, and gravity sewers:
 - a. Fill pipe with water or provide other acceptable positive means to prevent flotation during placement of fill in casing.
- G. Filling the annular space. Furnish all materials and equipment necessary for the backfilling operation. Backfill materials shall conform to the requirements of Section 02312. CLSM shall be pumped through a pipe or hose. The CLSM shall be proportioned to flow and to completely fill the annular space between the carrier pipe and the casing.
- H. Install casing end seals as indicated on the Drawings.

3.05 SETTLEMENT MONITORING

- A. Surface settlement monitors:
 - 1. Install surface settlement monitors at:
 - a. Jacking pit.
 - b. Receiving pit.
 - c. Two (2) intermediate points between the jacking and receiving pits, or a minimum of every 50 feet, whichever is greater.
 - 2. Surface settlement monitors shall be furnished and installed in accordance with the approved submittal required in 1.04B11.
 - 3. Make observations of installed settlement monitors a minimum of twice daily.
 - 4. In the event of settlement or heave on any monitor, immediately cease work and take immediate action to prevent further settlement or heave in accordance with the approved contingency plan.
 - 5. Restore surface elevations to those existing prior to start of bore and jack operations.
- B. Subsurface settlement monitors:
 - 1. Install subsurface settlement indicators as required prior to start of dewatering or bore and jack activities.
 - 2. Monitor movements of indicators to an accuracy of +/- 0.01 foot.
 - 3. Whenever bore and jack occurs within 20 feet of the indicator, monitor movements of indicator before and after each advance.

- C. Report any settlement or movement immediately to the ENGINEER and jurisdictional agency and take immediate remedial action:
 - 1. The CONTRACTOR shall submit readings within 24 hours.

END OF SECTION

SECTION 02581
PRECAST ELECTRICAL HANDHOLES AND ELECTRICAL MANHOLES

PART 1 GENERAL

1.01 SUMMARY

- A. Design, fabricate, and install precast electrical handholes and precast electrical manholes of the size and type indicated on the Drawings and specified:
 - 1. Construction of cast-in-place concrete electrical structures, including handholes and manholes, are specified in other Sections.

- B. Section includes:
 - 1. Precast polymer concrete handholes and accessories.
 - 2. Precast portland cement concrete handholes and accessories.
 - 3. Precast portland cement concrete manholes and accessories.

- C. Related sections:
 - 1. Section 01410 - Regulatory Requirements.
 - 2. Section 01612 - Seismic Design Criteria.
 - 3. Section 02300 - Earthwork.
 - 4. Section 03150 - Concrete Accessories.
 - 5. Section 03300 - Cast-in-Place Concrete.
 - 6. Section 05500 - Metal Fabrications.
 - 7. Section 07900 - Joint Sealants.
 - 8. Section 16050 - Common Work Results for Electrical.
 - 9. Section 16070 - Hangers and Supports.
 - 10. Section 16133 - Duct Banks.

- D. Alternates:
 - 1. Contractor may propose to construct cast-in-place structures in lieu of the precast structures specified:
 - a. Obtain Engineer's acceptance of this alternative before submitting, providing, or installing.
 - b. Submit full information on design and detailing of proposed alternatives including design details and drawings of the same types required by this Section for precast structures.

1.02 REFERENCES

- A. American Association of State Highway Transportation Officials (AASHTO):
 - 1. Standard Specifications for Highway Bridges.

- B. American Concrete Institute (ACI):
 - 1. 318 - Building Code Requirements for Structural Concrete and Commentary.

- C. ASTM International (ASTM):
 - 1. A48 - Standard Specification for Gray Iron Castings.
 - 2. C857 - Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
 - 3. C858 - Standard Specification for Underground Precast Concrete Utility Structures.

4. C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures.
 5. C1028 - Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
 6. C1037 - Standard Practice for Inspection of Underground Precast Concrete Utility Structures.
- D. Code of Federal Regulations (CFR):
1. Title 29, Chapter XVII, Part 1910 - Occupational Safety and Health Standards (OSHA).
- E. National Fire Protection Association (NFPA):
1. National Electrical Safety Code (NEC).
- F. National Precast Concrete Association (NPCA).
- G. Society of Cable Telecommunications Engineers (SCTE):
1. 77 - Specification for Underground Enclosure Integrity.
- H. Underwriters Laboratories (UL).

1.03 DEFINITIONS

- A. Handhole: An enclosure for use in underground systems that has been sized and detailed to allow personnel to reach into, but not enter, the enclosure to install, operate, or maintain equipment or wiring or both. (Reference: NEC, Article 100):
1. As used in this Section, "handhole" will refer to a precast electrical handhole.
- B. Manhole: An enclosure for use in underground systems that has been sized and detailed to allow personnel to enter the enclosure to install, operate, or maintain equipment or wiring or both:
1. As used in this Section, "manhole" will refer to a precast electrical manhole.
- C. Polymer concrete: A composite material consisting of an organic polymer binder mixed with embedded aggregate particles. Also known as "resin concrete":
1. Abbreviated "PC" as in "PC HANDHOLE."
- D. Portland cement concrete: A composite material consisting of a portland cement binder, water, admixtures, and a combination of fine and coarse mineral aggregates:
1. Abbreviated "PCC" as in "PCC HANDHOLE" or "PCC MANHOLE."
- E. Precast concrete: A concrete fabrication designed by a qualified engineer and subsequently fabricated at a qualified fabrication site, which is usually located some distance from the site where the fabrication will be installed.

1.04 SYSTEM DESCRIPTION

- A. General requirements for handholes and manholes:
1. As specified in Section 16050 for general requirements for electrical work.

2. Provide structures of the sizes and shapes indicated on the Drawings, with layouts, dimensions, and details as indicated on the Drawings and as specified.
 3. Conform to the requirements of:
 - a. NEC.
 - b. Project regulatory requirements as specified in Section 01410.
- B. Polymer concrete handholes:
1. Load resistance of boxes and covers:
 - a. Conform to all provisions of SCTE 77 for Tier 5, 8, 15, or 22 applications as specified in this Section:
 - 1) Where multiple "Tiers" are specified, handholes shall adequately support compatible covers while providing the highest Tier rating specified.
 - 2) Load rating of cover for an assembly shall not exceed the load capability of the box below.
 - 3) Coefficient of friction between cover and box: Not less than 0.50 when measured in accordance with ASTM C1028.
 2. Testing and certification:
 - a. Each handhole to be installed shall have a report certifying that the design and construction of the unit has successfully passed all tests for materials and product performance required by SCTE 77:
 - 1) Testing and report shall be by a qualified testing agency, independent of the manufacturer. Test report shall bear the seal of a licensed professional engineer.
 - 2) Provide evidence of UL listing as required by NEC for products to be provided.
- C. Portland cement concrete handholes and manholes:
1. Load resistance of boxes and covers.
 2. Design requirements: Loads on structures:
 - a. In accordance with ASTM C 857, except as modified in this Section.
 - b. Loads at the ground surface:
 - 1) See "Electrical Handhole and Manhole Schedule" indicated on the Drawings for minimum surface loading requirements at each structure. Loads are designated as "sidewalk," or "roadway."
 - 2) The vehicle and pedestrian loadings in the following paragraphs need not be additive; however, structures designated for "roadway" loading shall also support "sidewalk" loads.
 - 3) "Sidewalk": Load from regular pedestrian traffic with considerations for occasional non-deliberate vehicular traffic:
 - a) Designation "A-0.3" in ASTM C 857 Table 1 (300-psf uniform load).
 - 4) "Roadway": Load from heavy, frequently repeated vehicle traffic:
 - a) Designation "A-16" in ASTM C 857 Table 1 (AASHTO HS20-44).

- c. Lateral earth pressure loads:
 - 1) Determine in accordance with the following requirements. Include effects of groundwater and seismic accelerations on lateral earth pressures:
 - a) Surface surcharge load:
 - (1) In accordance with ASTM C857 Vehicle Load Designation "A-16" for "Roadway" or "A-0.3" for "Sidewalk" where such surcharge exceeds backfill loads described in the preceding paragraph.
 - b) Groundwater effects:
 - (1) Include effects from groundwater and soils saturated by flooding.
 - c) Seismic acceleration effects:
 - (1) See Section 01612 for seismic design criteria.
 - (2) Apply seismic effects as additive force on side where the soil mass is being accelerated toward the structure, and as subtractive force on the opposite side where the soil mass is being accelerated away from the structure.
- d. Groundwater and flood loads - buoyancy effects:
 - 1) Groundwater: Design for site groundwater elevation taken at the level of finished grade around the structure.
 - 2) Buoyancy: For groundwater and flood conditions, provide factor of safety against flotation of at least 1.20:
 - a) If the weight of soil overlying footing projections on the structure is considered to resist flotation, use a buoyant unit weight of soil equal to not more than 30 pounds per cubic foot.
 - b) Concrete fill may be provided in the bottom section of precast portland cement concrete structures to add weight. Submit proposed details.
- e. Soil-bearing pressure at base:
 - 1) Maximum pressure not greater than the weight of the vertical column of soil removed.
- f. Lifting and handling loads:
 - 1) Make provision in the design for the effects of loads or stresses that may be imposed on structures during fabrication, transportation, or erection.
- g. Load combinations:
 - 1) Design structures to sustain the specified loads individually or in combination.
- 3. Design requirements: Structural analysis, design, and detailing:
 - a. General:
 - 1) Analyze and design structures including the effects of 2-way action ("plate action") and of load transfer around current and future openings.
 - 2) Where structures include panels designed for future removal ("knockout panels"), design structures for loads and stresses with any combination of any or all such panels in place or removed.
 - b. Precast polymer concrete handholes:
 - 1) Design to resist loads with cover in place or removed.
 - 2) Detail cover support and top edges to maintain cover in place over walls and to prevent soil from sloughing into the handhole when cover is removed.

- c. Precast portland cement concrete handholes and manholes:
 - 1) Design structures in accordance with the requirements of ACI 318 and this Section.
 - 2) Provide reinforcement at all areas subject to tensile stress when loaded with the specified loads and combinations thereof.
 - 3) Provide temperature and shrinkage reinforcement to equal or exceed ACI 318 requirements in all concrete sections.
 - 4) Provide minimum clear concrete cover over reinforcement at both interior and exterior faces of all members in accordance with the following:
 - a) Handholes: 1.25 inches.
 - b) Manholes: 2 inches.
 - 5) Reinforcement details:
 - a) Walls: For structures with wall thickness of 8 inches or less, locate a single mat of reinforcement at the center of the wall.
 - b) Slabs: For structures with slab thickness of 7 inches or less, locate a single mat of reinforcement at the center of the slab.
 - c) Structures with wall or slab thicknesses exceeding these limits shall have a reinforcement at each face of the member.
 - 6) Joints:
 - a) Provide structures with watertight joints between sections, and detailed to minimize water infiltration at duct bank and conduit penetrations.
 - b) Provide structures with non-skid, shiplap or tongue and groove joints between sections.

1.05 SUBMITTALS

- A. Product data: Manufacturer's catalog data, details, and warranties for the following items:
 - 1. Polymer concrete handholes:
 - a. Materials of construction, and resistance of those materials to water absorption, flammability, sunlight/ultraviolet exposure, and chemicals likely to be found in the area of use.
 - b. Available colors.
 - c. Details for covers, cover support, and cover attachment to the underlying box.
 - 2. Portland cement concrete handholes and manholes:
 - a. Materials of construction.
 - b. Joint details and joint-sealing materials.
 - c. Data for hatches or covers and rings.
 - d. Preformed channels and accessories for cable racking.
 - e. Drain and sump details, including removable covers.
 - f. Pulling iron details.
- B. Shop drawings:
 - 1. Polymer concrete handholes:
 - a. Manufacturer's catalog cuts showing dimensions and details of construction.

2. Portland cement concrete handholes and manholes:
 - a. Shop drawings for each structure shall bear the seal and signature of a professional engineer licensed in the state where the structures will be installed.
 - b. Dimensioned and “to-scale” plans, sections, and details for each structure including:
 - 1) Layout plan for that structure.
 - 2) Sizes, locations, and vertical positions of duct bank windows and knockout panels.
 - 3) Locations and details for access openings, pulling irons, embedded cable supports and racks, and sumps.
 - 4) Details of structural reinforcement showing bar size and spacing; true position of reinforcement in structural members with clear concrete cover at both inside and outside faces; location, bar size, and spacing of added reinforcement around openings; and other details relevant to design and fabrication of the structure.
 - 5) Details of joints between adjacent precast sections, including provisions for overlap and for placement of sealants.
- C. Design data:
1. Portland cement concrete handholes and manholes:
 - a. Structural calculations:
 - 1) Submit complete structural calculations for each structure.
 - 2) Provide calculations bearing the seal and signature of a professional engineer licensed in the state where the structures will be installed.
 - 3) Calculations will be filed for record. Review comments will not be returned.
 - b. Manufacturer’s statement of materials used for fabrication and construction, in accordance with ASTM C858, for record. Include the following:
 - 1) Concrete mix design: For each concrete mix design to be used for the structures, include data describing:
 - a) Source and type of cement.
 - b) Sources, grading, and specific gravities of aggregates.
 - c) Aggregate reactivity data.
 - d) Concrete mix proportions and design strength.
 - e) Type, name, and dosage of all admixtures included in the concrete mix.
 - 2) Reinforcing steel: Mill certificates.
- D. Test reports:
1. Polymer concrete handholes:
 - a. Independent laboratory test reports bearing the seal of a licensed professional engineer and demonstrating compliance with the requirements of SCTE 77 for the loading conditions specified.
 2. Portland cement concrete handholes and manholes:
 - a. Fabricator’s tests for compressive strength of concrete used in structures, made in accordance with recommendations of ASTM C858.

- E. Certificates:
 - 1. Polymer concrete handholes:
 - a. Manufacturer's certification that polymer concrete handholes are in accordance with the requirements of SCTE 77.
 - 2. Portland cement concrete handholes and manholes:
 - a. Manufacturer's current plant certification under NPCA for the structures to be supplied:
 - 1) Certification shall be current and in-effect at the time structures are manufactured.
 - b. Manufacturer's certification that handholes and manholes are in accordance with the requirements of ASTM C858.
- F. Manufacturer's instructions:
 - 1. Instructions for handling and setting structures in place.
- G. Manufacturer's field reports:
 - 1. Portland cement concrete handholes and manholes:
 - a. Manufacturer's inspection reports in accordance with ASTM C1037.
- H. Closeout documents:
 - 1. Project record documents:
 - a. Portland cement concrete handholes and manholes:
 - 1) Final, revised plans and details of as-constructed precast handholes and manholes if requested for record by the Engineer.
 - 2. Warranties:
 - a. Manufacturer's standard warranty for:
 - 1) Polymer concrete handholes.
 - 2) Portland concrete handholes and manholes and accessories.

1.06 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Designer:
 - a. Portland cement concrete handholes and manholes:
 - 1) Professional engineer qualified in the design of concrete structures and holding a current license in the state where the structures will be installed.
 - 2. Manufacturer:
 - a. Polymer concrete handholes:
 - 1) Demonstrating at least 5 years of experience in the design and production of products of the type required for this Work.
 - 2) Holding product testing records demonstrating load resistance of products to be installed.
 - b. Portland cement concrete handholes and manholes:
 - 1) Holding current NPCA plant certification for the products produced.
 - 2) Demonstrating at least 5 years of experience in the design, production, and installation of products of the type required for this Work.
 - 3) Capable of providing structural designs prepared by a professional engineer licensed in the state where the structures will be installed.
 - 4) Providing inspection during fabrication and handling in accordance with the requirements of ASTM C1037.

3. Installer:
 - a. Capable of providing equipment of adequate capacity and mobility to handle and set units with proper bearing on the subgrade and without damage to the unit.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Packing, shipping, handling, and unloading:
 1. Package and brace structures to avoid damage during shipping and handling.
 2. Furnish crane or forklift for unloading and setting of portland cement concrete handholes and manholes.
- B. Acceptance at site:
 1. Structures delivered to the site with cracks, damage, and damaged or missing accessories shall be removed from the site and replaced at no additional cost to the Owner.
- C. Storage and protection:
 1. Store handholes and manholes and their appurtenances in areas protected from damage due to weather and site operations.

1.08 SEQUENCING

- A. Coordinate installation of precast electrical handholes and manholes with duct banks specified in Section 16133.

1.09 WARRANTY

- A. Provide manufacturer's standard warranty for precast handhole and manhole structures and accessories.

1.10 SYSTEM START-UP

- A. As specified in Section 16050.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS - POLYMER CONCRETE HANDHOLES

- A. General:
 1. Enclosures, boxes, and cover shall conform to all test provisions of SCTE 77.
- B. Manufacturers: One of the following or equal:
 1. Quazite Division of Hubble, Incorporated.
 2. Carson Industries, LLC.
- C. Materials:
 1. Polymer concrete with optional fiberglass reinforcement:
 - a. Handholes constructed of plastic or fiberglass will not be permitted.

- D. Components:
1. Cover:
 - a. Provide gasketed cover with lifting slot and stainless steel hex head bolts for attachment to box.
 - b. Fasten cover to box using stainless steel hex head bolts.
 - c. Skid-resistant surface: Coefficient of friction for walking surface on top of cover shall be at least 0.50 when measured in accordance with ASTM C1028.
 - d. Custom logo not required.
 2. Box:
 - a. Open-bottom base unless otherwise indicated on the Drawings:
 - 1) Stackable sections with interlocking joints to maintain horizontal and vertical alignment.
 - b. Provide knockouts, terminators, pulling eyes, and inserts as required for a complete installation.
 3. Fabrication:
 - a. All components in assembly (boxes and cover) shall be manufactured using matched surface tooling for consistency of production.

E. Load rating:

1. Provide "TIER" rating based on Schedule of Electrical Handholes and Electrical Manholes indicated on the Drawings, and the following loading requirements:

Surface Loading Rating	Requirements
"Sidewalk"	"TIER 15" - "Medium Duty" For driveway, parking, and ramp areas where vehicle wheel loads will not exceed 2,000 pounds on a single wheel.
"Roadway"	Not allowed. - "Heavy Duty" For highway traffic or AASHTO wheel loads of at least 16,000 pounds.

2. Provide covers with "TIER" rating embossed or cast into the top surface.
3. Design load rating of cover for an assembly may not exceed the design load rating of the box below.

F. Accessories:

1. Provide 2 non-corroding steel lifting hooks for removing covers.

2.02 MANUFACTURED UNITS - PORTLAND CEMENT CONCRETE HANDHOLES AND MANHOLES

A. General:

1. Provide portland cement concrete handholes and manholes configured and designed as indicated on the Drawings and specified.
2. In accordance with ASTM C858 unless otherwise noted.

B. Manufacturers: One of the following, or equal:

1. Oldcastle Precast.
2. Jensen Precast.

- C. Components:
1. Floor:
 - a. Construct floors as a monolith.
 - b. Where sump or low-point drain is included, slope floor to that point.
 2. Roof, walls, and base:
 - a. Designed and rated to support vehicle and pedestrian loads at the spans indicated.
 - b. See the Electrical Handhole and Manhole Schedule indicated on the Drawings for required load rating by structure location.
 3. Access covers:
 - a. Handholes: Aluminum plate hinged floor access door (hatch) as specified in Section 08320:
 - 1) Load rating:
 - a) "Heavy Duty" for covers at locations designated for "Roadway" loads.
 - b) "Medium Duty" or stronger for covers at locations designated for "Sidewalk" loads.
 - 2) Minimum access door size not less than 36 inches square, unless otherwise indicated on the Drawings.
 - 3) Provide bearing surface with pre-installed continuous elastomeric gasket to minimize water infiltration at lid.
 - 4) Provide skid-resistant lid with cast-in or machined-in grid pattern and the word "ELECTRICAL" in block letters at least 1.5 inches high.
 - b. Manholes: Cast iron frame and cover:
 - 1) Manhole rings and covers: As specified in Section 05500.
- D. Accessories:
1. Provide accessories as indicated on the Drawings and specified.
 2. Materials at duct bank penetrations:
 - a. Joint filler as specified in Section 03150.
 - b. Backer rod and sealant as specified in Section 07900.
 3. Pulling irons:
 - a. Provide non-corroding cable pulling irons located for use with each current duct bank location and additional irons for use with duct banks that may be installed through future knockout panels.
 - b. Pulling irons may not be located on the floor.
 - c. Where pulling irons are installed on the wall, any pockets surrounding the irons shall have bottom surfaces sloped to drain.
 - d. Secure pulling eyes to structure reinforcement.
 4. Cable racks and racking hardware:
 - a. Materials: Hot-dip galvanized steel as specified in Section 16070.
 - b. Embedded slots: Maximum depth of 1.5 inches.
 5. Sumps and drains:
 - a. Fiberglass or HDPE fabrications including removable lids to prevent tripping hazards.
 6. Exterior dampproofing:
 - a. As specified in Section 07110.
 - b. Field applied to all wall and roof surfaces exposed to soil.

- E. Fabrication:
 - 1. Embeds:
 - a. Install embedded items with provisions for drainage to remove dripping or standing water, and to minimize corrosion:
 - 1) Pulling irons may not be placed on the floor or in pockets that will collect water.
 - 2) Detail bottom of cable rack channels to provide a downward sloping "sill" at the bottom of each vertical channel, so that the channel slot drains toward the floor.
 - b. Concrete cover:
 - 1) Provide minimum 0.75-inch clear concrete cover between embeds and surrounding reinforcement.
 - 2) Provide minimum 1.25-inch clear concrete cover between embed and exterior face of wall.
- F. Tests and inspections:
 - 1. Test and inspect structures in accordance with ASTM C858 and ASTM C1037.

PART 3 EXECUTION

3.01 GENERAL

- A. Furnish and install precast electrical handholes and manholes as indicated on the Drawings and specified.
- B. Install additional handholes and manholes required so installation procedures will conform to cable manufacturer's pulling tension requirements:
 - 1. Include proposed locations and details of such additional handholes and manholes with the submittals under Part 1.

3.02 PREPARATION

- A. Design:
 - 1. Prepare detailed and scalable layouts for each manhole structure showing locations of conduit or duct bank penetrations, clearances, locations, and sizes of access openings and major accessories.
- B. Protection:
 - 1. Where handhole and manhole structures are installed adjacent to existing site structures or utilities, provide excavation support or other protection as required to maintain those facilities in service and to prevent damage to both existing and new facilities.
- C. Site preparation:
 - 1. Excavate and prepare exposed subgrade.
 - 2. Install and compact foundation layer.
 - 3. Level foundation materials so that structures will be set plumb, and duct banks will be at proper grade and alignment:
 - a. Install with uniform bearing on foundation materials.
 - b. Wedging or blocking of base sections for leveling over the foundation materials will not be permitted.

3.03 INSTALLATION

- A. General:
 - 1. Protect handholes and manholes from displacement, flooding, or flotation.
- B. Polymer concrete handholes:
 - 1. Install structures in accordance with the manufacturer's recommendations.
 - 2. Clean joints between adjacent sections for tight fit.
 - 3. Set covers at elevations indicated on the Drawings:
 - a. Securely attach cover to below-grade box.
 - 4. Backfill polymer concrete handholes as indicated on the Drawings and as specified.
- C. Portland cement concrete handholes and manholes:
 - 1. Install structures in accordance with ASTM C891 and the provisions of this Section:
 - a. In the event of conflicts, the more restrictive provisions shall apply.
 - 2. Clean and prime joints between adjacent precast sections:
 - a. Install sealing compound between sections and provide watertight joints.
 - 3. Set covers and hatches at elevations indicated on the Drawings:
 - a. Securely attach frames to top of precast structures and grade adjustment rings.
 - 4. Penetrations:
 - a. Holes for duct banks and other penetrations may not be cut into precast handholes and manholes unless they are located at designated locations shown on the shop drawings or at knockout panels cast into the structure during manufacturing.
 - b. Carefully remove concrete from knockout panel areas with saws:
 - 1) Ensure that break-back does not extend beyond the designated limits of the knockout panel.
 - c. Coat any reinforcement cut or exposed during removal of knockout panel sections with minimum 2 coats of high solids epoxy as specified in Section 09960:
 - 1) Apply epoxy coating applied over and at least 1-inch past the perimeter of the reinforcement.
 - 5. Install duct banks and conduit penetrations in accordance with the penetration details indicated on the Drawings:
 - a. Place all joint fillers, caulks, and sealants before coating exterior concrete surface with bituminous dampproofing.
 - 6. Fill holes that were provided for handling or other temporary purposes with non-shrink cement grout using procedures as specified in Section 03300 unless otherwise detailed by the manufacturer.
 - 7. After structures are set and before backfilling, coat exterior below-grade surfaces (around the sidewalls, over the top slab, and around any vertical risers to grade) with 2 heavy coats of bituminous dampproofing as specified in Section 07110:
 - a. Apply dampproofing in accordance with the coating manufacturer's instructions and at a rate of 40 to 60 square feet per gallon per coat.
 - b. Mask over at least 1 inch back from joint caulks or sealants, and prevent dampproofing from coming in contact with those materials.
 - 8. Backfill handholes and manholes.

- D. Site tolerances:
 - 1. Set electrical handholes and manholes plumb and true at locations indicated on the Drawings.
 - 2. Tolerances on placing:
 - a. Horizontal location: Plus or minus 1 inch.
 - b. Vertical elevation: Plus or minus 1/2 inch.
 - c. Plumb: Plus or minus 1/8 inch over 10 feet.

3.04 REPAIR/RESTORATION

- A. Repair cracks or blemishes in concrete.

3.05 ADJUSTING

- A. After final grading is complete, adjust access covers to grade.

3.06 CLEANING

- A. Before installation of cables in any duct banks and handholes or manholes, remove all concrete spoil, forms, debris, silt, dust, and other foreign material.

3.07 SCHEDULES

- A. See Drawings for Electrical Handhole and Electrical Manhole Schedule.

END OF SECTION

SECTION 02722

AGGREGATE BASE COURSE

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Aggregate base course.
- B. Related Sections:
 - 1. Section 02300 - Earthwork.

1.02 REFERENCES

- A. State of California Department of Transportation:
 - 1. Standard Specifications.
 - 2. California Test 205.
 - 3. California Test 217.
 - 4. California Test 229.
 - 5. California Test 301.
- B. American Society of Testing and Materials (ASTM):
 - 1. C 117 - Standard Test Method for Materials Finer than 75 μ M (No. 200) Sieve in Mineral Aggregate by Washing.
 - 2. C 131 - Standard Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - 3. C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 4. D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.03 SUBMITTALS

- A. Product Data:
 - 1. Source.
 - 2. Gradation.
 - 3. Testing data.
- B. Quality Control:
 - 1. Test Reports: As required by Sections of the current edition of the Caltrans Standard Specifications.
 - 2. Certificates of Compliance: As required by Sections of Standard Specifications.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Protection: Protect from segregation and excessive moisture during delivery, storage, and handling.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Aggregate Base Course:
1. Class 2, 3/4-inch maximum aggregate size free from vegetable matter and other deleterious substances, and of such nature that aggregate can be compacted readily under watering and rolling to form a firm, stable base.
 2. Materials derived from processing demolished or removed asphalt concrete are not acceptable.
 3. Aggregate Base Course for Structures:
 - a. Consist of crushed or fragmented particles.
 - b. Coarse aggregate material retained in Number 4 sieve shall consist of material of which at least 25 percent by weight shall be crushed particles when tested in accordance with California Test 205.
 4. Aggregate shall not be treated with lime, cement, or other chemical material before the Durability Index test is performed.
 5. Durability Index: Not less than 35 when tested in accordance with California Test 229.
 6. Aggregate grading and sand equivalent tests shall be performed to represent not more than 500 cubic yards or one day's production of material, whichever is smaller.
 7. Sand Equivalent: Not less than 22 when tested in accordance with California Test 217.
 8. Resistance (R Value): Not less than 78 when tested in accordance with California Test 301.
 9. Conform to size and grade within the limits as follows when tested in accordance with ASTM C 117 and ASTM C 136:

Sieve Sizes (Square Openings)	Percent by Weight Passing Sieve
1 inch	100
3/4 inch	90-100
Number 4	35-60
Number 30	10-30
Number 200	2-9

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine conditions upon which the work specified in this Section depends for defects that may influence installation and performance.
- B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Subgrade Preparation: Prepare as specified in Section 02300.

3.03 INSTALLATION

- A. Furnish, spread, and compact material to the lines, grades, and dimensions indicated on the Drawings:
 - 1. Spread in accordance with sections of Standard Specifications.
 - 2. Compact in accordance with sections of Standard Specifications.

3.04 FIELD QUALITY CONTROL

- A. Tests: Perform field tests as required by sections of Standard Specifications.

END OF SECTION

SECTION 02742

ASPHALTIC CONCRETE PAVING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Asphalt concrete pavement on prepared subgrade or aggregate base course, and on existing pavement, to lines, grades, compacted thicknesses, and cross sections indicated on the Drawings.

1.02 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. Standard Specifications for Transportation Materials and Methods of Sampling and Testing:
 - a. MP1: Specification for Performance Graded Asphalt Binder.
- B. ASTM International (ASTM):
 - 1. C 117 - Standard Test Method for Material Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing.
 - 2. C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - 3. C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 4. D 977 - Standard Specification for Emulsified Asphalt.
 - 5. D 2041 - Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
 - 6. D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.03 DEFINITIONS

- A. Bituminous prime coat: Consist of application of hot bituminous material on previously prepared base course.

1.04 SYSTEM DESCRIPTION

- A. Performance requirements:
 - 1. Compact the asphalt concrete to at least 95 percent of the density of the theoretical maximum density in accordance with ASTM D 2041.

1.05 SUBMITTALS

- A. Proposed mix design and gradation of materials.
- B. Quality control submittals:
 - 1. Certificate of Compliance.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Asphalt concrete delivery:
 - 1. Transport the mixture from the mixing plant to the point of use in vehicles having tight bodies previously cleaned of all foreign materials.
 - 2. Treat bodies as necessary to prevent material from sticking to the bodies.
 - 3. Cover each load with canvas or other suitable material of sufficient size and thickness to protect the asphalt mixture from the weather.

1.07 PROJECT CONDITIONS

- A. Environmental requirements:
 - 1. Asphalt concrete:
 - a. Place asphalt concrete only when surface is dry, and when atmospheric temperature in the shade is 40 degrees Fahrenheit and rising, or above 50 degrees Fahrenheit if falling.
 - b. Do not place asphalt concrete when weather is foggy or rainy or when base on which material is to be placed is in wet or frozen condition.
 - 2. Prime coat:
 - a. Do not apply prime coat when atmospheric temperature is below 60 degrees Fahrenheit.
 - b. Apply prime coat only when base course is dry or contains moisture not in excess of that which will permit uniform distribution and desired penetration.

1.08 SEQUENCING AND SCHEDULING

- A. Prime coat:
 - 1. Prior to requesting Engineer's acceptance for application, inspect area to be coated to determine its fitness to receive bituminous priming material.
 - 2. Do not begin application before area to be coated has been accepted for application by the Engineer.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Prime coat: Use bituminous material for prime coat conforming to requirements for SC-70 and apply at temperature of 105 to 175 degrees Fahrenheit at rate of 0.3 to 0.6 gallons per square yard by use of bituminous distributor.
- B. Sand: Acceptable to the Engineer.
- C. Tack coat: Grade SS-1h anionic emulsion in accordance with ASTM D 977.
- D. Asphalt concrete materials:
 - 1. Asphalt cement: Conform to requirements for asphalt cement, PG 64-10 AASHTO MP1.

2. Mineral aggregate:
 - a. Consist of coarse aggregate of crushed stone or gravel composed of hard, durable particles, sand, and filler as follows:
 - 1) Coarse aggregate: Portion of material retained on Number 8 sieve.
Fine aggregate: That portion passing Number 8 sieve.
 - b. Provide composite material that is uniformly graded from coarse to fine and that complies with requirements of one of following gradings when tested in accordance with ASTM C 136.
 - c. Asphalt concrete: As indicated on the Drawings, 2-course plant mix for asphalt concrete having an overall thickness of 2 1/2 inches or more if not indicated. If less than 2-1/2 inches of asphalt concrete, use single-course plant mix.

Plant Mix, Two Course				Plant Mix, Single Course	
Seal, 3/4 inch Thick Minimum		Base, 1-3/4 inch Thick Minimum		1-1/2 inch Thick Minimum	
Sieve Size	Percent Passing	Sieve Size	Percent Passing	Sieve Size	Percent Passing
1/2"	100	1-1/4"	100	3/4"	100
3/8"	95 - 100	1"	87 - 100	1/2"	75 - 95
No. 4	50 - 70	3/4"	75 - 90	3/8"	65 - 85
No. 8	35 - 55	3/8"	55 - 72	No. 4	50 - 65
No. 30	15 - 30	No. 4	40 - 60	No. 8	35 - 50
No. 100	5 - 15	No. 8	30 - 50	No. 30	15 - 30
No. 200	3 - 8	No. 30	15 - 30	No. 100	5 - 15
		No. 100	5 - 15	No. 200	3 - 8
		No. 200	3 - 8		

3. Coarse aggregate:
 - a. Consist of at least 70 percent by weight of each size aggregate and consist of particles that have at least 1 rough, angular surface produced by crushing:
 - 1) Have percentage of wear of not more than 50 at 500 revolutions, in accordance with ASTM C 131.
 - b. Aggregate plasticity index: Not more than 2 in accordance with ASTM D 4318.
 - c. Sand may be added to crusher or pit-run product to supply any deficiency in Number 8 sieve and filler may be added to supply any deficiency in Number 200 sieve material. If aggregate contains an excess of sand, wasting will be required.
 - d. Filler:
 - 1) Use finely powdered limestone, portland cement, or other artificially or naturally powdered mineral dust acceptable to the Engineer.
 - 2) Weigh filler and add separately to each batch at time of proportioning.
 - 3) Use filler that is free from deleterious matter of any kind.

- 4) Fineness that meet the following requirements:
 - a) Passing Number 50 sieve: 100 percent.
 - b) Passing Number 200 sieve: At least 75 percent.
- 5) Determine amount of material passing the Number 200 sieve in accordance with ASTM C 117.
- e. Provide composite aggregate that is free from vegetable matter, lumps or balls of clay, adherent films of clay, or other matter which would prevent thorough coating of asphalt cement.
- f. Materials derived from processing demolished, or removed asphalt concrete, are not acceptable.

E. Fog sealing: Asphalt emulsion, Grade SS-1h.

2.02 EQUIPMENT

- A. Bituminous distributor: Designed and equipped so as to distribute bituminous material uniformly at even heat on variable widths of surface at readily determined and controlled rate with pressure range of 25 to 75 pounds per square inch.
- B. Liquid asphalt distributor:
 1. Designed and operated to distribute asphaltic material in uniform spray without atomization.
 2. Equipped with bitumeter having dial registering feet of travel per minute:
 - a. Locate dial so that it is visible to truck driver so that he can maintain constant speed required for application at specified rate.
 3. Equip pump with tachometer having dial registering gallons per minute passing through nozzles:
 - a. Locate dial so that it is readily visible to operator.
 4. Provide means for accurately indicating temperature of asphaltic material in distributor at all times:
 - a. Locate thermometer well so that it is not in contact with, or close to, heating tube.
 5. Have spray bar having normal width of application of not less than 12 feet and capable of providing for application of lesser width when necessary.
 6. Provided with hose and spray nozzle attachment for applying asphaltic material to patches and areas inaccessible to spray bar.
 7. Equipped with heating attachments and capable of circulating asphaltic material through spray bar during entire heating process.
- C. Asphalt concrete mixing plants:
 1. Equipment:
 - a. Use screen and storage bins at plant of sufficient capacity to furnish the necessary amount of all aggregates, when operating at the maximum capacity of the plant, with no periods of undue waiting for material:
 - 1) Use bins consisting of at least 2 compartments, so proportioned as to ensure adequate storage of appropriate fractions of the aggregate.
 - 2) Provide each compartment with an overflow pipe of such size and at such location as to prevent any backing up of material into other compartments.

- b. Dryer:
 - 1) Designed to heat and dry the aggregate to Specification requirements and to agitate it continuously during the heating.
 - 2) Capable of preparing aggregates at a rate equal to the full-rated capacity of the plant.
- c. Dust collector:
 - 1) So constructed as to waste or return uniformly to the hot elevator all or any part of the material collected.
- d. Mixer:
 - 1) Adequate capacity, with twin shafts.
- e. Thermometers:
 - 1) Furnished for determining the temperature of the mix.
- f. Weighing and measuring equipment:
 - 1) Weighing or volumetric measuring equipment of sufficient capacity.
 - 2) Devices to permit easy readjustment of any working part needing readjustment, so that the equipment will function properly and accurately.
 - 3) Attach scales for weighing to the bucket.
 - 4) Test and seal all weighing equipment by a representative of the Inspector of Weights and Measures having jurisdiction, as often as the Engineer may deem necessary to ensure accuracy.
- g. Tanks for storage of bituminous material:
 - 1) Capable of heating the material under effective and positive control at all times to temperatures within the range stipulated.

2. Asphalt concrete plant operation:

- a. Mineral aggregate:
 - 1) Dry and heat mineral and then screen into at least 2 fractions and conveyed into separate compartments ready for proportioning and mixing.
 - 2) When combined with asphalt cement.
- b. Aggregate:
 - 1) Contain not more than 2 percent moisture by weight.
 - 2) Be at a temperature within the range of that specified for the asphalt cement but not more than 25 degrees Fahrenheit above the temperature of the asphalt cement.
- c. Combine dry aggregate in the plant in the proportionate amounts of each fraction of aggregate required to meet the specified grading:
 - 1) Introduce the asphalt cement into the mixer in the amount and at the temperature for the particular material being used.
 - 2) Continue mixing for at least 30 seconds, and for such longer period as may be necessary to coat all the particles.
- d. When a continuous mixer is used, determine the mixing time by weight method using the following formula:
 - 1) $\text{Mixing time in seconds} = \text{Pugmill dead capacity in pounds.}$
 - 2) $\text{Pugmill output in pounds per second.}$

D. Asphalt-concrete-placing equipment:

- 1. Use equipment for placing, spreading, shaping, and finishing asphalt concrete consisting of a self-contained power machine operating in such manner that no supplemental spreading, shaping, or finishing is required to provide surface that complies with requirements for smoothness contained in this Section:
 - a. In areas inaccessible to the machine, hand spreading may be permitted.

2. Furnish 1 self-propelled, pneumatic-tired roller, and one 8-ton (minimum), smooth-wheel tandem roller:
 - a. When spreading is in excess of 100 tons per hour, furnish 1 additional roller of either type for each additional 100 tons, or fraction thereof, spread per hour.

2.03 MIXES

- A. Asphalt cement:
 1. Do not mix at temperatures lower than 275 degrees Fahrenheit or higher than 325 degrees Fahrenheit.
 2. Usual amount of asphalt cement, by weight, to be added to aggregate be 5.4 to 5.8 percent of weight of mixture.
- B. Asphalt concrete:
 1. Before being delivered to the site, mix aggregate with asphalt cement at the central mixing plant.
 2. Use mixing plants that are in good working order with no excessively worn parts and so equipped that:
 - a. Temperatures of aggregates leaving dryer, of asphalt cement entering mixer, and of mix leaving mixer can be readily determined and positively controlled within Specification limits at all times.
 - b. Weights of different sizes of aggregates and of asphalt cement as set by the Engineer can be consistently introduced into the mixer.
 - c. Asphalt cement can be uniformly distributed throughout the mixture with aggregate completely coated.
 - d. Mixing time can be positively controlled to minimum specified.
 - e. Bin samples of aggregate can be readily obtained.
 - f. Provide means of calibrating weighing devices.

PART 3 EXECUTION

3.01 PREPARATION

- A. Protection:
 1. Prime-coated surfaces:
 - a. Maintain surfaces until succeeding layer of pavement has been placed.
 - b. During this interval, protect primed surfaces against damage and repair any broken spots.
- B. Surface preparation:
 1. Prime coat:
 - a. Where portions of base course prepared for immediate treatment are excessively dry, sprinkle such portions lightly with water immediately in advance of prime coat application.
 - b. Immediately following preparation of base course, apply bituminous material by means of bituminous distributor at the temperature previously specified.
 - c. Apply priming material in manner that results in uniform distribution being obtained at all points of surface to be primed.

- d. Following the application of prime material, allow the surface to dry for a period of not less than 48 hours without being disturbed, or for such additional period of time as may be necessary to obtain penetration into the base course and drying out or evaporation of the volatiles from prime material.
 - e. Spread sufficient sand on areas that show an excess of bituminous material to effectively blot up and cure the excess.
2. Base courses:
- a. Thoroughly clean base and apply prime coat before placing asphalt concrete.
 - b. Thoroughly clean any existing base, surfacing, or pavement prior to placing plant-mixed surfacing.
 - c. Where existing pavement is being widened or extended, cut to straight vertical face and treat with asphalt paint binder prior to paving operations.
 - d. When asphalt concrete is to be applied over existing pavement and local irregularities in existing surface would result in course of more than specified thickness, bring surface of existing pavement to uniform contour by patching with asphalt concrete thoroughly tamped or rolled until it conforms with surrounding surface, and then apply tack coat.

3.02 APPLICATION

- A. At existing asphalt to be paved over: Apply tack coat at minimum rate of 0.10 gallons per square yard.
- B. Placing and compacting asphalt concrete:
 - 1. Placing and compacting asphalt mixture: Progress in sections generally not more than 750 linear feet in length.
 - 2. Spreading of mixture:
 - a. Spread, shape, and finish by specified equipment.
 - b. Spread each successive strip adjacent to previously spread strip.
 - c. Do not compact minimum 6-inch width of each strip adjacent to new strip until after new strip has been placed.
 - d. Spread as nearly continuous as possible.
 - e. Laying against vertical surfaces such as gutters: Roughen and clean face of vertical surfaces as required for proper bonding and then paint with light coating of asphalt cement or emulsified asphalt.
 - f. At terminations of new surface courses: Feather asphalt mixture into existing surface over such distance as may be required to produce smooth riding transition.
 - g. Base-course and single-course construction: Joined by vertical butt joints, finished and rolled to smooth surface.
 - h. Rolling:
 - 1) Perform initial or "breakdown" rolling with tandem power roller and follow spreading operation when mixture has reached temperature where it does not "pick up" on rolls.
 - 2) Keep rolls properly moistened but do not use surplus of water.
 - 3) Follow initial rolling with pneumatic roller when mixture is in proper condition and when rolling does not cause undue displacement, cracking, or shoving.
 - 4) Begin rolling at sides and progress gradually to center, lapping each preceding track until entire surface has been rolled.

- 5) Terminate alternate trips of roller in stops at least three feet distant from any preceding stop.
 - 6) At any place not accessible to roller, thoroughly compact mixture with tampers and finish, if necessary, with hot iron to provide uniform layer over entire width being paved.
3. Provide finish surface having uniform texture.
- C. Fog sealing:
1. Fog seal asphalt pavement after compaction with fog sealing material applied at rate of 0.05 gallons per square yard at the following locations:
 - a. All asphalt pavement.
- D. Full-depth asphalt pavement:
1. Pneumatic rollers used for initial or secondary rolling: Use 12 to 15 tons with tires capable of 90-pounds-per-square-inch inflation pressure.
 2. Asphalt concrete for full-depth asphalt pavement:
 - a. Asphalt concrete as previously specified in this Section.
 - b. Apply bituminous prime coats where full-depth asphalt pavement is installed.
 3. Except for asphalt thickness, aggregate base course thickness, and prime coating, full-depth asphalt pavement shall comply with requirements of this Section.

3.03 FIELD QUALITY CONTROL

- A. Placement:
1. Place the mixture on the roads, pavements, or walks at a temperature not less than 225 degrees Fahrenheit.
- B. Tests:
1. Provide sampling and control testing for the asphalt concrete.
 - a. Type and size of the samples: Suitable to determine conformance with stability, density, thickness, compaction, and other specified requirements.
 - b. Use an approved power saw or core drill for cutting samples.
 - c. Furnish all tools, labor, and materials for cutting samples, testing, and replacing the pavement where samples were removed.
 - d. Take a minimum of 1 sample per 200 tons of asphalt concrete placed.
- C. Inspection:
1. Asphalt concrete:
 - a. Test with a 10-foot straightedge laid on the surface parallel with the centerline of the road. Variation of the surface from the testing edge of the straightedge not to exceed 1/4 inch.

END OF SECTION

SECTION 02762

PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Pavement marking requirements for striping, text, and graphics; traffic signs.

1.02 SUBMITTALS

- A. Product data.
- B. Manufacturer's instructions.

1.03 QUALITY ASSURANCE

- A. Applicator qualifications: Minimum 5 year's experience of applying traffic markings with satisfactory performance record.
- B. Regulatory requirements: Comply with applicable requirements of governmental agencies having jurisdiction, including airborne emissions and industrial waste disposal requirements.

1.04 PROJECT CONDITIONS

- A. Apply pavement marking paint when:
 - 1. Pavement is clean and thoroughly dry.
 - 2. Ambient temperature is above 40 degrees Fahrenheit.
 - 3. Precipitation is not expected within 12 hours of completion of application.

PART 2 PRODUCTS

2.01 PAVEMENT MARKING PAINT

- A. Manufacturers: One of the following manufacturers or equal:
 - 1. Dunn-Edwards Corporation, Los Angeles, CA.
 - 2. Glidden Company, Cleveland, OH.
 - 3. Sherwin Williams Company, Cleveland, OH.
- B. Materials:
 - 1. Pavement marking paint, latex based: One of the following or equal:
 - a. Dunn-Edwards: No. W 801, Vin-L-Stripe, epoxy-modified acrylic-latex based paint.
 - b. Glidden: 63240 Series, UltraHide Latex Traffic Paint.
 - c. Sherwin Williams: Set fast acrylic water borne traffic marking paint.

2. Pavement marking paint, alkyd based: One of the following or equal:
 - a. Glidden: 63220 Series, UltraHide Traffic Paint.
 - b. Sherwin Williams: ProMar Alkyd Traffic Marking Paint.
3. Masonry conditioner: One of the following or equal:
 - a. Sherwin Williams: B46WZ1000, Masonry Conditioner.
4. Colors:
 - a. Text: White.
 - b. Parking dividers: White.
 - c. No parking zone markings: Yellow.
 - d. No parking curb: Red.
 - e. Handicap zone markings: Blue and white:
 - 1) Blue paint: Match color No. 15090 in Federal Standard 595A as specified in Section 2-1720 of California Administrative Code Title 24 Handicap Regulations.
 - f. Accessible parking dividers and accessible route: Yellow.
 - g. Directional arrows: White.
 - h. Driving lane dividers: White.

2.02 TRAFFIC SIGNS

- A. Manufacturers: One of the following or equal:
 1. Seton Name Plate Co., Branford, Connecticut.
 2. Emedco, Buffalo, New York.
- B. Material, shapes, and graphics: Post mounted baked enamel on steel sheet, reflectorized to show the same shape and color both day and night, with mounting holes, in accordance with the Uniform Traffic Control Devices manual. Fasten sign to post with stainless steel bolts.

PART 3 EXECUTION

3.01 PREPARATION

- A. Remove dirt, oil, grease, and other materials which may affect paint adhesion.
- B. Apply masonry conditioner on weathered or sandblasted surfaces, brick, or stucco.

3.02 APPLICATION

- A. Apply paint at package consistency whenever possible. Thin paint as little as possible.
- B. Apply paint with specifically designed and manufactured equipment for pavement marking. Provide:
 1. Uniform straight edges without overspray.
 2. Four inch wide lines, unless indicated otherwise.
 3. Hatching in handicap parking areas.
- C. Provide striping between parking stalls as indicated on the Drawings:
 1. Identify parking spaces with text as indicated on the Drawings:
 - a. Compact spaces: COMPACT.
 - b. Carpool spaces: CARPOOL.

- c. Motorcycle spaces: MOTORCYCLE.
 - d. Visitor spaces: VISITOR.
- D. Apply paint to obtain thickness recommended by paint manufacturer.
- E. Paint traffic control markings, including striping, directional arrows, cross walks and lettering, and handicap striping and symbols as indicated on the Drawings and in accordance with local governing agency's standards. Use stencils for arrows, lettering, and symbols.
- F. Apply 700 square inch international handicap symbol on pavement surface where indicated on the Drawings:
- 1. On asphalt surfaces, paint blue symbol on white square.
 - 2. On concrete surfaces, paint white symbol on blue square.
- G. Install traffic signs where indicated on the Drawings. Set post in concrete to depth to resist sign damage from wind speed of 100 miles per hour.

END OF SECTION

SECTION 02820

FENCES AND GATES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Metallic fences and gates. Fences and gates at the Blackhorse Reservoir site shall match existing fences and gates.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 1. A 120 - Specification for Pipe, Steel, Black, and Hot Dipped Zinc-Coated (Galvanized) Welded and Seamless for Ordinary Uses.
 2. A 121 - Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.
 3. A 123 - Specification for Zinc (Hot Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strip.
 4. A 153 - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 5. A 385 - Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
 6. A 392 - Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
 7. A 702 - Specification for Steel Fence Posts and Assemblies, Hot-Wrought.
 8. F 626 - Specification for Fence Fittings.
 9. F 668 - Specification for Polyvinyl Chloride (PVC)-Coated Chain-Link Fence Fabric.
- B. State of California Department of Transportation (CALTRANS):
 1. SS - Standard Specifications.
 2. SP - Standard Plans.

1.03 SUBMITTALS

- A. Product Data: Submit data completely describing products.
- B. Samples: Provide for polyvinyl chloride coated fabric and accessories.
- C. Quality Control Submittals:
 1. Certificates of Compliance: Provide certification that materials conform to referenced specifications.
 2. Manufacturer's Instructions: Provide for automatic gate equipment.

1.04 QUALITY ASSURANCE

- A. Qualifications: Provide installer's references and list of local references.
- B. Pre-installation Conference: Participate in conference, if required.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Handling: Unload, store, and protect materials such that they are not damaged.

1.06 PROJECT CONDITIONS

- A. Field Measurements: Verify actual field distances so that post spacing can be made uniform.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Chain Link Fence And Gates: One of the following or equal:
 - 1. Master-Halco.
 - 2. Allied Tube and Conduit.

2.02 MATERIALS

- A. Fabric:
 - 1. Height:
 - a. Fence: 8 feet 0 inch.
 - 2. Mesh: 2 inches.
 - 3. Size Wire: 6 gauge:
 - a. Coating: Zinc coating, ASTM A 392, Class 1.
 - b. Color Coating: PVC, ASTM F 668, Color Selected by ENGINEER.
 - c. Tensile Strength: 80,000 pounds per square inch minimum.
 - d. Barbed Wire:
 - 1) Total Number Strands: 3.
 - 2) Wires Per Strand: 2.
 - 3) Size Wires: 12-1/2 gauge.
 - 4) Barbs: 14 gauge, 4-point at 3 inches on center.
 - 5) Coating: Galvanized, ASTM A 121, Class 3.
- B. Top Rail:
 - 1. Size: 1-5/8 inch outside diameter, galvanized.
 - 2. Weight: 2.27 pounds per linear foot.
 - 3. Tension Wire: 7 gauge galvanized coil spring wire.
- C. Line Posts: 2-3/8 inch outside diameter, 3.65 pounds per linear foot, galvanized.
- D. Terminal, Corner, and Pull Posts:
 - 1. Size: 2-7/8 inch outside diameter round.
 - 2. Weight: 5.79 pounds per linear foot.

- E. Gate Posts and Concrete Foundations for Gate Posts: Except where differently indicated on the Drawings, determine gate posts and concrete foundations for gate posts in accordance with following schedule:

Gate Leaf Widths (Feet)	Posts		Foundations	
	O.D. (Inches)	(Lbs per Lin Ft)	Diameter (Inches)	Depth (Feet)
0 TO 6	2-7/8	5.79	12	4
Over 6 to 13	4	9.11	18	3
Over 13 to 18	6-5/8	18.97	18	4
Over 18 to 25	8-5/8	24.70	18	4.5

- F. Gate Frames: 1.90 inch outside diameter galvanized pipe weighing 2.72 pounds per linear foot.
- G. Color: Coat posts, rails, and frame the same color as fabric and per ASTM F 626.
- H. Accessories:
1. Fence Fittings: Conform to ASTM F 626.
 2. Post Top Fittings:
 - a. General: Provide post top fitting extension arms designed such that top rail passes through extension arm fitting.
 - b. Post Top Fittings: Extension arms, 45-degree angle type, capable of receiving three strands of barbed wire.
 3. Fabric Accessories:
 - a. Wire Clips: Minimum 6 gauge hot-dip galvanized.
 - b. Tension Bars: 1/4 inch by 3/4 inch, galvanized.
 - c. Steel Bands: 11 gauge, one inch wide, hot-dip galvanized.
 - d. Bolts and Nuts: 3/8 inch diameter.
 - e. Hog Rings: 11 gauge.
- I. Gate Accessories:
1. Corner Fittings: Heavy pressed steel or malleable castings.
 2. Gate Tensioning:
 - a. Cross Tensioning Rods: 3/8 inch, galvanized.
 - b. Turnbuckles: Heavy duty.
 3. Tension Rods for 4 Foot Gates: 3/8 inch, easily adjustable, galvanized.
 4. Gate Frame Corner Fittings: Fitting designed for purpose, manufacturer's standard.
 5. Horizontal Gate Stiffeners: 1-5/8 inch outside diameter galvanized pipe weighing 2.27 pounds per linear foot.
 6. Gate Hardware:
 - a. Catch and Locking Attachment: Combination steel or malleable iron catch and locking attachment of acceptable design.
 - b. Stops.
 - c. Type 1: Capable of holding gates open.
 - d. Type 2: Center rest with catch.

2.03 SPECIAL GATES

- A. Roller Gates:
 - 1. Material: As specified in Paragraph 2.02.
- B. Tracking Channel: Provide each channel with stop permanently attached at rear of channel:
 - 1. Roller Guide: Steel guide capable of being cast into roadway.
 - 2. Posts for Gate and Track Support: 3 inch by 3 inch tubing.
- C. Coatings:
 - 1. As specified in Paragraph 2.02.

2.04 FABRICATION

- A. Shop Finishing:
 - 1. Galvanizing: For items not fabricated of galvanized materials hot-dip galvanize products after fabrication in accordance with following as applicable:
 - a. ASTM A 123.
 - b. ASTM A 153.
 - c. ASTM A 385.
 - 2. Mark galvanized products with name of galvanize, applicable ASTM designation, and weight of zinc coating.
 - 3. Galvanize fabricated items complete, or in largest practicable sections.
 - 4. Provide galvanizing at rate of 2.0 ounces per square foot, minimum.
 - 5. Hardware:
 - a. Padlocks: Cadmium plated.
 - b. Chain: Galvanized.
- B. Finish Schedule:
 - 1. Ferrous Metal:
 - a. Typical: Clean, then hot-dip galvanize in accordance with galvanizing standards.
 - b. Coat with PVC as specified in Paragraph 2.02.
- C. Field Finish Touch-up Painting:
 - 1. Galvanized Repair Paint: Apply paint having minimum dry film thickness of 2.0 to 3.5 mils.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Verify field conditions prior to construction.

3.02 PREPARATION

- A. Surface Preparation:
 - 1. Before locating fence posts grade ground to permit grade of fence to remain constant over any local elevations or depressions in groundline.

3.03 INSTALLATION

A. Fences and Gates:

1. Chain Link Fences and Gates:

a. General:

- 1) Install chain link fence and gates as indicated on the Drawings and specified in this Section.
- 2) Provide fence systems that are plumb, taut, true to line and grade, and complete in all details.
- 3) Install fencing to generally follow finish grade of ground and provide pull posts at points where required to conform to change in grade.
- 4) Install fencing such that space between bottom of fence and finish groundline does not exceed 3 inches.

b. Concrete Foundation for Fence Posts:

- 1) Set fence posts in concrete foundations, that extend at least 3 feet into ground, and space posts not over 10 feet apart.
- 2) Provide concrete foundations having minimum of 10 inches in diameter for line posts and 12 inches in diameter for corners and gates.
- 3) Provide foundations that extend minimum of 1 inch above finish grade and have tops that are shaped to slope to drain away from posts.
- 4) Trowel finish tops of footings, and slope or dome to direct water away from posts. Set keepers, stops, sleeves, tracks, eye bolts, and other accessories into concrete as required. Wheel rolling area for sliding gates shall be steel-trowel smooth finish concrete.

c. Post Bracing:

- 1) End Corner, Pull, and Gate Posts: Brace with same material as top rail and trussed to line posts with 3/8 inch rods and tighteners.
- 2) Bracing End, Corner, Slope, and Gate Posts:
 - a) Brace to midpoint of nearest line post or posts with horizontal braces used as compression members.
 - b) Then from such line posts truss from brace back to bottom of end, corner, slope, or gate post with 3/8 inch steel truss rods with turnbuckles or other suitable tightening devices used as tension members.

d. Top Rail:

- 1) Unless otherwise specified or indicated on the Drawings, install fencing with top rail and bottom tension wire.

e. Fabric:

- 1) Place fabric on outward facing side of the posts and install so that top edge projects over top rail of fence.
- 2) Stretch fabric taut and securely fasten to posts, top rail and bottom tension wire.
- 3) Install tension wire parallel to line of fabric.
- 4) Fabric: Connect fabric to:
 - a) Line posts with wire clips minimum every 14 inches.
 - b) Terminal, corner, and gate posts with tension bars tied to posts minimum 14 inches on center and with steel bands and bolts and nuts.
 - c) Tension wires with hog rings minimum 24 inches on center.

- f. Post Top Fittings: Provide post tops with extension arms.
- g. Swing Gates:
 - 1) Provide chain link fencing with swing gates, unless otherwise indicated on the Drawings or specified in this Section.
 - 2) Provide swing chain link gates where indicated on the Drawings.

3.04 ADJUSTING

- A. Adjust gate travel, stops, and operator position to meet field conditions.

3.05 CLEANING

- A. Clean up surplus dirt, concrete, and other waste material and dress grade up upon completion of the work.

3.06 PROTECTION

- A. Protect installed fences and gates against damage and, if damaged, repair prior to final acceptance.

END OF SECTION

SECTION 02952

PAVEMENT RESTORATION AND REHABILITATION

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Resurfacing roads and paved surfaces in which surface is removed or damaged by installation of new work.
- B. Related Sections:
 - 1. Section 02722 - Aggregate Base Course.
 - 2. Section 02742 - Asphaltic Concrete Paving.
 - 3. Section 03300 - Cast-in-Place Concrete.

1.02 SYSTEM DESCRIPTION

- A. Performance Requirements:
 - 1. Limiting Dimensions:
 - a. Determine the exact lengths and dimensions of such roads, pavements, parking areas, and walks that will require removal and replacement for new work.
 - b. Join existing surfaces to terminals of new surfacing in smooth juncture.

1.03 SUBMITTALS

- A. Mix Designs:
 - 1. Prior to placement of asphalt concrete, submit full details, including design and calculations for the asphalt concrete mix proposed.
 - 2. Submit gradation of aggregate base.
 - 3. Submit proposed mix design of portland cement concrete.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Aggregate Base Course: As specified in Section 02722.
- B. Asphalt Pavement: As specified in Section 02742.
- C. Portland Cement Concrete Replacement Material: Class A concrete as specified in Section 03300.

2.02 EQUIPMENT

- A. Roads, Pavements, Parking Areas, and Walks:
 - 1. Equipment Requirements: Good condition, capable of performing work intended in satisfactory manner.

2.03 ACCESSORIES

- A. Material for Painting Asphalt Concrete Pavement: Tack coat as specified in Section 02742.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Aggregate Surface Removal Replacement:
 - 1. When trench cut is in aggregate surfaced areas, replace aggregate base course material with material matching existing material compacted to 95 percent of its maximum density.
- B. Pavement Removal and Temporary Asphalt Replacement:
 - 1. Install temporary asphalt pavement or first course of permanent pavement replacement immediately following backfilling and compaction of trenches that have been cut through existing pavement.
 - 2. Except as otherwise provided, maintain this temporary pavement in safe and reasonably smooth condition until required permanent pavement is installed.
 - 3. Remove and dispose of temporary paving from project site.
 - 4. Where longitudinal trench is partly in pavement, replace pavement to original pavement edge, on a straight line, parallel to center line of roadway.
 - 5. Where no part of longitudinal trench is in pavement, surfacing replacement shall only be required where existing surfacing materials have been removed.
- C. Asphalt Pavement Replacement:
 - 1. Replace asphalt pavement to same thickness as adjacent pavement and match as nearly as possible adjacent pavement in texture, unless otherwise indicated on the Drawings.
 - 2. Cut existing asphalt pavements to be removed for trenches or other underground construction by wheel cutter, clay spade, or other device capable of making neat, reasonably straight and smooth cut without damaging adjacent pavement. Cutting device operation shall be subject to acceptance of ENGINEER.
 - 3. Cut and trim existing pavement after placement of required aggregate base course and just prior to placement of asphalt concrete for pavement replacement, and paint trimmed edges with material for painting asphalt concrete pavement immediately prior to constructing new abutting asphalt pavements. No extra payment will be made for these items, and all costs incurred in performing this work shall be incidental to pipe laying or pavement replacement.
 - 4. Conform replacement of asphalt pavement to contour of original pavement.
- D. Portland Cement Concrete Pavement Replacement:
 - 1. Where trenches lie within Portland cement concrete section of streets, alleys, sidewalks, and similar concrete construction, saw cut such concrete (to a depth of not less than 1-1/2 inches) to neat, vertical, true lines in such manner adjoining surfaces are not damaged.
 - 2. Place portland cement concrete replacement material to dimension as indicated on the Drawings.

3. Provide expansion joints that match existing.
4. Provide reinforcing bars per standards of local jurisdiction.
5. Before placing replacement concrete, thoroughly clean edges of existing pavement and wash with neat cement and water.
6. Surface Finish: Wood float finish.

E. Curb, Gutter, and Sidewalk Replacement:

1. Where any concrete curb, gutter, or sidewalk has been removed or displaced, replace to nearest construction joints with new Class A curb, gutter, or sidewalk to same dimensions and finish as original construction that was removed:
 - a. Provide expansion joints of same spacing and thickness as original construction.

3.02 FIELD QUALITY CONTROL

A. Tests:

1. Asphalt concrete as specified in Section 02742.
2. Concrete as specified in Section 03300.

B. Inspection:

1. Asphalt Concrete:
 - a. Lay 10 foot straightedge parallel to center line of trench when the trenches run parallel to street, and across pavement replacement when trench crosses street at angle.
 - b. Remove and correct any deviation in cut pavement replacement greater than 1/4 inch in 10 feet.
2. Portland Cement Concrete Replacement Pavement:
 - a. Lay 10 foot straightedge either across pavement replacement or longitudinal with center line of gutter or ditch.
 - b. Remove and correct any deviation in cut pavement replacement greater than 1/4 inch in 10 feet.

END OF SECTION

SECTION 02977

PAVEMENT REINFORCING FABRIC

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Nonwoven Engineering Fabrics (Geotextile) for restoring asphaltic concrete overlay surfaces.
- B. Related Sections:
 - 1. Section 02952 - Pavement Restoration and Rehabilitation.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. D 276 - Test Methods for Identification of Fibers in Textiles.
 - 2. D 461 - Test Methods for Felt.
 - 3. D 3776 - Test Methods for Mass per Unit Area (Weight) of Woven Fabric.
 - 4. D 3786 - Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm Brushing Strength Tester Method.
 - 5. D 4355 - Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
 - 6. D 4632 - Test Method for Grab Breaking Load and Elongation of Geotextiles.
- B. Texas Department of Transportation (DOT):
 - 1. Texas DOT 3099 - Test Method for Establishing the Asphalt Retention Properties of Geotextile Fabrics.

1.03 DEFINITIONS

- A. Pavement Reinforcing Fabric: Nonwoven reinforcing fabric manufactured from polyester, polypropylene, or polypropylene-nylon material.

1.04 PROJECT CONDITIONS

- A. Field Measurements:
 - 1. Limiting Dimensions:
 - a. Take field measurements to determine the exact lengths and dimensions of such roads, pavements, parking areas, and walks to receive the reinforcing fabric.

1.05 SUBMITTALS

- A. Product Data.
- B. Samples.

- C. Quality Control Submittals:
 1. Certificates of Compliance.
 2. Manufacturer's Instructions.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Protection:
 1. Furnish engineering fabrics in protective covers capable of protecting the fabric from ultraviolet rays, abrasion and water.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. One of the Following or Equal:
 1. Amoco, Petromat 4598.
 2. Tencate, Mirafi Mirapave (MPV 500).

2.02 MATERIAL REQUIREMENTS

- A. Physical Properties: Meet the following minimum requirements:

Property⁽¹⁾	Test Method	Requirements⁽¹⁾
Weight	ASTM D 3776	4.0 to 8.0 ounces per square yard
Grab tensile strength	ASTM D 4632	90 pounds
Grab tensile elongation	ASTM D 4632	40 to 55 percent
Fabric thickness	ASTM D 461	30 to 100 mil.
Asphalt retention	Texas Dot 3099	0.20 gallons per square yard
Melting point	ASTM D 276	300 degrees Fahrenheit
Mullen burst strength	ASTM D 3786	200 to 210 pounds per square inch
UV resistance after 500 hours	ASTM D 4355	70 percent
(1) Minimum average roll values		

2.03 EQUIPMENT

- A. Roads, Pavements, Parking Areas, and Walks:
 1. Use equipment in good condition, capable of performing work intended in satisfactory manner.

2.04 ACCESSORIES

- A. Material for Painting Asphalt Concrete Pavement: Paint binder or emulsified asphalt.

PART 3 EXECUTION

3.01 PREPARATION

- A. Surface Preparation: Before placing the pavement reinforcing fabric, apply a binder of paving asphalt to the surface to receive the pavement reinforcing fabric at an approximate rate of 0.20 gallon per square yard of surface covered:
 - 1. Apply binder to a width equal to the width of the fabric mat plus 3 inches on each side.
- B. Before applying binder, repair large cracks, spalls, and chuckholes in existing pavement.

3.02 INSTALLATION

- A. Follow manufacturer's installation instructions and as complimented herein.
- B. Placement of Reinforcing Fabric:
 - 1. Align and place fabric with no wrinkles that lap:
 - a. Make test for lapping by gathering together the fabric in a wrinkle.
 - b. If the height of the doubled portion of extra fabric is 1/2 inch or more, cut the fabric to remove the wrinkle, then lapped in the direction of paving.
 - c. Remove lap in excess of 2 inches.
 - 2. Do not place pavement reinforcing fabric in areas of conform tapers where the thickness of the overlying asphalt concrete is 0.08 foot or less.
 - 3. If manual lay down methods are used, unroll the fabric aligned, and placed in increments of approximately 30 feet.
 - 4. Lap adjacent borders of the fabric 2 to 4 inches:
 - a. Preceding roll 2 to 4 inches over the following roll in the direction of paving at ends of rolls or at any break.
 - b. At fabric overlays, both the tack coat and the fabric shall overlap the previously placed fabric by the same amount.
 - 5. Seating of the fabric with rolling equipment after placing will be permitted. Turning of the paving machine and other vehicles shall be gradual and kept to a minimum to avoid damage.
 - 6. A small quantity of asphalt concrete may be spread over the fabric immediately in advance of placing asphalt concrete surfacing in order to prevent fabric from being picked up by construction equipment.
 - 7. Do not allow public traffic on the bare reinforcing fabric, except that public cross traffic shall be allowed to cross the fabric, under traffic control, after the placement of a small quantity of asphalt concrete over the fabric.
 - 8. Take care to avoid tracking binder material onto the pavement reinforcing fabric or distorting the fabric during seating of the fabric with rolling equipment. If necessary, cover exposed binder material lightly with sand.

END OF SECTION

SECTION 03071

EPOXIES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Epoxy.
 - 2. Epoxy gel.
 - 3. Epoxy bonding agent.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. D 638 - Standard Test Method for Tensile Properties of Plastics.
 - 2. D 695 - Standard Test Method for Compressive Properties of Rigid Plastics.
 - 3. D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

1.03 SYSTEM DESCRIPTION

- A. Performance Requirements:
 - 1. Provide epoxy materials that are new and use them within shelf life limitations set forth by manufacturer.
 - 2. Perform and conduct work of this Section in neat orderly manner.

1.04 SUBMITTALS

- A. Product Data: Submit manufacturer's data completely describing epoxy materials.
- B. Quality Control Submittals:
 - 1. Manufacturer's installation instructions.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Epoxy: Water-insensitive two-part type low viscosity epoxy adhesive material containing 100 percent solids and meeting or exceeding following characteristics when tested in accordance with standards specified: Manufacturers: One of the following or equal:
 - 1. BASF, Masterinject 1500.
 - 2. Sika Chemical Corp., Sikadur 35 Hi-Mod LV.

Physical Characteristic	Test Method	Required Results
Tensile Strength	ASTM D 638	8,000 pounds per square inch minimum at 14 days and 77 degrees Fahrenheit cure.
Flexure Strength	ASTM D 790	11,000 pounds per square inch minimum at 14 days and 77 degrees Fahrenheit cure.
Compressive Strength	ASTM D 695	16,000 pounds per square inch minimum at 24 hours and 77 degrees Fahrenheit cure.
Bond Strength	--	Concrete shall fail before failure of epoxy.
Gel Time for 5 Mil Film	--	Four hours maximum at 77 degrees Fahrenheit.
Elongation	ASTM D 638	1 percent minimum at 14 days and 77 degrees Fahrenheit.

- B. Epoxy Gel: Manufacturers: One of the following or equal:
1. Sika Chemical Corp., Sikadur 31, Hi-Mod Gel.
- C. Epoxy Bonding Agent: Manufacturers: One of the following or equal:
1. BASF, MasterEmaco ADH 326.
 2. Sika Chemical Corp., Sikadur 32, Hi-Mod LPL.
 3. If increased tack time is required for concrete placement, epoxy resin - portland cement bonding agent as specified in Section 03072 may be used instead of epoxy bonding agent.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install and cure epoxy materials in accordance with manufacturer's installation instructions.
- B. Epoxy:
1. Apply in accordance with manufacturer's installation instructions.
- C. Epoxy Gel:
1. Apply in accordance with manufacturer's installation instructions.
 2. Use for vertical or overhead work, or where high viscosity epoxy is required.
 3. Epoxy gel used for vertical or overhead work may be used for horizontal work.
- D. Epoxy Bonding Agent:
1. Apply in accordance with manufacturer's installation instructions.
 2. Bonding agent will not be required for filling form tie holes or for normal finishing and patching of similar sized small defects.

END OF SECTION

SECTION 03102
CONCRETE FORMWORK

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Concrete formwork.
- B. Related Sections:
 - 1. Section 03300 - Cast-in-Place Concrete.
 - 2. Section 03600 - Grouts.
 - 3. Section 07900 - Joint Sealers.

1.02 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
- B. American Society for Testing of Materials (ASTM):
 - 1. A 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
 - 2. A 153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 3. A 167 - Standard Specification for Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - 4. A 580 - Standard Specification for Stainless Steel Wire.

1.03 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Design of concrete forms, falsework, and shoring in accordance with local, state, and federal regulations.
 - 2. Design forms and ties to withstand concrete pressures without bulging, spreading, or lifting of forms.
- B. Performance Requirements:
 - 1. Construct forms so that finished concrete conforms to shapes, lines, grades, and dimensions indicated on the Drawings.
 - 2. It is intended that surface of concrete after stripping presents smooth, hard, and dense finish that requires minimum amount of finishing.
 - 3. Provide sufficient number of forms so that the work may be performed rapidly and present uniform appearance in form patterns and finish.
- C. National Sanitary Foundation (NSF):
 - 1. 61 - Drinking Water System Components: Health.
 - 2. Use forms that are clean and free from dirt, concrete, and other debris. Coat with acceptable form release oil if required, prior to use or reuse.

1.04 SUBMITTALS

- A. Information on the CONTRACTOR's Proposed Forming System: Submit in such detail as the ENGINEER may require to assure himself that intent of the Specifications can be complied with by use of proposed system.
- B. Alternate Combinations of Plywood Thickness and Stud Spacing: May be submitted.

1.05 QUALITY ASSURANCE

- A. Qualifications of Formwork Manufacturers: Use only forming systems manufactured by manufacturers having minimum 5 years experience, except as otherwise specified, or accepted in writing by the ENGINEER.
- B. Regulatory Requirements: Install work of this Section in accordance with local, state, and federal regulations.

1.06 PROJECT CONDITIONS

- A. Requirements Due to Weather Condition:
 - 1. Removal of Formwork: Do not remove forms from concrete which has been placed when outside ambient air temperature is below 50 degrees Fahrenheit until concrete has attained specified strength as determined by test cylinders stored in field under equivalent conditions as concrete structure.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

- A. Form Ties:
 - 1. General:
 - a. Provide form ties for forming system selected that are manufactured by recognized manufacturer of concrete forming equipment.
 - b. Do not use wire ties or wood spreaders of any form.
 - c. Provide ties of type that accurately tie, lock, and spread forms.
 - d. Provide form ties of such design that when forms are removed, they locate no metal or other material within 1-1/2 inches of the surface of the concrete.
 - e. Do not allow holes in forms for ties to allow leakage during placement of concrete.
 - 2. Cone-Snap Ties:
 - a. Cone-snap ties shall form a cone shaped depression in the concrete with a minimum diameter of 1 inch at the surface of the concrete and 1-1/2 inches deep.
 - b. Provide neoprene waterseal washer that is located near the center of the concrete.
 - 3. Taper Ties:
 - a. Neoprene Plugs for Taper Tie Holes: Size so that after they are driven, plugs are located in center third of wall thickeners.
 - b. Dry-Pack Mortar for Filling Taper Tie Holes:
 - 1) Consist of mix of 1 part of portland cement to 1 part of plaster sand.

- 2) Amount of water to be added to cement-sand mix is to be such that mortar can be driven into holes and be properly compacted.
 - 3) Admixtures or Additives: Are not to be used in dry-pack mortar.
- B. Built-Up Plywood Forms:
1. Built-up plywood forms may be substituted for prefabricated forming system subject to following minimum requirements:
 - a. Size and Material:
 - 1) Full size 4-by 8-foot plywood sheets, except where smaller pieces are able to cover entire area.
 - 2) Sheet Construction: 5-ply plywood sheets, 3/4-inch nominal, made with 100 percent waterproof adhesive, and having finish surface that is coated or overlaid with surface which is impervious to water and alkaline calcium and sodium hydroxide of cement.
 - b. Wales: Minimum 2-by 4-inch lumber.
 - c. Studding and Wales: Contain no loose knots and be free of warps, cups, and bows.
- C. Steel or Steel Framed Forms:
1. Steel Forms: Provide forms that are:
 - a. Rigidly constructed and capable of being braced for minimum deflection of finish surface.
 - b. Capable of providing finish surfaces that are flat without bows, cups, or dents.
 2. Steel Framed Plywood Forms:
 - a. Provide forms that are rigidly constructed and capable of being braced.
 - b. Plywood Paneling: 5-ply, 5/8-inch nominal or 3/4-inch nominal, made with 100 percent waterproof adhesive, and having finish surface that is coated or overlaid with surface which is impervious to water and alkaline calcium and sodium hydroxide of cement.
- D. Incidentals:
1. External Angles:
 - a. Where not otherwise indicated on the Drawings, provide with 3/4-inch bevel, formed by utilizing true dimensioned wood or solid plastic chamfer strip on walkways, slabs, walls, beams, columns, and openings.
 - b. Provide 1/4-inch bevel formed by utilizing true dimensioned wood or solid plastic chamfer strip on walkways, walls, and slabs at expansion, and construction joints.
 2. Keyways: Steel, plastic, or lumber treated with form coating, applied according to label directions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Site Verification of Conditions:
1. Do not place any concrete until all forms have been thoroughly checked for alignment, level, strength, and to assure accurate location of all mechanical and electrical inserts or other embedded items.

3.02 INSTALLATION

A. Forms and Accessories:

1. Vertical Forms:
 - a. Remain in place minimum of 24 hours after concrete is placed.
 - b. If, after 24 hours, concrete has sufficient strength and hardness to resist surface or other damage, forms may be removed.
2. Other Forms Supporting Concrete and Shoring: Remain in place as follows:
 - a. Sides of Footings: 24 hours minimum.
 - b. Vertical Sides of Beams, Girders, and Similar Members: 48 hours minimum.
 - c. Slabs, Beams, and Girders: Until concrete strength reaches specified strength f'_c or until shoring is installed.
 - d. Shoring for Slabs, Beams, and Girders: Shore until concrete strength reaches specified strength.
 - e. Wall Bracing: Brace walls until concrete strength of beams and slabs laterally supporting wall reaches specified strength.
3. Green Concrete:
 - a. No heavy loading on green concrete will be permitted.
 - b. Green concrete is defined as concrete with less than 100 percent of specified strength f'_c .
4. Immediately after forms are removed, carefully examine concrete surfaces, and repair any irregularities in surfaces and finishes as specified in Section 03300.

B. Form Ties:

1. Cone-Snap Rod and Bar Ties: Tie forms together at not more than 2-foot centers vertically and horizontally. After forms are removed from wall, fill tie holes as follows:
 - a. Remove form ties from surfaces.
 - b. Roughen cone shaped tie holes by heavy sandblasting before repair.
 - c. Dry pack cone shaped tie holes with dry-pack mortar as specified in Section 03600.
2. Taper Ties:
 - a. After forms and taper ties are removed from wall, plug tie holes with neoprene plug as follows:
 - 1) Heavy sandblast and then clean tie holes.
 - 2) After cleaning, drive neoprene plug into each of taper tie holes with steel rod. Final location of neoprene plug shall be in center third of wall thickness. Bond neoprene plug to concrete with epoxy.
 - 3) Locate steel rod in cylindrical recess, made in plug, during driving:
 - a) At no time are plugs to be driven on flat area outside cylindrical recess.
 - b. Dry-Pack of Taper Tie Holes: After Installing Plugs in Tie Holes:
 - 1) Coat tie hole surface with epoxy bonding agent and fill with dry-pack mortar as specified in Section 03600:
 - a) Dry-Pack Mortar: Place in holes in layers with thickness not exceeding tie hole diameter and heavily compact each layer.
 - b) Dry-pack the outside of the hole no sooner than 7 days after the inside of the hole has been dry packed.

- c) Wall surfaces in area of dry-packed tie holes: On the water side of water containing structures and the outside of below grade walls:
 - (1) Cover with minimum of 10 mils of epoxy gel.
 - (2) Provide epoxy gel coating on wall surfaces that extend minimum of 2 inches past dry-pack mortar filled tie holes.
 - (3) Provide finish surfaces that are free from sand streaks or other voids.

C. Built-Up Plywood Forms:

- 1. Studding:
 - a. Spaced at 16 inches or 24 inches on center.
 - b. Closer spacing may be required depending upon strength requirements of the forms, in order to prevent any bulging surfaces on faces of finished concrete work.
 - c. Install studs perpendicular to grain of exterior plies of plywood sheets.
- 2. Wales: Form wales of double lumber material with minimum size as specified in this Section.
- 3. Number of Form Reuses: Depends upon durability of surface coating or overlay used, and ability to maintain forms in condition such that they are capable of producing flat, smooth, hard, dense finish on concrete when stripped.

D. Steel or Steel Framed Forms:

- 1. Steel Forms:
 - a. Adequately brace forms for minimum deflection of finish surface.
- 2. Steel Framed Plywood Forms:
 - a. Rigidly construct and brace with joints fitting closely and smoothly.
 - b. Number of Form Reuses: Depends upon durability of surface coating or overlay used.
- 3. Built-Up Plywood Forms: As specified in this Section may be used in conjunction with steel forms or steel framed plywood forms for special forming conditions such as corbels and forming around items which will project through forms.

E. Bracing and Alignment of Forms:

- 1. Line and Grade: Limit deviations to tolerances which will permit proper installation of structural embedded items or mechanical and electrical equipment and piping.
- 2. Formwork:
 - a. Securely brace, support, tie down, or otherwise hold in place to prevent any movement.
 - b. Make adequate provisions for uplift pressure, lateral pressure on forms, and deflection of forms.
- 3. When Second Lift is Placed on Hardened Concrete: Take special precautions in form work at top of old lift and bottom of new lift to prevent:
 - a. Spreading and vertical or horizontal displacement of forms.
 - b. Grout "bleeding" on finish concrete surfaces.
- 4. Pipe Stubs, Anchor Bolts, and Other Embedded Items: Set in forms where required.
- 5. Cracks, Openings, or Offsets at Joints in Formwork: Close those that are 1/16-inch or larger by tightening forms or by filling with acceptable crack filler.

- F. Incidentals:
1. Keyways: Construct keyways as indicated on the Drawings.
 2. Reentrant Angles: May be left square.
 3. Level Strips: Install level strips at top of wall concrete placements to maintain true line at horizontal construction joints.
 4. Inserts:
 - a. Encase pipes, anchor bolts, steps, reglets, castings, and other inserts, as indicated on the Drawings or as required, in concrete.
 - b. Use dovetail anchors in conjunction with slots as specified in this section and as may be necessary for required work.
- G. Pipe and Conduit:
1. Install pipe and conduit in structures as indicated on the Drawings, and seal with materials as specified in Section 07900.

3.03 CONSTRUCTION

- A. Tolerances:
1. Finish concrete shall conform to shapes, lines, grades, and dimensions indicated on the Drawings.
 2. The maximum deviation from true line and grade shall not exceed tolerances listed below at time of acceptance of project.
 3. General: In accordance with ACI 117, paragraphs 2.1 through 2.2 and paragraphs 4.0 through 4.6, except as modified in following:
 - a. Slabs:
 - 1) Slope: Uniformly sloped to drain when slope is indicated on the Drawings.
 - 2) Slabs Indicated to Be Level: Have maximum deviation of 1/8-inch in 10 feet without any apparent changes in grade.
 - b. On Circular Tank Walls: The CONTRACTOR may deviate from finish line indicated on the Drawings by use of forms with chord lengths not to exceed 2 feet.
 - c. Inserts: Set inserts to tolerances required for proper installation and operation of equipment or systems to which insert pertains.
 - d. Maximum Tolerances: As follows:

Item	Tolerance
Sleeves and Inserts	Plus 1/8 Minus 1/8 inches
Projected Ends of Anchor Bolts	Plus 1/4 Minus 0.0 inches
Anchor Bolt Setting	Plus 1/16 Minus 1/16 inches

END OF SECTION

SECTION 03150
CONCRETE ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Waterstops
 - 2. Preformed synthetic sponge rubber expansion joint material.
 - 3. Preformed bituminous fiber expansion joint material.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. D 570 - Standard Test Method for Water Absorption of Plastics.
 - 2. D 624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
 - 3. D 638 - Standard Test Method for Tensile Properties of Plastics.
 - 4. D 746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
 - 5. D 747 - Standard Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam.
 - 6. D 792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
 - 7. D 2240 - Standard Test Method for Rubber Property – Durometer Hardness.
- B. U. S. Army Corps of Engineers (USACE):
 - 1. CRD-C-572, Specification for Polyvinyl Chloride Waterstop.

1.03 SUBMITTALS

- A. Product Data:
 - 1. Polyvinyl Chloride Waterstops: Complete physical characteristics.
 - 2. Preformed Expansion Joint Material: Sufficient information on each type of material for review to determine conformance of material to requirements specified.

PART 2 PRODUCTS

2.01 WATERSTOPS

- A. Waterstops - polyvinyl chloride (PVC):
 - 1. Manufactured from prime virgin polyvinyl chloride plastic compound containing the plasticizers, resins, stabilizers, and other materials necessary to meet the requirements as specified in this Section.
 - 2. Manufacturers: One of the following or equal:
 - a. Vinylex Corporation.
 - b. Greenstreak Plastic Products Company, Inc.

3. Type: Ribbed waterstop:
 - a. Construction joints: 6-inch wide ribbed type.
 - b. Expansion joint for wall penetrations for concrete encased electrical duct banks: 6-inch ribbed type with hollow center bulb.
 - c. Expansion joints: 9-inch wide ribbed type with hollow center bulb.
 - d. Dumbbell-type waterstop will not be allowed unless otherwise specified or indicated on the Drawings.
 - e. No scrap or reclaimed material shall be used.

Properties as indicated in the following table:

Physical Characteristics	Test Method	Required Results
Specific Gravity	ASTM D 792	Not less than 1.3.
Hardness	ASTM D 2240	70 to 90 Type A15 Shore durometer.
Tensile Strength	ASTM D 638	Not less than 2,000 pounds per square inch.
Ultimate Elongation	ASTM D 638	Not less than 300 percent.
Alkali Extraction	CRD-C-572	Change in weight after 7 days: Between minus 0.1 percent and plus 0.25 percent. Change in hardness after 7 days: Not more than plus 5 points.
Low Temperature Brittle Point	ASTM D 746	No sign of cracking or chipping at -35 degrees Fahrenheit.
Water Absorption	ASTM D 570	Not more than 0.15 percent after 24 hours.
Accelerated Extraction Test	CRD-C-572	Tensile strength: Not less than 1,600 pounds per square inch. Elongation: Not less than 280 percent.
Stiffness in Flexure	ASTM D 747	Not less than 600 pounds per square inch.
Tear Resistance	ASTM D 624	Not less than 225 pounds per inch.
Thickness	—	3/8 inch.
Center Bulb		
6-inch Waterstops	—	7/8 inch or 1-inch nominal outside diameter.
9-inch Waterstops	—	For expansion joints 1 inch and narrower: 1-inch nominal outside diameter. For expansion joints wider than 1 inch: 2-inch nominal outside diameter.
Allowable Tolerances		
Width	—	Plus or minus 3/16 inch.
Thickness	—	Plus or minus 1/32 inch.

2.02 PREFORMED EXPANSION JOINT MATERIALS

- A. Preformed Synthetic Sponge Rubber Expansion Joint Material:
 - 1. Manufacturers: One of the following or equal:
 - a. Tamms Industries, Inc., Cementone
 - b. Burke Concrete Accessories inc., Neoprene Sponge Rubber Expansion Joint.
- B. Preformed Bituminous Fiber Expansion Joint Material:
 - 1. Manufacturers: One of the following or equal:
 - a. Tamms Industries, Inc., Hornboard/fiber
 - b. Burke Concrete Accessories inc., Fiber Expansion Joint.
- C. Use specific type in applications as indicated on the Drawings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Waterstops:
 - 1. General:
 - a. Store waterstops so as to permit free circulation of air around waterstop material and prevent direct exposure to sunlight.
 - b. Install waterstops in concrete joints where indicated on the Drawings.
 - c. Carry waterstops in walls into lower slabs and join to waterstops in slabs with appropriate types of fittings.
 - d. Provide waterstops that are continuous.
 - e. Hold and securely fix edges in position at intervals of not more than 24 inches so that they do not move during placing of concrete.
 - f. Position the waterstop so that symmetrical halves of waterstop are equally divided between concrete pours. Center axis of waterstop shall be coincident with centerline of the joint.
 - g. Do not drive nails, screws, or other fasteners through waterstops in vicinity of construction joints.
 - h. Use wires at not more than 24 inches on centers near outer edge of waterstop to tie waterstops into position.
 - i. Special clips may be used in lieu of wires, at Contractor's option.
 - j. Terminate waterstops 3 inches from top of finish surfaces of walls and slabs.
 - k. When any waterstop is installed in concrete on one side of joint, while the other half or portion of the waterstop remains exposed to the atmosphere for more than 2 days, take suitable precautions to shade and protect exposed waterstop from direct rays of sunlight during entire exposure and until exposed portion is embedded in concrete.
 - l. When placing concrete at waterstops in slabs, lift edge of waterstop while placing concrete below the waterstop. Manually force waterstop against and into concrete, and then cover waterstop with fresh concrete.
 - 2. Polyvinyl chloride waterstop:
 - a. Install waterstops so that joints are watertight.
 - b. Weld joints such as unions, crosses, ells, and tees, with thermostatically controlled equipment recommended by waterstop manufacturer:
 - 1) Do not damage material by heat sealing.

- 2) Make joints by overlapping, then simultaneously cut ends of sections to be spliced so they will form smooth even joint. Heat cut ends with splicing tool until the plastic melts. Press 2 ends together until plastic cools.
 - 3) Maintain continuity of waterstop ribs and tubular center axis.
 - 4) The splices shall have tensile strength of not less than 60 percent of unspliced materials tensile strength.
- c. Butt joints of ends of 2 identical waterstop sections may be made while material is in forms.

B. Joints:

1. Construct construction, and expansion joints as indicated on the Drawings.
2. Preformed Expansion Joint Material: Fasten expansion joint strips to concrete, masonry, or forms with adhesive. No nailing will be permitted, nor shall expansion joint strips be placed without fastening.

END OF SECTION

SECTION 03200
CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Concrete reinforcement.
- B. Related Sections:
 - 1. Section 01410 - Regulatory Requirements.

1.02 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. 315 - Detailing Manual: Details and Detailing of Concrete Reinforcement.
 - 2. 318 - Building Code Requirements for Structural Concrete.
 - 3. 350 - Code Requirements for Environmental Engineering Concrete Structures.
- B. American Society for Testing and Materials (ASTM):
 - 1. A 143 - Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
 - 2. A 185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - 3. A 615 - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
 - 4. A 706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
 - 5. A 767 - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
- C. American Welding Society (AWS):
 - 1. D1.4 - Structural Welding Code - Reinforcing Steel.

1.03 DEFINITIONS

- A. Give Away Bars: Bars that are not required by Contract Documents, that are installed by the CONTRACTOR to support the reinforcing bar.

1.04 SYSTEM DESCRIPTION

- A. The Drawings contain general notes concerning amount of reinforcement and placing, details of reinforcement at wall corners and intersections, and details of extra reinforcement around openings in concrete.

1.05 SUBMITTALS

- A. Shop Drawings:
 - 1. Changes to Reinforcing Steel Contract Drawing Requirements:
 - a. Indicate in separate letter submitted with shop drawings any changes of requirements indicated on the Drawings for reinforcing steel.
 - b. Such changes will not be acceptable unless the ENGINEER has accepted such changes in writing.
 - 2. Reinforcement Detail Drawings:
 - a. Review of reinforcement shop drawings by the ENGINEER will be limited to general compliance with the Contract Documents.
 - b. Reinforcement shop drawings shall be submitted as a complete package for a specific structure. Partial submittals will be rejected.
- B. Samples:
 - 1. Bar Supports: Submit samples of chairs proposed for use along with letter stating where each type of chair will be used.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping:
 - 1. Deliver bars bundled and tagged with identifying tags.
- B. Acceptance at Site:
 - 1. Reinforcing Bars: Deliver reinforcing bars lacking grade identification marks accompanied by manufacturer's guarantee of grade.

1.07 SEQUENCING AND SCHEDULING

- A. Bar Supports: Do not place concrete until samples and attached data of bar supports has been accepted by the ENGINEER.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Reinforcement:
 - 1. General: Provide reinforcing steel that is of quality specified, free from excessive rust or scale or any defects affecting its usefulness.
- B. Reinforcing Bars:
 - 1. Reinforcing Bars to Be Embedded in Concrete or Masonry: Grade 60 deformed bars in accordance with ASTM A 615 except as specified in the next subparagraph.
 - 2. Reinforcing bars that are required to be welded shall be low alloy Grade 60 deformed bars in accordance with ASTM A 706. Filler metal shall be [ASTM A 615 Grade 60 reinforcing may be used in lieu of ASTM A 706 Grade 60 provided the following requirements are met:
 - a. Weld procedures shall be submitted for review by the ENGINEER. Such weld procedures shall meet the requirements of AWS D1.4. The minimum preheat and interpass temperature requirements shall be adhered to.

- b. Mill certificates are submitted to the ENGINEER for review.
 - c. The specific location for the proposed substitution is approved by the ENGINEER.
- C. Bar Supports:
 - 1. Reinforcement Support Chairs:
 - a. Provide Type 304 stainless steel reinforcement support chairs.
- D. Tie Wires: Annealed steel.
- E. Welded Wire Fabric Reinforcement:
 - 1. In accordance with ASTM A 185.
 - 2. Fabric may be used in place of reinforcing bars if accepted by the ENGINEER.
 - 3. Provide welded wire fabric in flat sheet form.
 - 4. Provide welded wire fabric having cross-sectional area per linear foot of not less than cross-sectional area per linear foot of reinforcing bars indicated on the Drawings.

2.02 FABRICATION

- A. Shop Assembly:
 - 1. Cut and bend bars in accordance with provisions of ACI 315, ACI 318, and ACI 350.
 - 2. Bend bars cold.
 - 3. Provide bars free from defects and kinks and from bends not indicated on the Drawings.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions:
 - 1. Reinforcing Bars:
 - a. Verify that bars are new stock free from rust scale, loose mill scale, excessive rust, dirt, oil, and other coatings which adversely affect bonding capacity when placed in the work.

3.02 PREPARATION

- A. Surface Preparation:
 - 1. Reinforcing Bars: Thin coating of red rust resulting from short exposure will not be considered objectionable. Thoroughly clean any bars having rust scale, loose mill scale, or thick rust coat.
 - 2. Cleaning of Reinforcement Materials: Remove concrete or other deleterious coatings from dowels and other projecting bars by wire brushing or sandblasting before bars are embedded in subsequent concrete placement.

3.03 INSTALLATION

- A. Reinforcing Bars:
 - 1. No field bending of bars will be allowed.

2. Welding:
 - a. Weld reinforcing bars where indicated on the Drawings or acceptable to the ENGINEER.
 - b. Perform welding in accordance with AWS D1.4.
 - c. Do not tack weld reinforcing bars.

B. Placing Reinforcing Bars:

1. Accurately place bars and adequately secure them in position.
2. Overlap bars at splices as indicated on the Drawings or specified.
3. Unless specifically otherwise indicated on the Drawings, install bars at lap splices in contact with each other and fasten bars together with tie wire.
4. If lap splice length for bars in concrete is not specified or indicated on the Drawings, bars shall be lap spliced in accordance with ACI 318 and ACI 350.
5. If not indicated on the Drawings and not specified in Division 4, lap splice bars in masonry in accordance with the building code as specified in Section 01410.
6. Bar Supports:
 - a. Provide in sufficient number to prevent sagging and to support loads during construction, but in no case less than quantities and at locations as indicated in ACI 315.
 - b. Support reinforcing for concrete placed on ground by standard manufactured chairs, with steel plates for resting on ground.
 - c. Do not use brick, broken concrete masonry units, spalls, rocks, or similar material for supporting reinforcing steel.
 - d. Do not use give away bars that have less cover than required by the Contract Documents. Do not adjust location of reinforcement required by the Contract Documents to provide cover to the give away bars.
7. If not indicated on the Drawings, provide protective concrete cover in accordance with ACI 318 and ACI 350.

C. Tying of Bar Reinforcement:

1. Fasten bars securely in place with wire ties.
2. Tie bars sufficiently often to prevent shifting.
3. There shall be at least 3 ties in each bar length (does not apply to dowel lap splices or to bars shorter than 4 feet, unless necessary for rigidity).
4. Tie slab bars at every intersection around periphery of slab.
5. Tie wall bars and slab bar intersections other than around periphery at not less than every fourth intersection, but at not greater than following maximum spacings:

Bar Size	Slab Bars Spacing Inches	Wall Bars Spacing Inches
Bars Number 5 and Smaller	60	48
Bars Number 6 through Number 9	96	60
Bars Number 10 and Number 11	120	96

6. After tying wire ties, bend ends of wire ties in towards the center of the concrete section. Wire ties shall conform to the cover requirements of the reinforcing bars.
7. Above tying requirements do not apply to reinforcement for masonry. Refer to Division 4 for tying requirements for masonry.

- D. Lap Splices of Reinforcing Bars:
1. Where bars are to be lapped spliced at joints in concrete, ensure bars project from concrete first placed, minimum length equal to lap splice length indicated on the Drawings.
 2. Where lap splice length is not indicated on the Drawings, then provide lap splice length in accordance with ACI 318, ACI 350, and as specified in this Division.
- E. Welded Wire Fabric Reinforcement:
1. Install necessary wiring, spacing chairs, or supports to keep welded wire fabric in place while concrete is being placed.
 2. Bend fabric as indicated on the Drawings or required to fit work.
 3. Unroll or otherwise straighten fabric to make perfectly flat sheet before placing in the Work.
 4. Lap splice welded wire fabric as indicated on the Drawings.
 5. If lap splice length is not indicated on the Drawings, splice fabric in accordance with ACI 318 and ACI 350.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Cast-in-place concrete.
- B. Related Sections:
 - 1. Section 03071 - Epoxies.
 - 2. Section 03150 - Concrete Accessories.
 - 3. Section 03366 - Tooled Concrete Finishes.
 - 4. Section 03931 - Epoxy Injection System.
 - 5. Section 07900 - Joint Sealers.

1.02 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. 318 - Building Code Requirements for Structural Concrete and Commentary.
 - 2. 350 - Code Requirements for Environmental Engineering Concrete Structures and Commentary.
 - 3. Manual of Concrete Practice.
 - 4. Recommended Practices.
- B. American Society for Testing and Materials (ASTM):
 - 1. C 31 - Practice for Making and Curing Concrete Test Specimens in the Field.
 - 2. C 33 - Specification for Concrete Aggregates.
 - 3. C 39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - 4. C 40 - Test Method for Organic Impurities in Fine Aggregates for Concrete.
 - 5. C 42 - Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
 - 6. C 88 - Test Method of Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
 - 7. C 94 - Specification for Ready-Mixed Concrete.
 - 8. C 114 - Test Methods for Chemical Analysis of Hydraulic Cement.
 - 9. C 117 - Test Method for Materials Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing.
 - 10. C 123 - Test Method for Lightweight Particles in Aggregate.
 - 11. C 131 - Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - 12. C 136 - Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 13. C 142 - Test Method for Clay Lumps and Friable Particles in Aggregate.
 - 14. C 143 - Test Method for Slump of Hydraulic-Cement Concrete.
 - 15. C 150 - Specification for Portland Cement.
 - 16. C 156 - Test Method for Water Retention by Concrete Curing Materials.
 - 17. C 171 - Specifications for Sheet Materials for Curing Concrete.
 - 18. C 172 - Practice for Sampling Freshly Mixed Concrete.

19. C 173 - Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
20. C 260 - Specification for Air-Entraining Admixtures for Concrete.
21. C 289 - Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
22. C 295 - Guide to Petrographic Examination of Aggregates for Concrete.
23. C 309 - Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
24. C 311 - Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete.
25. C 494 - Specification for Chemical Admixtures for Concrete.
26. C 618 - Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
27. D 75 - Practice for Sampling Aggregates.
28. D 2103 - Specification for Polyethylene Film and Sheeting.

1.03 DEFINITIONS

- A. Alkali: Is defined as the sum of sodium oxide and potassium oxide calculated as sodium oxide.
- B. Cementitious Materials: Defined as portland cement and pozzolan admixture.
- C. Hairline Crack: Crack with a crack width of less than 4 thousandths of an inch.

1.04 SYSTEM DESCRIPTION

- A. Performance Requirements:
 1. General:
 - a. Except as otherwise specified, provide concrete composed of portland cement, fly ash, fine aggregate, coarse aggregate, and water so proportioned and mixed as to produce plastic, workable mixture in accordance with requirements as specified in this Section and suitable to specific conditions of placement.
 - b. Proportion materials in a manner such that will secure lowest water-cement ratio which is consistent with good workability, plastic, cohesive mixture, and one which is within specified slump range.
 - c. Proportion fine and coarse aggregates in manner such as not to produce harshness in placing or honeycombing in structures.
 2. It is the intent of this Section to secure for every part of the Work concrete and grout of homogeneous structure, which when hardened will have required strength, watertightness, and durability:
 - a. It is recognized that some surface hairline cracks and crazing will develop in the concrete surfaces.
 - b. Construction and expansion joints have been specified and positioned in structures as indicated on the Drawings, and curing methods specified, for purpose of reducing number and size of cracks, due to normal expansion and contraction expected from specified concrete mixes.
 - c. Pressure inject visible cracks, other than hairline cracks and crazing, in following areas with epoxy as specified in Section 03931:
 - 1) Floors and walls of water bearing structures.

- 2) Walls and overhead slabs of passageways or occupied spaces, outsides of which are exposed to weather or may be washed down and are not specified to receive separate waterproof membrane.
- 3) Other Items Not Specified to Receive Separate Waterproof Membrane: Slabs over water channels, wet wells, reservoirs, and other similar surfaces.
 - d. Walls or slabs, as specified above, that leak or sweat because of porosity or cracks too small for successful pressure grouting: Seal on water or weather side by coatings of surface sealant system, as specified in this Section.
 - e. Grouting and Sealing: Continue as specified above until structure is watertight and remains watertight for not less than one year after final acceptance or date of final repair, whichever occurs later in time.
3. Workmanship and Methods: Provide concrete work, including detailing of reinforcing, conforming with best standard practices and as set forth in ACI 318, ACI 350, Manuals, and Recommended Practices.

1.05 SUBMITTALS

- A. Product Data: Submit data completely describing products.
- B. Information on Heating Equipment to Be Used for Cold Weather Concreting: Submit information on type of equipment to be used for heating materials and/or new concrete in process of curing during excessively cold weather.
- C. For conditions that promote rapid drying of freshly placed concrete such as low humidity, high temperature, and wind: Submit corrective measures proposed for use prior to placing concrete.
- D. Copies of Tests of Concrete Aggregates: Submit certified copies in triplicate of commercial laboratory tests not more than 90 days old of all samples of concrete aggregates:
 1. Fine Aggregate:
 - a. Clay lumps.
 - b. Reactivity.
 - c. Shale and chert.
 - d. Soundness.
 - e. Color.
 - f. Decantation.
 2. Coarse Aggregate:
 - a. Clay lumps and friable particles.
 - b. Reactivity.
 - c. Shale and chert.
 - d. Soundness.
 - e. Abrasion loss.
 - f. Coal and lignite.
 - g. Materials finer than 200 sieve.
- E. Sieve Analysis: Submit sieve analyses of fine and coarse aggregates being used in triplicate at least every 3 weeks and at any time there is significant change in grading of materials.

- F. Concrete Mixes: Submit full details, including mix design calculations for concrete mixes proposed for use for each class of concrete:
 - 1. Include information on correction of batching for varying moisture contents of fine aggregate.
 - 2. Submit source quality test records with mix design submittal:
 - a. Include calculations for f'_{cr} based on source quality test records.
- G. Trial Batch Test Data:
 - 1. Submit data for each test cylinder.
 - 2. Submit data that identifies mix and slump for each test cylinder.
- H. Sequence of Concrete Placing: Submit proposed sequence of placing concrete showing proposed beginning and ending of individual placements.
- I. Curing Compound Other than Specified Compound: Submit complete data on proposed compound.
- J. If Either Fine or Coarse Aggregate Is Batched from More than One Bin: Submit analyses for each bin, and composite analysis made up from these, using proportions of materials to be used in mix.
- K. Cement Mill Tests: Include alkali content, representative of each shipment of cement for verification of compliance with specified requirements.
- L. Pozzolan Certificate of Compliance: Identify source of pozzolan and certify compliance with requirements of ASTM C 618.
- M. Information on mixing equipment.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping:
 - 1. Deliver, store, and handle concrete materials in manner that prevents damage and inclusion of foreign substances.
 - 2. Deliver and store packaged materials in original containers until ready for use.
 - 3. Deliver aggregate to mixing site and handle in such manner that variations in moisture content will not interfere with steady production of concrete of specified degree of uniformity and slump.
- B. Acceptance at Site: Reject material containers or materials showing evidence of water or other damage.

1.07 PROJECT CONDITIONS

- A. Environmental Requirements:
 - 1. Hot Weather Concreting:
 - a. When Ambient Air Temperature Is above 90 Degrees Fahrenheit: Prior to placing concrete, cool forms and reinforcing steel by water cooling to below 90 degrees Fahrenheit.
 - b. Temperature of Concrete Mix at Time of Placement: Keep temperature below 90 degrees Fahrenheit by methods which do not impair quality of concrete.

2. Cold Weather Concreting:
 - a. Concrete placed below ambient air temperature of 45 degrees Fahrenheit and falling or below 40 degrees Fahrenheit: Make provision for heating water.
 - b. If materials have been exposed to freezing temperatures to degree that any material is below 35 degrees Fahrenheit: Heat such materials.
 - c. Heating Water, Cement, or Aggregate Materials:
 - 1) Do not heat in excess of 160 degrees Fahrenheit.
 - d. Protection of Concrete in Forms:
 - 1) Protect by means of covering with tarpaulins, or other acceptable covering acceptable to ENGINEER.
 - 2) Provide means for circulating warm moist air around forms in manner to maintain temperature of 50 degrees Fahrenheit for at least 5 days.
3. For conditions that promote rapid drying of freshly placed concrete such as low humidity, high temperature, and wind: Take corrective measures to minimize rapid water loss from concrete:
 - a. Furnish and use sufficient number of maximum and minimum self-recording thermometers to adequately measure temperature around concrete.

1.08 SEQUENCING AND SCHEDULING

- A. Schedule placing of concrete in such manner as to complete any single placing operation to construction or expansion joint.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Admixtures:
 1. General:
 - a. Do not use admixtures of any type, except as specified, unless written authorization has been obtained from the ENGINEER.
 - b. Compatible with concrete and other admixtures.
 - c. Do not use admixtures containing chlorides calculated as chloride ion in excess of 0.5 percent by weight.
 - d. Use in accordance with manufacturer's recommendations and add each admixture to concrete mix separately.
 2. Air Entraining Admixture:
 - a. Provide all concrete with 5 percent, plus or minus 1 percent, entrained air of evenly dispersed air bubbles at time of placement.
 - b. Conform to ASTM C 260.
 3. Water Reducing Admixture:
 - a. May be used at the CONTRACTOR's option.
 - b. Conform to ASTM C 494, Type A or Type D.
 - c. Not contain air entraining agents.
 - d. Liquid form before adding to the concrete mix.
 - e. No decrease in cement is permitted as result of use of water reducing admixture.
 4. Superplasticizers: Are not to be used without acceptance by ENGINEER.

B. Aggregate:

1. General:

- a. Provide concrete aggregates that are sound, uniformly graded, and free of deleterious material in excess of allowable amounts specified.
- b. Grade aggregate in accordance with ASTM C 136 and D 75.
- c. Provide unit weight of fine and coarse aggregate that produces in place concrete with weight of not less than 140 pounds per cubic foot.
- d. Do not use aggregate made from recycled materials such as crushed and screened hydraulic-cement concrete, brick, and other construction materials.

2. Fine Aggregate:

- a. Provide fine aggregate for concrete or mortar consisting of clean, natural sand or of sand prepared from crushed stone or crushed gravel.
- b. Do not provide aggregate having deleterious substances in excess of following percentages by weight of contaminating substances. In no case shall total exceed percent listed.

Item	Test Method	Percent
Removed by decantation (dirt, silt, etc.)	ASTM C 117	3
Shale or Chert	ASTM C 295	1
Clay Lumps	ASTM C 142	1
* Test Method C 123 is used to identify particles in the sample lighter than 2.40 Specific Gravity. Test Method C 295 is used to identify which of the lightweight particles are shale or chert. If the results of Test Method C 123 are less than 1 percent, Test Method C 295 is not required.		

- c. Except as otherwise specified, grade fine aggregate from coarse to fine in accordance with requirements of ASTM C 33.

3. Coarse Aggregate:

- a. General: Provide coarse aggregate consisting of gravel or crushed stone made up of clean, hard, durable particles free from calcareous coatings, organic matter, or other foreign substances.
- b. Weight: Not exceeding 15 percent, for thin or elongated pieces having length greater than 5 times average thickness.
- c. Deleterious Substances: Not in excess of following percentages by weight, and in no case having total of all deleterious substances exceeding 2 percent.

Item	Test Method	Percent
Shale or chert	ASTM C 295	1
Coal and lignite	ASTM C 123	1/4
Clay lumps and friable particles	ASTM C 142	1/4
Materials finer than Number 200 sieve	ASTM C 117	1/2*
* Except when material finer than Number 200 sieve consists of crusher dust, maximum amount shall be 1 percent.		
** Test Method C 123 is used to identify particles in the sample lighter than 2.40 Specific Gravity. Test Method C 295 is used to identify which of the lightweight particles are shale, chert, coal or lignite. If the results of Test Method C 123 are less than 1.25 percent (the minimum combined percentage of shale, chert, coal and lignite), Test Method C 295 is not required.		

- d. Grading:
 - 1) Aggregate for Class A, and C Concrete: As specified in ASTM C 33, Size Number 57, except as otherwise specified or authorized in writing by the ENGINEER.
 - 2) Aggregate for Class CE Concrete for Encasement of Electrical Conduits:
 - a) Graded as specified in ASTM C 33, Size Number 8.

- C. Concrete Sealer:
 - 1. Manufacturers: One of the following or equal:
 - a. ChemMasters, Madison, OH, Spray-Cure & Seal 25.
 - b. Tamms Industries, Luster Seal WB-300.

- D. Conduit Encasement Coloring Agent:
 - 1. Color: Red color concrete used for encasement of electrical ducts, conduits, and similar type items.
 - 2. Manufacturers: One of the following or equal:
 - a. Davis Company, #100 Utility Red.
 - b. I. Reiss Company, Inc., equivalent product.
 - 3. Conduit Encasement Concrete: Mix into each cubic yard of concrete 10 pounds of coloring agent.

- E. Evaporation Retardant:
 - 1. Manufacturers: One of the following or equal:
 - a. Master Builders Technologies, Cleveland, Ohio, Confilm.
 - b. Euclid Chemical Company, Cleveland, Ohio, Eucobar.

- F. Keyway Material: Steel, plastic, or lumber.

- G. Nonslip Abrasive:
 - 1. Type: Aluminum oxide abrasive of size 8/16, having structure of hard aggregate, homogenous, nonglazing, rustproof, and unaffected by freezing, moisture, or cleaning compounds.
 - 2. Manufacturers: One of the following or equal:
 - a. Exolon Company, Tonawanda, New York.
 - b. Abrasive Materials, Incorporated, Hillsdale, Michigan.

- H. Portland Cement:
 - 1. General: Conform to specifications and tests for ASTM C 150, Types II or III, Low Alkali, except as specified otherwise.
 - 2. Low Alkali Portland: Have total alkali containing not more than 0.60 percent.
 - 3. Exposed Concrete in Any Individual Structure: Use only one brand of portland cement.
 - 4. Cement for Finishes: Provide cement from same source and of same type as concrete to be finished.

- I. Plastic Membrane Curing: Use polyethylene film in accordance with ASTM C 171.
 - 1. Color: White.
 - 2. Thickness: Nominal thickness of polyethylene film shall not be less than 0.0040 inches when measured in accordance with ASTM D 2103. Thickness of polyethylene film at any point shall not be less than 0.0030 inches.
 - 3. Loss of Moisture: Not exceed 0.055 grams per square centimeter of surface when tested in accordance with ASTM C 156.

- J. Sprayed Membrane Curing Compound: Clear type with fugitive dye conforming to ASTM C 309, Type 1D.
- K. Water:
 - 1. Water for Concrete, Washing Aggregate, and Curing Concrete: Clean and free from oil and deleterious amounts of alkali, acid, organic matter, or other substances.
 - 2. Chlorides and Sulfate Ions:
 - a. Water for Conventional Reinforced Concrete: Use water not containing more than 1,000 milligrams per liter of chlorides calculated as chloride ion, nor more than 1,000 milligrams per liter of sulfates calculated as sulfate ion.
 - b. Water for Prestressed or Post-tensioned Concrete: Use water not containing more than 650 milligrams per liter of chlorides calculated as chloride ion, nor more than 800 milligrams per liter of sulfates calculated as sulfate ion.

2.02 EQUIPMENT

- A. Mixing Concrete:
 - 1. Mixers may be of stationary plant, paver, or truck mixer type.
 - 2. Provide adequate equipment and facilities for accurate measurement and control of materials and for readily changing proportions of material.
 - 3. Mixing Equipment:
 - a. Capable of combining aggregates, cementitious materials, and water within specified time into thoroughly mixed and uniform mass and discharging mixture without segregation.
 - b. Maintain concrete mixing plant and equipment in good working order and operated at loads, speeds, and timing recommended by manufacturer or as specified.
 - c. Proportion cementitious materials and aggregate by weight.
- B. Machine Mixing:
 - 1. Batch plant shall be capable of controlling delivery of all material to mixer within 1 percent by weight of individual material.
 - 2. If bulk cementitious materials are used, weigh them on separate visible scale which will accurately register scale load at any stage of weighing operation from zero to full capacity.
 - 3. Prevent cementitious materials from coming into contact with aggregate or with water until materials are in mixer ready for complete mixing with all mixing water.
 - 4. Procedure of mixing cementitious materials with sand or with sand and coarse aggregate for delivery to project site, for final mixing and addition of mixing water will not be permitted.
 - 5. Retempering of concrete will not be permitted.
 - 6. Discharge entire batch before recharging.
 - 7. Volume of Mixed Material Per Batch: Not exceed manufacturer's rated capacity of mixer.
 - 8. Mixers:
 - a. Perform mixing in batch mixers of acceptable type.

- b. Equip each mixer with device for accurately measuring and indicating quantity of water entering concrete, and operating mechanism such that leakage will not occur when valves are closed.
- c. Equip each mixer with device for automatically measuring, indicating, and controlling time required for mixing:
 - 1) Interlock device to prevent discharge of concrete from mixer before expiration of mixing period.

C. Transit-Mixed Concrete:

1. Mix and deliver in accordance with ASTM C 94.
2. Total Elapsed Time Between Addition of Water at Batch Plant and Discharging Completed Mix: Not to exceed 90 minutes. Elapsed time at project site shall not exceed 30 minutes.
3. Under conditions contributing to quick setting, total elapsed time permitted may be reduced by the ENGINEER.
4. Equip each truck mixer with device interlocked to prevent discharge of concrete from drum before required number of turns and furnish such device that is capable of counting number of revolutions of drum.
5. Continuously revolve drum after it is once started until it has completely discharged its batch:
 - a. Do not admit water until drum has started revolving.
 - b. Right is reserved to increase required minimum number of revolutions or to decrease designated maximum number of revolutions allowed, if necessary, to obtain satisfactory mixing. The CONTRACTOR will not be entitled to additional compensation because of such increase or decrease.

D. Other Types of Mixers: In case of other types of mixers, mixing shall be as follows:

1. Mix concrete until there is uniform distribution of materials, and discharge mixer completely before recharging.
2. Neither speed nor volume loading of mixer shall exceed manufacturer's recommendations.
3. Continue mixing for minimum of 1-1/2 minutes after all materials are in drum, and for batches larger than one cubic yard increase minimum mixing time 15 seconds for each additional cubic yard or fraction thereof.

2.03 MIXES

A. Measurements of Materials:

1. Measure materials by weighing, except as otherwise specified or where other methods are specifically authorized in writing by the ENGINEER.
2. Furnish apparatus for weighing aggregates and cementitious materials that is suitably designed and constructed for this purpose.
3. Accuracy of Weighing Devices: Furnish devices that have capability of providing successive quantities of individual material that can be measured to within 1 percent of desired amount of that material.
4. Measuring or Weighing Devices: Subject to review by the ENGINEER. Shall bear valid seal of the Sealer of Weights and Measures having jurisdiction.
5. Weighing Cementitious Materials:
 - a. Weigh cementitious materials separately.
 - b. Cement in Unbroken Standard Packages (Sacks): Need not be weighed.
 - c. Bulk Cementitious Materials and Fractional Packages: Weigh such cementitious materials.

6. Mixing Water: Measured by volume or by weight.
- B. Concrete Proportions and Consistency:
1. Concrete Consistency and Composition:
 - a. Provide concrete that can be worked readily into corners and angles of forms and around reinforcement without excessive vibration and without permitting materials to segregate or free water to collect on surface.
 - b. Prevent unnecessary or haphazard changes in consistency of concrete.
 2. Ratio of Coarse Aggregate to Fine Aggregate: Not less than 1.0 or more than 2.0 for all concrete Classes, with exception of Class CE.
 3. Aggregate:
 - a. Obtain aggregate from source that is capable of providing uniform quality, moisture content, and grading during any single day's operation.
 4. Concrete Mix Water to Cementitious Materials Ratio, Minimum Cementitious Materials Content, and Slump Range: Conform to values specified in Table A in this Section.
 5. Concrete Batch Weights: Control and adjust to secure maximum yield. At all times, maintain proportions of concrete mix within specified limits.
 6. Mix Modification: If required, by the ENGINEER, modify mixture within limits set forth in this Section.
- C. Concrete Mixes:
1. Proportioning of Concrete Mix: Proportion mixes based on required average on compressive strength f'_{cr} .
 2. Mixes:
 - a. Adjusting of Water: After acceptance, do not change mixes without acceptance by ENGINEER, except that at all times adjust batching of water to compensate for free moisture content of fine aggregate.
 - b. Total Water Content of Each Concrete Class: Not exceed those specified in Table A in this Section.
 - c. Checking Moisture Content of Fine Aggregate: Furnish satisfactory means at batching plant for checking moisture content of fine aggregate.
 3. Change in Mixes: Submit new mix design and undertake new trial batch and test program as specified in this Section.
- D. Classes of Concrete:
1. Provide concrete consisting of 3 classes, referred herein as Classes A, C, and CE as specified in this Section. Use where specified or indicated on the Drawings.
 2. Weight of Concrete Classes: Provide classes of concrete having minimum weight of 140 pounds per cubic foot.
 3. Class C Concrete: Class C concrete may be used for fill for unauthorized excavation, for thrust blocks and ground anchors for piping, for bedding of pipe, and where indicated on the Drawings.
 4. Class CE Concrete: Use Class CE for electrical conduit encasements.
 5. All other concrete, unless specified or otherwise indicated on the Drawings: Use Class A concrete.

TABLE A CONCRETE WITH AIR ENTRAINMENT				
Class	Specified Compressive Strength f'_c at 28 Days (Pounds per Square Inch)	Maximum Water-to- Cementitious Materials Ratio	Minimum Cementitious Materials per Cubic Yard of Concrete by Weight (Pounds)	Slump Range (Inches)
A	4,000	0.45	564	2 to 4
C	2,500	0.62	423	3 to 6
CE	2,500	0.62	564	3 to 6

6. Pumped Concrete: Provide pumped concrete that complies with all requirements of this Section.
7. Do not place concrete with slump outside limits indicated in Table A.
8. Classes:
 - a. Classes A, C, and CE Concrete: Make with Type II low alkali portland cement.
 - b. Admixtures: Provide admixtures as specified in this Section.

E. Air Entraining Admixture:

1. Add agent to batch in portion of mixing water.
2. Batch solution by means of mechanical batcher capable of accurate measurement.

2.04 SOURCE QUALITY CONTROL

A. Tests:

1. Trial Batches:
 - a. After concrete mix designs have been accepted by ENGINEER, have trial batches of the accepted Class A, concrete mix design prepared by testing laboratory acceptable to the ENGINEER.
 - b. Prepare trial batches using specified cementitious materials and aggregates proposed to be used for the Work.
 - c. Prepare trial batches with sufficient quantity to determine slump, workability, consistency, and finishing characteristics, and to provide sufficient test cylinders.
 - d. Test Cylinders: Provide cylinders having 6 inch diameter by 12 inch length and that are prepared in accordance with ASTM C 31 for tests specified in this Section.
 - e. Determine slump in accordance with ASTM C 143.
 - f. Test Cylinders from Trial Batch:
 - 1) Test 8 cylinders for compressive strength in accordance with ASTM C 39:
 - a) Test 4 cylinders at 7 days and 4 at 28 days.
 - b) Establish ratio between 7 day and 28 day strength for mix. Seven day strength may be taken as satisfactory indication of 28 day strength provided effects on concrete of temperature and humidity between 7 day and 28 day are taken into account.

- 2) Average Compressive Strength of 4 Test Cylinders Tested At 28 Days: Equal to or greater than required average compressive strength f'_{cr} on which concrete mix design is based.
 - g. If trial batch tests do not meet specified requirements for slump, strength, workability, consistency, and finishing, change concrete mix design proportions and, if necessary, source of aggregate. Make additional trial batches and tests until an acceptable trial batch is produced that meets requirements of this Section.
 - h. Perform test batches and tests required to establish trial batches and acceptability of materials without change in Contract Price.
 - i. Do not place concrete until the concrete mix design and trial batch have been accepted by ENGINEER.
2. Required Average Compressive Strength:
- a. Determine required average compressive strength (f'_{cr}) for selection of concrete proportions for mix design, for each class of concrete, using calculated standard deviation and its corresponding specified compressive strength f'_c , in accordance with ACI 318 and ACI 350.
 - b. When test records of at least 30 consecutive tests that span period of not less than 45 calendar days are available, establish standard deviation as described in ACI 318 and ACI 350 and as modified as follows herein.
 - c. Provide test records from which to calculate standard deviation that represent materials, quality control procedures, and conditions similar to materials, quality control procedures, and conditions expected to apply in preparation of concrete for the Work.
 - d. Provide changes in materials and proportions within test records that are more restricted than those for the Work.
 - e. Specified Compressive Strength (f'_c) of Concrete Used in Test Records: Within 1,000 pounds per square inch of that specified for the Work.
 - f. When lacking adequate test records for calculation of standard deviation meeting requirements, determine required average compressive strength f'_{cr} from following Table B.

TABLE B

Specified Compressive Strength f'_c (pounds per square inch)	Required Average Compressive Strength f'_{cr} (pounds per square inch)
Less than 3,000	$f'_c + 1,000$
3,000 to 5,000	$f'_c + 1,200$
Over 5,000	$1.10 f'_c + 700$

3. Pozzolan Admixture:
 - a. Sampling and Testing:
 - 1) Sample and test pozzolan admixture in accordance with ASTM C 311.
4. Aggregate:
 - a. Testing of concrete aggregate is at CONTRACTOR's expense.
 - b. If there is change in aggregate source or if there is a significant change in aggregate quality from same source, submit new set of design mixes covering each class of concrete and prepare new trial batches.
 - c. Sieves:
 - 1) Use sieves with square openings for testing grading of aggregates.

- 2) Sieve Analyses: If sieve analyses indicate significant change in materials, the ENGINEER may require that new mix design and trial batch be submitted and accepted before further placing of concrete.
- d. Sample aggregate in accordance with ASTM C 136 and D 75.
- e. Fine Aggregate:
 - 1) Provide fine aggregate that does not contain strong alkali nor organic matter which gives color darker than standard color when tested in accordance with ASTM C 40.
 - 2) Provide aggregate having soundness complying with requirements of ASTM C 33 when tested in accordance with ASTM C 88.
 - 3) Provide aggregate complying with reactivity requirements of ASTM C 33 when tested in accordance with ASTM C 289.
- f. Coarse Aggregate:
 - 1) Soundness when tested in accordance with ASTM C 88: Have loss not greater than 10 percent when tested with sodium sulfate.
 - 2) Abrasion Loss: Not exceed 45 percent after 500 revolutions when tested in accordance with ASTM C 131.
 - 3) Reactivity: Not exceed limits specified in Appendix of ASTM C 33 when tested in accordance with ASTM C 289.
- g. Portland Cement:
 - 1) Determination Alkali Content: Determine by method set forth in ASTM C 114.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Liquid Evaporation Retardant: Under conditions which result in rapid evaporation of moisture from the surface of the concrete, immediately after the concrete has been screeded, coat the surface of the concrete with a liquid evaporation retardant. Apply the evaporation retardant again after each work operation as necessary to prevent drying shrinkage cracks. Conditions which result in rapid evaporation of moisture may include one or more of the following:
 1. Low humidity.
 2. Windy conditions.
 3. High temperature.
- B. Joints and Bonding:
 1. As far as practicable construct concrete work as monolith.
 2. Locations of construction, expansion, and other joints are indicated on the Drawings or as specified in this Section.
 3. Construction Joints:
 - a. Where construction joints are not indicated on the Drawings, provide construction joints in slabs and ring walls at intervals not greater than 35 feet.
 - b. In order to preserve strength and watertightness of structures, make no other joints, except as authorized the ENGINEER.
 - c. At construction joints, thoroughly clean concrete of laitance, grease, oil, mud, dirt, curing compounds, mortar droppings, or other objectionable matter by means of heavy sandblasting, and wash surfaces just prior to succeeding concrete placement.

- d. At Horizontal Joints: Immediately prior to resuming concrete placing operations, thoroughly spread bed of grout not less than 1/2 inch in thickness nor more than 1 inch in thickness over horizontal joint surfaces.
 4. Keyways in Joints:
 - a. Provide keyways in joints as indicated on the Drawings.
 - b. Treat lumber keyway material with form release coating, applied in accordance with manufacturer's instructions.
 5. Take special care to ensure that concrete is well consolidated around and against waterstops and waterstops are secured in proper position.
 6. Cleaning of Construction Joints:
 - a. Wash construction joints free of sawdust, chips, and other debris after forms are built and immediately before concrete or grout placement.
 - b. Should formwork confine sawdust, chips, or other loose matter in such manner that it is impossible to remove them by flushing with water, use vacuum cleaner for their removal, after which flush cleaned surfaces with water.
 - c. Provide cleanout hole at base of each wall and column for inspection and cleaning.
 7. Construction and expansion Joints:
 - a. Constructed where and as indicated on the Drawings.
 - b. Waterstops, Expansion Joint Material, Synthetic Rubber Sealing Compound, and Other Similar Materials: As specified in Sections 03150 and 07900.
 8. Repair of Concrete: Where it is necessary to repair concrete by bonding mortar or new concrete to concrete which has reached its initial set, first coat surface of set concrete with epoxy bonding agent as specified in Section 03071.
- C. Conveying and Placing Concrete:
1. Convey concrete from mixer to place of final deposit by methods that prevent separation or loss of materials.
 2. Use equipment for chuting, pumping, and conveying concrete of such size and design as to ensure practically continuous flow of concrete at delivery end without separation of materials.
 3. Design and use chutes and devices for conveying and depositing concrete that direct concrete vertically downward when discharged from chute or conveying device.
 4. Keep equipment for conveying concrete thoroughly clean by washing and scraping upon completion of any day's placement.
- D. Placing Concrete:
1. Place no concrete without prior authorization of the ENGINEER.
 2. Do Not Place Concrete Until:
 - a. Reinforcement is secure and properly fastened in its correct position and loose form ties at construction joints have been retightened.
 - b. Dowels, bucks, sleeves, hangers, pipes, conduits, anchor bolts, and any other fixtures required to be embedded in concrete have been placed and adequately anchored.
 - c. Forms have been cleaned and oiled as specified.
 3. Placement of concrete in which initial set has occurred, or of retempered concrete, will not be permitted.

4. Place no concrete during rainstorms or high velocity winds.
5. Protect concrete placed immediately before rain to prevent water from coming in contact with such concrete or winds causing excessive drying.
6. Keep sufficient protective covering on hand at all times for protection of concrete.
7. After acceptance, adhere to proposed sequence of placing concrete, except when specific changes are requested and accepted by the ENGINEER.
8. Notify the ENGINEER in writing of readiness, not just intention, to place concrete in any portion of the work:
 - a. Provide this notification in such time in advance of operations, as the ENGINEER deems necessary to make final inspection of preparations at location of proposed concrete placing.
 - b. Place forms, reinforcement, screeds, anchors, ties, and inserts in place before notification of readiness is given to the ENGINEER.
 - c. Depositing Concrete:
 - 1) Deposit concrete at or near its final position to avoid segregation caused by rehandling or flowing.
 - 2) Do not deposit concrete in large quantities in one place and work along forms with vibrator or by other methods.
 - 3) Do not drop concrete freely into place from height greater than 5 feet.
 - 4) Use tremies for placing concrete where drop is over 5 feet.
 - 5) Commence placement of concrete on slopes, at bottom of slope.
9. Place concrete in approximately horizontal layers not to exceed 24 inches in depth and bring up evenly in all parts of forms.
10. Continue concrete placement without avoidable interruption, in continuous operation, until end of placement is reached.
11. After placement begins, it should continue without significant interruption. Precautions should be planned and implemented to prevent any delay, between layers being placed, from exceeding 20 minutes.
12. If concrete is to be placed over previously placed concrete and more than 20 minutes have elapsed, then spread layer of grout not less than 1/2 inch in thickness nor more than 1 inch in thickness over surface before placing additional concrete.
13. Placement of Concrete for Slabs, Beams, or Walkways:
 - a. If cast monolithically with walls or columns, do not commence until concrete in walls or columns has been allowed to set and shrink.
 - b. Allow set time of not less than one hour for shrinkage.

E. Consolidating Concrete:

1. Place concrete with aid of acceptable mechanical vibrators.
2. Thoroughly consolidate concrete around reinforcement, pipes, or other shapes built into the work.
3. Provide sufficiently intense vibration to cause concrete to flow and settle readily into place and to visibly affect concrete over radius of at least 18 inches.
4. Vibrators:
 - a. Keep sufficient vibrators on hand at all times to vibrate concrete as placed.
 - b. In addition to vibrators in actual use while concrete is being placed, have on hand minimum 1 spare vibrator in serviceable condition.
 - c. Place no concrete until it has been ascertained that all vibrating equipment, including spares, are in serviceable condition.

5. Take special care to place concrete solidly against forms to leave no voids.
 6. Take every precaution to make concrete solid, compact, and smooth, and if for any reason surfaces or interiors have voids or are in any way defective, repair such concrete in manner acceptable to the ENGINEER.
- F. Ring Wall and Slabs on Grade:
1. Do not place concrete on ground or compacted fill until subgrade is in moist condition acceptable to the ENGINEER.
 2. If necessary, sprinkle subgrade with water not less than 6 or more than 20 hours in advance of placing concrete.
 3. If it becomes dry prior to actual placing of concrete, sprinkle again, without forming pools of water.
 4. Place no concrete if subgrade is muddy or soft.
- G. Loading Concrete:
1. Green Concrete:
 - a. No heavy loading of green concrete will be permitted.
 - b. Green concrete is defined as concrete with less than 100 percent of the specified strength.
 2. No backfill shall be placed against concrete walls, connecting slabs, or beams until the concrete has reached the specified strength.
 3. Use construction methods, sequencing, and allow time for concrete to reach adequate strength to prevent overstress of the concrete structure during construction.
- H. Curing Concrete:
1. General:
 - a. Cure concrete by methods specified in this Section.
 - b. Cure concrete minimum of 7 days.
 - c. Cure concrete to be painted with water or plastic membrane.
 - d. Do not use curing compound on concrete surfaces that are to receive paint or upon which any material is to be bonded.
 - e. Water cure or plastic membrane cure concrete slabs that are specified to be sealed by concrete sealer.
 - f. Cure other concrete by water curing or sprayed curing membrane at the CONTRACTOR's option.
 - g. Floor slabs may be cured using plastic membrane curing.
 2. Water Curing:
 - a. Keep surfaces of concrete being water cured constantly and visibly moist day and night for period of not less than 7 days.
 - b. Each day forms remain in place may count as 1 day of water curing.
 - c. No further curing credit will be allowed for forms in place after contact has once been broken between concrete surface and forms.
 - d. Do not loosen form ties during period when concrete is being cured by leaving forms in place.
 - e. Flood top of walls with water at least 3 times per day, and keep concrete surfaces moist at all times during 7 day curing period.
 3. Sprayed Membrane Curing:
 - a. Apply curing compound to concrete surface after repairing and patching, and within 1 hour after forms are removed.
 - b. If more than 1 hour elapses after removal of forms, do not use membrane curing compound, but use water curing for full curing period.

- c. If surface requires repairing or painting, water cure such concrete surfaces.
- d. Curing Compound:
 - 1) Do not remove curing compound from concrete in less than 7 days.
 - 2) Curing compound may be removed only upon written request by the CONTRACTOR and acceptance by the ENGINEER, stating what measures are to be performed to adequately cure structures.
 - 3) Take care to apply curing compound in area of construction joints. See that curing compound is placed within construction joint silhouette.
 - 4) After curing period is complete, remove curing compound placed within construction joint silhouette by heavy sandblasting prior to placing any new concrete.
 - 5) CONTRACTOR's Option: Instead of using curing compound for curing of construction joints, such joints may be water cured.
 - 6) Apply curing compound by mechanical, power operated sprayer and mechanical agitator that will uniformly mix all pigment and compound.
 - 7) Apply compound in at least 2 coats.
 - 8) Apply each coat in direction 90 degrees to preceding coat.
 - 9) Apply curing compound in sufficient quantity so that concrete has uniform appearance and that natural color is effectively and completely concealed at time of spraying.
 - 10) Continue to coat and recoat surfaces until specified coverage is achieved and until coating film remains on concrete surfaces.
 - 11) Thickness and Coverage of Curing Compound: Provide compound having film thickness that can be scraped from surfaces at any and all points after drying for at least 24 hours.
 - 12) The CONTRACTOR is cautioned that method of applying curing compound specified herein may require more compound than normally suggested by manufacturer of compound and also more than is customary in the trade.
 - 13) Apply amounts specified herein, regardless of manufacturer's recommendations or customary practice, if curing compound is used in place of water curing.
 - 14) If the CONTRACTOR desires to use curing compound other than specified curing compound, coat sample areas of concrete wall with proposed curing compound and also similar adjacent area with specified compound in specified manner for comparison:
 - a) If proposed sample is not equal or better, in opinion of the ENGINEER, in all features, proposed substitution will not be allowed.
 - 15) Prior to final acceptance of the work, remove, by sandblasting or other acceptable method, any curing compound on surfaces exposed to view, so that only natural color of finished concrete is visible uniformly over entire surface.
- 4. Plastic Membrane Curing:
 - a. Polyethylene film may be used to cure slabs. Seal joints and edges with small sand berm.
 - b. Install plastic membrane as soon as concrete is finished and can be walked on without damage.
 - c. Keep concrete moist under plastic membrane.

3.02 CONCRETE FINISHING

- A. Provide concrete finishes in accordance with Section 03366.
- B. Edges of Joints:
 - 1. Provide joints having edges as indicated on the Drawings.
 - 2. Protect wall and slab surfaces at edges against concrete spatter and thoroughly clean upon completion of each placement.
- C. Concrete Sealer:
 - 1. Floors and Slabs to Receive Concrete Sealer: As specified in DIVISION 9.
 - 2. Apply Concrete Sealer:
 - a. Apply concrete sealer at coverage rate not to exceed 300 square feet per gallon.
 - b. Apply as soon as slab or floor will bear weight.
 - c. Sealer:
 - 1) Before applying concrete sealer, sweep entire surface clean with very soft bristled brush that will not mark finish and remove any standing water.
 - 2) Apply concrete sealer with sprayer.
 - 3) Use of paint rollers or mop is not acceptable.
 - 4) Workmen shall wear flat soled shoes which will not mark or scar surface.
 - 5) Do not allow traffic on floors and slabs until concrete sealer has dried and hardened.

3.03 FIELD QUALITY CONTROL

- A. Testing of Concrete:
 - 1. During progress of construction, the OWNER will have tests made to determine whether the concrete, as being produced, complies with requirements specified.
 - 2. Tests will be performed in accordance with ASTM C 31, ASTM C 39, and ASTM C 172.
 - 3. The ENGINEER will make and deliver test cylinders to the laboratory and testing expense will be borne by the OWNER.
 - 4. Required Number Cylinders:
 - a. Not less than 3 cylinder specimens, 6 inch diameter by 12 inch long, will be tested for each 150 cubic yards of each class of concrete with minimum of 3 three specimens for each class of concrete placed and not less than 3 specimens for each half day's placement.
 - b. One cylinder will be broken at 7 days and 2 at 28 days.
 - 5. The CONTRACTOR shall:
 - a. Test slump of concrete using slump cone in accordance with requirements of ASTM C 143.
 - b. Furnish test equipment.
 - c. Do not use concrete that does not meet specification requirements in regards to slump. Remove such concrete from project site.
 - d. Test slump at the beginning of each placement, as often as necessary to keep slump within the specified range, and when requested to do so by the ENGINEER.

- e. Make provisions for and furnish concrete for test specimens, and provide manual assistance to the ENGINEER in preparing said specimens.
- f. Assume responsibility for care of and providing of curing conditions for test specimens in accordance with ASTM C 31.

B. Air Entraining Admixture:

1. Test percent of entrained air in concrete at beginning of each placement, as often as necessary to keep entrained air within specified range, and when requested to do so by the ENGINEER.
2. Provide test equipment.
3. Do not use concrete that does not meet Specification requirements for air entrainment. Remove such concrete from project site.
4. Test air entrainment in concrete in accordance with ASTM C 173.
5. The ENGINEER may at any time test percent of entrained air in concrete received on project site.

C. Enforcement of Strength Requirement:

1. Concrete is expected to reach higher compressive strength than that which is indicated in Table A as specified compressive strength f'_c .
2. Strength Level of Concrete: Will be considered acceptable if following conditions are satisfied:
 - a. Averages of all sets of 3 consecutive strength test results is greater or equal to specified compressive strength f'_c .
 - b. No individual strength test (average of 2 cylinders) falls below specified compressive strength f'_c by more than 500 pounds per square inch.
 - c. Whenever one, or both, of 2 conditions stated above is not satisfied, provide additional curing of affected portion followed by cores taken in accordance with ASTM C 42, ACI 318, and ACI 350 and comply with following requirements:
 - 1) If additional curing does not bring average of 3 cores taken in affected area to at least specified compressive strength f'_c , designate such concrete in affected area as defective.
 - 2) The ENGINEER may require the CONTRACTOR to strengthen defective concrete by means of additional concrete, additional reinforcement, or replacement of defective concrete, all of the CONTRACTOR's expense.

3.04 ADJUSTING

A. Repair of Defective Concrete:

1. Remove and replace or repair defective work.
2. Correct defective work as specified in this Article.
3. Do not patch, repair, or cover defective work without inspection by the ENGINEER.
4. Provide repairs having strength equal to or greater than specified concrete for areas involved.
5. Preparation of Concrete for Repair:
 - a. Make no repair until ENGINEER has accepted method for preparing surface for repair.

- b. Chip out and key imperfections in the work and make them ready for repair.
 - c. Surfaces of Set Concrete to Be Repaired: First coat with epoxy bonding agent as specified in Section 03071.
6. Methods of Repair:
- a. Dry Pack Method:
 - 1) Use for holes having depth nearly equal to or greater than least surface dimension of hole, for cone-bolt holes, and for narrow slots cut for repair.
 - 2) Smooth Holes: Clean and roughen by heavy sandblasting before repair.
 - b. Mortar Method of Replacement:
 - 1) Use for holes too wide to dry pack and too shallow for concrete replacement.
 - 2) Comparatively shallow depressions, large or small, which extend no deeper than nearest surface reinforcement.
 - c. Concrete Replacement:
 - 1) Use when holes extend entirely through concrete section or when holes are more than 1 square foot in area and extend halfway or more through the section.

END OF SECTION

SECTION 03366

TOOLED CONCRETE FINISHES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Tooled concrete finishes.

1.02 DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping:
 - 1. Deliver and store packaged materials in original containers until ready for use.

PART 2 PRODUCTS

2.01 MIXES

- A. Mortar Mix for F4 Finish: Consist of 1 part cement and 1-1/2 parts of fine sand passing Number 100 screen, mixed with enough water and emulsified bonding agent to have consistency of thick cream.

PART 3 EXECUTION

3.01 CONCRETE FINISHING

- A. Cement for Finishes:
 - 1. Addition of white cement may be required to produce finish which matches color of concrete to be finished.
- B. Vertical Concrete Surfaces: Use Following Finishes for Vertical Concrete Surfaces as Indicated in Article 3.02:
 - 1. F1 Finish: No special treatment other than repair defective work and fill depressions 1 inch or deeper and tie holes with mortar after removal of curing membrane.
 - 2. F2 Finish: No special treatment other than repair defective work, remove fins, fill depressions 1/2 inch or deeper and tie holes with mortar after removal of curing membrane.
 - 3. F3 Finish: Repair defective work, remove fins, offsets, and curing membrane, and grind projections smooth. Fill depressions 1/4 inch or larger in depth or width and tie holes with mortar after removal of curing membrane.
 - 4. F4 Finish:
 - a. Same as specified for F3 Finish, and, in addition fill depressions and holes 1/16 inch or larger in width with mortar.
 - b. "Brush-Off" sandblast surfaces prior to filling holes to expose all holes near surface of the concrete.
 - c. Thoroughly wet surfaces and commence filling of pits, holes, and depressions while surfaces are still damp.

- d. Perform filling by rubbing mortar over entire area with clean burlap, sponge rubber floats, or trowels.
 - e. Do not let any material remain on surfaces, except that within pits and depressions.
 - f. Wipe surfaces clean and moist cure.
- C. Horizontal Concrete: After proper and adequate vibration and tamping, use following finishes for horizontal concrete surfaces as indicated in Article 3.02:
- 1. S1 Finish: Screeded to grade and leave without special finish.
 - 2. S2 Finish: Smooth steel trowel finish.
 - 3. S3 Finish: Steel trowel finish free from trowel marks. Provide smooth finish free of all irregularities.
 - 4. S4 Finish: Steel trowel finish, without local depressions or high points, followed by light hairbroom finish. Do not use stiff bristle brooms or brushes. Perform brooming parallel to slab-drainage. Provide resulting finish that is rough enough to provide nonskid finish. Finish shall be subject to review and acceptance by the ENGINEER.
- D. Concrete Floor Surfaces to Which Surfacing Material Is Applied: Finish smooth with tolerance within 1/8 inch in 10 feet in any direction from lines indicated on the Drawings.

3.02 CONCRETE FINISHING

- A. Finish concrete surfaces as indicated on the Drawings. Where not specified or indicated on the Drawings, finish surfaces as follows:
- 1. F4 Finish for Following Vertical Surfaces:
 - a. Concrete surfaces exposed to view.
 - 2. F3 Finish for Following Vertical Surfaces:
 - a. Concrete surfaces not exposed to view.
 - 3. S4 Finish for Following Surfaces:
 - a. Exterior walkways and slabs.
 - 4. S3 Finish for Following Surfaces:
 - a. Tops of ring wall.
 - b. All other surfaces not specified to be finished otherwise.

END OF SECTION

SECTION 03600

GROUTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Concrete mortar.
 - 2. Drypack mortar.
 - 3. Epoxy grout.
 - 4. Grout.
 - 5. Non-shrink epoxy grout.
 - 6. Non-shrink grout.
- B. Related Sections:
 - 1. Section 03071 - Epoxies.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (using 2-inch or 50-millimeter cube specimens).
 - 2. C 230 - Standard Specification For Flow Table For Use In Tests Of Hydraulic Cement
 - 3. C 531 - Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
 - 4. C 579 - Standard Test Method for Compressive Strength of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacing and Polymer Concretes.
 - 5. C 939 - Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).
 - 6. C 1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
 - 7. C 1181 - Standard Test Methods for Compressive Creep of Chemical-Resistant Polymer Machinery Grouts.

1.03 SUBMITTALS

- A. Non-Shrink Grout: Submit manufacturer's literature and certified test data prior to installation.
- B. Non-Shrink Epoxy Grout: Submit manufacturer's literature and certified test data prior to installation.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. All materials shall be delivered to the jobsite in their original, unopened packages or containers, clearly labeled with the manufacturer's product identification and printed instructions.

- B. All materials shall be stored in a cool dry place and in accordance with the manufacturer's recommendations.
- C. All materials shall be handled in accordance with the manufacturer's instructions.

1.05 PROJECT/SITE CONDITIONS

- A. Refer to manufacturer's literature or contact the manufacturer for any special physical or environmental limitations that may be required for use of products.

1.06 WARRANTIES

- A. Non-Shrink Grout: The manufacturer shall warranty that the non-shrink grout will never go below its initial placement volume when tested in accordance with ASTM C 1107.
- B. Non-Shrink Epoxy Grout: The manufacturer shall warranty that non-shrink epoxy grout will show negligible shrinkage or expansion when tested in accordance with ASTM C 531.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Concrete Mortar:
 - 1. General: Consist of concrete mixture with coarse aggregate removed and water quantity adjusted as required.
 - 2. At Exposed Concrete Surfaces Not to Be Painted or Submerged in Water: White cement.
- B. Dry-Pack Mortar:
 - 1. Consist of mixture of portland cement and sand.
- C. Epoxy Grout:
 - 1. Consist of mixture of epoxy and sand.
 - 2. Sand: Clean, bagged, graded, and kiln dried silica sand.
- D. Grout:
 - 1. Consist of mixture of portland cement and sand.
- E. Non-Shrink Epoxy Grout:
 - 1. Manufacturers: One of the following or equal:
 - a. Five Star Products, Inc., Fairfield, CT, Five Star Epoxy Grout.
 - b. BASF, Shakopee, MN., Masterflow 648.
 - c. L&M Construction Chemicals, Inc., EPOGROUT.
 - 2. Non-shrink epoxy grout shall be a 100 percent solid, premeasured, prepackaged system containing a 2-component thermosetting epoxy resin and inert aggregate.
 - 3. Consistency: Non-shrink epoxy grout shall maintain a flowable consistency for at least 45 minutes at 70 degrees Fahrenheit.

4. Dimensional Stability (height change):
 - a. Non-shrink epoxy grout shall have negligible shrinkage or expansion (less than 0.0006 inches/inch) when tested in accordance with ASTM C 531.
5. Compressive Strength: Non-shrink epoxy grout shall show a minimum compressive strength of 10,000 pounds per square inch at 24 hours and 14,000 pounds per square inch at 7 days when tested in accordance with ASTM C 579, Method B.
6. Compressive Creep: The compressive creep for non-shrink epoxy grout shall not exceed 0.0027 inches/inch when tested under a 400 pounds per square inch constant load at 140 degrees Fahrenheit in accordance with ASTM C 1181.
7. Thermal Capability: The coefficient of thermal expansion for non-shrink epoxy grout shall not exceed 0.000018 inches per inch per degree Fahrenheit when tested under ASTM C 531, Method B.

F. Non-Shrink Grout:

1. Manufacturers: One of the following or equal:
 - a. Five Star Products, Inc., Fairfield, CT, Five Star Grout.
 - b. BASF, Shakopee, MN., Masterflow 928.
 - c. L&M Construction Chemicals, Inc., Omaha, NE, CRYSTEX.
2. Preportioned and prepackaged cement-based mixture. It shall contain no metallic particles such as aluminum powder and no metallic aggregate such as iron filings. It shall require only the addition of potable water.
3. Potable Water for Pre-Soaking, Mixing, and Curing: Clean and free of oils, acids, alkalies, organics, and any other deleterious matter.
4. Bleeding: Free from the emergence of mixing water from within or the presence of water on its surface.
5. In accordance with ASTM C 1107.
6. Consistency: Remain at a minimum flowable consistency for at least 45 minutes after mixing at 45 degrees Fahrenheit to 90 degrees Fahrenheit when tested in accordance with ASTM C 230. If at a fluid consistency, it shall be verified in accordance with ASTM C 939.
7. Dimensional Stability (height change): In accordance with ASTM C 1107, volume-adjusting Grade B or C at 45 degrees to 90 degrees. It shall show 90 percent or greater bearing area under bases or baseplates.
8. Compressive Strength: Non-shrink grout shall show minimum compressive strengths at 45 degrees Fahrenheit to 90 degrees Fahrenheit in accordance with ASTM C 1107 for various periods from the time of placement, including 5,000 pounds per square inch at 28 days when tested in accordance with ASTM C 109 as modified by ASTM C 1107.

2.02 MIXES

A. Concrete Mortar Mix:

1. Use water-to-cementitious materials ratio that is no more than that specified for concrete being repaired.
2. At Exposed Concrete Surfaces Not to Be Painted or Submerged in Water: Use sufficient white cement to make color of finished patch match that of surrounding concrete.

- B. Dry-Pack Mortar Mix: Use only enough water so that resulting mortar will crumble to touch after being formed into ball by hand.

- C. Epoxy Grout:
 - 1. Mix in accordance with manufacturer's installation instructions.
 - 2. Proportioning:
 - a. For Horizontal Work: Consist of mixture of 1 part epoxy as specified in Section 03071 with not more than 2 parts sand.
 - b. For Vertical or Overhead Work: Consist of 1 part epoxy gel as specified in Section 03071 with not more than 2 parts sand.
- D. Grout Mix:
 - 1. For Concrete Repair: Mix in same proportions used for concrete being repaired, with only sufficient water to give required consistency for spreading.
 - 2. For Spreading over the Surfaces of Construction or Cold Joints: Mix with no more water used than allowed by water-to-Cementitious materials ratio specified for concrete.
 - 3. For Other Applications: Mix in proportions by weight of 1 part cement to 4 parts of concrete sand.
- E. Non-Shrink Epoxy Grout: Mix in accordance with manufacturer's installation instructions.
- F. Non-Shrink Grout: Mix in accordance with manufacturer's installation instructions such that resulting mix has flowable consistency and is suitable for placing by pouring.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Inspect concrete surfaces to receive grout or mortar and verify that they are free of ice, frost, dirt, grease, oil, curing compounds, paints, impregnations, and all loose material or foreign matter likely to affect the bond or performance of grout or mortar.
- B. Inspect baseplate and anchor systems for rust, oil, and other deleterious substances that may affect the bond or performance of grout.
- C. Confirm that newly placed concrete has been cured sufficiently to attain its design strength and limit further shrinkage.
- D. Verify that temperature of cementitious or epoxy grout does not exceed manufacturer's recommendations.

3.02 PREPARATION

- A. Surface Preparation:
 - 1. Roughen all concrete surfaces by heavy sandblasting, chipping, or other mechanical means to assure bond. Loose or broken concrete shall be removed.
 - 2. All grease, oil, dirt, curing compounds, laitance, and other deleterious materials that may affect bond that were identified in the inspection process shall be completely removed from concrete and bottoms of baseplates. All metal surfaces should have a 2 to 3 mil peak-to-valley profile for epoxy grouts.

3. For cementitious mortars and grouts, concrete shall be saturated surface damp. Any standing water shall be removed prior to placing grouts.
 4. For epoxy grouts, do not wet concrete surfaces with water. Instead, where required, wet surfaces with epoxy for horizontal work or epoxy gel for vertical or overhead work prior to placing epoxy grouts.
- B. Forms and Headboxes for Cementitious or Epoxy Grouts:
1. Forms for grouts shall be built of material with adequate strength to withstand the placement of grouts.
 2. Forms must be rigid and liquid tight. All cracks and joints shall be caulked with an elastomeric sealant. All forms shall be lined with polyethylene for easy grout release. Forms carefully waxed with two coats of heavy-duty paste wax shall also be acceptable.
 3. Forms shall be 4 to 6 inches higher than the baseplate on one side of the baseplate configuration when using head pressure for placement.
 4. A sufficient number of headboxes shall be built to facilitate placement of grouts.
 5. Air relief holes a minimum 1/8 inch in diameter shall be provided when required by a baseplate configuration to avoid entrapping air underneath.

3.03 APPLICATION

- A. Cement Mortar and Grout:
1. For Defective Concrete Repair:
 - a. Filling: Filling of voids around items through the concrete.
 - b. Grout Spreading: Spread over construction joints, cold joints, and similar type items.
 2. Concrete Surfaces:
 - a. Apply epoxy-bonding agent to clean, roughened, and dry surfaces before placing mortar or grout.
 3. Placing:
 - a. Exercise particular care in placing Portland cement mortar or grout since they are required to furnish structural strength, or impermeable water seal, or both.
 - b. Do not use cement mortar or grout that has not been placed within 30 minutes after mixing.
- B. Epoxy Grout:
1. Apply in accordance with manufacturer's installation instructions.
 2. Use where specified herein or where indicated on the Drawings.

3.04 PLACEMENT

- A. Grout shall only be installed after the final equipment alignment is correct and accepted by the ENGINEER:
1. Grouts shall be mixed in accordance with the manufacturer's recommendations.
 2. Use mortar mixer with moving paddles for mixing grouts. For cementitious grouts, pre-wet the mixer and empty out excess water before beginning mixing.

3. Cementitious Grouts:
 - a. Add non-shrink cementitious grout to a premeasured amount of water that does not exceed the manufacturer's maximum recommended water content.
 - b. Mix cementitious grouts per manufacturer's instructions for uniform consistency.
 - c. Grouts may be drypacked, flowed, or pumped into place. All baseplate grouting shall take place from one side of a baseplate to the other to avoid trapping air. Do not overwork grouts.
 - d. Do not retemper grout by adding more water after stiffening.
 - e. Hydrostatic head pressure shall be maintained by keeping the level of the grout in the headbox above the bottom of the baseplate. The headbox should be filled to the maximum level and the grout worked down to top of baseplate.
4. Epoxy Grouts:
 - a. Epoxy grouts shall be mixed in complete units. Do not vary the ratio of components or add solvent to change the consistency of the mix.
 - b. Pour the hardener into the resin and mix for at least 1 minute and until each mixture is uniform in color. Pour the chemical components into the mortar mixer wheelbarrow and add the aggregate. Mix until aggregate is uniformly wetted. Over mixing will cause air entrapment in the mix.
 - c. All epoxy grout shall be flowed into place using a headbox. All grouting shall take place from one side of a baseplate to the other in a continuous flow to avoid trapping air.
 - d. Hydrostatic head pressure shall be maintained by keeping the level of grout in headboxes above the bottom of baseplates. Headboxes shall be filled to the maximum level and grout worked down to the bottom of baseplates.
 - e. Epoxy grouts shall not be cut back after setting. The final level of grout will be as installed with all chamfer edges built into the formwork.

3.05 CURING

- A. Cementitious Grouts:
 1. Grouts must be cut back to the lower edge of baseplates after reaching initial set. Provide a 45 degree angle cut back.
 2. Clean equipment and tools as recommended by the grout manufacturer.
 3. Cure grouts in accordance with manufacturer's specifications and recommendations. Keep grout moist for a minimum of 3 days. The method needed to protect grouts will depend on temperature, humidity, and wind. Wet burlap, a soaker hose, sun shading, ponding, and, in extreme conditions, a combination of methods shall be employed.
 4. Grouts shall be maintained above 40 degrees Fahrenheit until they have attained a compressive strength of 3,000 pounds per square inch, or above 70 degrees Fahrenheit for a minimum of 24 hours to avoid damage from subsequent freezing.
- B. Epoxy Grouts:
 1. Cure grouts in accordance with manufacturers' specifications and recommendations. Do not wet cure epoxy grouts.

2. Consult the manufacturer for appropriate cure schedule. In no case should any surface in contact with epoxy grout be allowed to fall below 50 degrees Fahrenheit for a minimum of 48 hours after placement.

3.06 FIELD QUALITY CONTROL

- A. Non-shrink cementitious grouts shall be tested for 24 hour compressive strength in accordance with ASTM C 109.
- B. Non-shrink grouts shall be tested for 24 hour compressive strength in accordance with ASTM C 579, Method B.

END OF SECTION

SECTION 03931

EPOXY INJECTION SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Epoxy injection system.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
1. D 638 - Standard Test Method for Tensile Properties of Plastics.
 2. D 695 - Standard Test Method for Compressive Properties of Rigid Plastics.
 3. D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's data completely describing epoxy injection system materials.
- B. Quality Control Submittals:
1. Certificates of Compliance.
 2. Manufacturer's Instructions.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Manufacturers: One of the following or equal:
1. BASF, Masterinject 1500.
 2. Sika Chemical Corp.'s, Sikadur 35, Hi-Mod LV.
- B. Epoxy:
1. Provide epoxy materials that are new and use them within shelf life limitations set forth by manufacturer.
 2. Water-insensitive 2 part type low viscosity epoxy adhesive material containing 100 percent solids and meeting or exceeding following characteristics when tested in accordance with standards specified:

Physical Characteristic	Test Method	Required Results
Tensile Strength	ASTM D 638	8,000 pounds per square inch at 14 days.
Flexure Strength	ASTM D 790	11,000 pounds per square inch at 14 days.
Compressive Strength	ASTM D 695	11,000 pounds per square inch at 24 hours.

Physical Characteristic	Test Method	Required Results
Bond Strength	--	Concrete shall fail before failure of epoxy.
Gel Time for 5 Mil Film	--	4 hours maximum.
Elongation	ASTM D 638	1 percent minimum at 14 days.

2.02 EQUIPMENT

- A. Pump Unit:
1. Furnish unit to be used for injection that is positive displacement type with interlock to provide in-line mixing and metering system for 2 component epoxy.
 2. Furnish pressure hoses and injection nozzle of such design as to allow proper mixing of 2 components of epoxy.
 3. Presence of standby injection unit may be required.

2.03 MIXES

- A. Epoxy Injection System Materials:
1. Mix epoxy in accordance with manufacturer's installation instructions.
 2. Do not use solvents to thin epoxy system materials introduced into cracks or joints.

PART 3 EXECUTION

3.01 PREPARATION

- A. Surface Preparation:
1. Epoxy Injection System:
 - a. General: Before processing, sweep or clean area in vicinity of crack location to receive epoxy and leave in generally clean condition.
 - b. Joints to Receive Epoxy: Clean in manner such that joints are free from dirt, laitance, and other loose matter.

3.02 INSTALLATION

- A. Install and cure epoxy materials in accordance with manufacturer's installation instructions.
- B. Perform and conduct work of this Section in neat orderly manner.
- C. Epoxy Injection System:
1. Apply adequate surface seal to crack or joint to prevent escape of epoxy.
 2. Establish entry points at distance along seal not less than thickness of cracked member.
 3. Force epoxy into crack at first port with sufficient pressure to advance epoxy to adjacent port.
 4. Seal original port and shift entry to port at which epoxy appears.
 5. Continue this manner of port-to-port injection until each joint has been injected for its entire length.

6. For small amounts, or where excessive grout pressure developed by pump unit might further damage structure, premixed material and hand caulking gun may be used if acceptable to the ENGINEER.
7. Seal ports, including adjacent locations where epoxy seepage occurs, as necessary to prevent drips or run out.
8. After epoxy injection is complete, remove surface seal material and refinish concrete in area where epoxy was injected to match existing concrete.

END OF SECTION

SECTION 05120
STRUCTURAL STEEL

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Structural steel shapes and plate.
 - 2. Fasteners:
 - a. All thread rods.
 - b. Anchor bolts.
 - c. Assembly bolts.
 - d. Chemical anchors.
 - e. Concrete anchors.
 - f. Sleeve anchors.
 - g. Welded studs.
 - 3. Isolation sleeves and washers.
 - 4. Thread coating.
 - 5. Welding.

- B. Related Sections:
 - 1. Section 01455 - Special Tests and Inspections.

1.02 REFERENCES

- A. American Institute of Steel Construction (AISC):
 - 1. Specification for Structural Steel Buildings.

- B. American National Standards Institute (ANSI):
 - 1. B212-15 - Cutting Tools - Carbide-tipped Masonry Drills and Blanks for Carbide-tipped Masonry Drills.

- C. American Society for Testing and Materials (ASTM):
 - 1. A 36/A 36M - Standard Specification for Carbon Structural Steel.
 - 2. A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded, and Seamless.
 - 3. A 108 - Standard Specification for Steel Bars, Carbon, Cold Finished Standard Quality.
 - 4. A 123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 5. A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 6. A 240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - 7. A 276 - Standard Specification for Stainless Steel Bars and Shapes.
 - 8. A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

9. A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 10. A 489 - Standard Specification for Carbon Steel Lifting Eyes.
 11. A 490 - Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
 12. A 496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
 13. A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 14. A 501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
 15. F 593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 16. F 959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.
- D. American Welding Society (AWS):
1. A 5.1 - Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.
 2. A 5.17 - Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding.
 3. A 5.20 - Specification for Carbon Steel Electrodes for Flux Cored Arc Welding.
 4. D 1.1 - Structural Welding Code - Steel.
 5. D 10.4 - Recommended Practices for Welding Austenitic Chromium-Nickel Stainless Steel Piping and Tubing.

1.03 SUBMITTALS

- A. Quality Control Submittals:
1. Submit shop drawings of members to be fabricated before starting their fabrication.
 2. Welder's certificates.
- B. Test Reports:
1. Certified copies of mill tests and analyses made in accordance with applicable ASTM standards, or reports from a recognized commercial laboratory, including chemical and tensile properties of each shipment of structural steel or part thereof having common properties.
 2. Current International Conference of Building Officials Evaluation Report.
 3. Concrete anchor installation test report.

1.04 QUALITY ASSURANCE

- A. Qualifications:
1. Perform welding of structural metals with welders who have current American Welding Society certificate for the type of welding to be performed.
 2. Notify ENGINEER 24 hours minimum before starting shop or field welding.
 3. ENGINEER may check materials, equipment, and qualifications of welders.
 4. Remove welders performing unsatisfactory Work, or require to requalify.
 5. ENGINEER may use gamma ray, magnetic particle, dye penetrant, trepanning, or other aids to visual inspection to examine any part of welds or all welds.

6. CONTRACTOR shall bear costs of retests on defective welds.
7. CONTRACTOR shall also bear costs in connection with qualifying welders.
8. Special inspection for the installation of chemical anchors as specified in Section 01455 is required.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping: Deliver structural steel free from mill scale, rust, and pitting.
- B. Storage and Protection: Until erection and painting, protect from weather items not galvanized or protected by a shop coat of paint.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Unless Otherwise Specified or Indicated on the Drawings, Materials Shall Conform to the Following:

Item	ASTM Standard	Class, Grade, Type, or Alloy Number
Steel		
Plate, bars, rolled shapes, and miscellaneous items	A 36	--
Tubing, cold-formed	A 500	--
Tubing, hot-formed	A 501	--
Round HSS	A 500	Grade B
Steel pipe	A 53	Grade B
Stainless steel		
Plate, sheet, and strip	A 240	Type 304* or 316**
Bars and shapes	A 276	Type 304* or 316**
* Use Type 304L if material will be welded.		
** Use Type 316L if material will be welded.		

- B. Where stainless steel is welded, use low-carbon stainless steel.

2.02 FASTENERS

- A. General: Furnish threaded fasteners, except high strength bolts, with flat washers, and self-locking nuts, or lock washers and nuts:
 1. Bolt Heads and Nuts: Hex-type.
 2. Bolts, Nuts, and Washers: Of domestic manufacture.
 3. Where bolts, including anchor bolts, nuts, washers, and similar fasteners are specified to be galvanized, galvanize in accordance with ASTM A 153.

- B. Anchor Bolts:
1. Anchor Bolts, Nuts, and Washers: Type 316 stainless steel in accordance with ASTM F 593 for use in wet and moist locations, including:
 - a. Water-Containing Structures:
 - 1) Below and at water level.
 - 2) Above Water Level:
 - a) Below top of walls of water-containing structures.
 - b) Under the roof, slab, beam, or walkway of enclosed water-containing structures.
 - 3) Dry side of walls of water-containing structures.
 - b. Pump bases.
 2. Anchor Bolts, Nuts, and Washers: Type 304 or Type 316 stainless steel for fastening aluminum to concrete or steel.
 3. Anchor Bolts, Nuts, and Washers: Hot-dip galvanized ASTM A 307 steel bolt or hot-dip galvanized ASTM A 36 steel, for applications other than those specified.
- C. Assembly Bolts:
1. Bolts, Nuts, and Washers for Wood Baffles, Collectors, and Other Field-Assembled Construction: Type 316 stainless steel in accordance with ASTM F 593 for use in wet and moist locations, including:
 - a. Water-Containing Structures:
 - 1) Below and at water level.
 - 2) Above water level:
 - a) Below top of walls of water-containing structures.
 - b) Under the roof, slab, beam, or walkway of enclosed water-containing structures.
 - c) Dry side of walls of water-containing structures.
 - b. Pump bases.
 2. Type 304 or Type 316 stainless steel in accordance with ASTM F 593 for aluminum assemblies.
 3. Hot-dip galvanized ASTM A 307 steel for galvanized assemblies and for applications other than those specified.
- D. Chemical Anchors:
1. Chemical anchors shall have vinyl ester resin in the composition of the adhesive.
 2. All-thread rods shall be either ASTM A 36 steel or stainless steel.
 3. Hot-dip galvanize or zinc plate ASTM A 36 steel all-thread rods.
 4. Stainless steel all-thread rod shall conform with ASTM F 593 and shall be used for corrosive conditions where indicated on the Drawings.
 5. All-thread rods used with the adhesive capsule shall have chisel points and shall be free of oil or coatings that may reduce bond.
 6. Do not use chemical anchors to resist tension in overhead positions.
 7. Chemical Anchors:
 - a. Manufacturers: One of the following or equal:
 - 1) Hilti Incorporated, Hilti HVA Adhesive Anchor System.
- E. Concrete Anchors:
1. Manufacturers: One of the following or equal:
 - a. Hilti Incorporated, Kwik Bolt 3 Concrete Anchor.
 - b. ITW Ramset/Redhead, Trubolt Wedge Concrete Anchor.
 - c. Simpson Strong Tie, Wedge-All Concrete Anchors.

2. Concrete Anchor's Integral Threaded Stud, Wedge, Washer, and Nut: Type 304 or Type 316 stainless steel in accordance with ASTM F 593. For use in wet and moist locations, including:
 - a. Water-Containing Structures:
 - 1) Below and at water level.
 - 2) Above Water Level:
 - a) Below top of walls of water-containing structures.
 - b) Under the roof, slab, beam, or walkway of enclosed water-containing structures.
 - 3) Dry side of walls of water-containing structures.
 - b. Pump bases.
 3. Concrete Anchor's Integral Threaded Stud, Wedge, Washer, and Nut: Type 304 or 316 stainless steel in accordance with ASTM F 593 for fastening aluminum to concrete or steel.
 4. Concrete Anchor's Integral Threaded Stud, Wedge, Washer, and Nut: Hot-dip galvanized carbon steel, for applications other than those specified.
 5. Do not use Slug-in, lead cinch, and similar systems relying on deformation of lead alloy or similar materials in order to develop holding power.
- F. Deformed Bar Anchors: In accordance with ASTM A 496:
1. Manufacturers: One of the following or equal:
 - a. Nelson Stud Welding Company, D2L Deformed Bar Anchors.
 - b. Stud Welding Products, DBA (Deformed Bar) Anchors.
- G. Sleeve Anchors:
1. Manufacturers: One of the following or equal:
 - a. Powers Fastening, Incorporated, Power-Bolt.
 2. For use in wet and moist locations, including locations listed below. Use Type 304 stainless steel in accordance with ASTM F 593 for sleeve anchor's internal bolt, expansion sleeve, extension sleeve, and washer. Use Type 303 stainless steel in accordance with ASTM F 593 for sleeve anchors expansion cone:
 - a. Water-Containing Structures:
 - 1) Below and at water level.
 - 2) Above Water Level:
 - a) Below top of walls of water-containing structures.
 - b) Under the roof, slab, beam, or walkway of enclosed water-containing structures.
 - 3) Dry side of walls of water-containing structures.
 - b. Pump bases.
 3. For fastening aluminum to concrete or steel, use Type 304 stainless steel in accordance with ASTM F 593 for sleeve anchor's internal bolt, expansion sleeve, extension sleeve. Use Type 303 stainless steel in accordance with ASTM F 593 for sleeve anchor's expansion cone.
 4. For applications other than those specified above, use hot-dip galvanized carbon steel for sleeve anchor's internal bolt, expansion sleeve, expansion cone, extension sleeve, and washer.
 5. The sleeve anchor shall have a nylon compression ring which compresses to ensure that the material being fastened is tightly secured against the concrete.
 6. Do not use slug-in, lead cinch, and similar systems relying on deformation of lead alloy or similar materials in order to develop holding power.

2.03 ISOLATING SLEEVES AND WASHERS

- A. Manufacturers: One of the following or equal:
 - 1. Central Plastics Company, Shawnee, Oklahoma.
 - 2. Corrosion Control Products, PSI Inc., Gardena, CA.

- B. Sleeves: Mylar, 1/32 inch thick, 4,000 volts per mil dielectric strength, of proper size to fit bolts and extending half way into both steel washers:
 - 1. One sleeve required for each bolt.

- C. Washers: The inside diameter of all washer shall fit over the isolating sleeve and both the steel and isolating washers shall have the same inside diameter and outside diameter:
 - 1. Proper size to fit bolts. Two insulating washers are required for each bolt.
 - 2. Two 1/8-inch thick steel washers for each bolt.
 - 3. G3 Phenolic:
 - a. Thickness: 1/8 inch.
 - b. Base Material: Glass.
 - c. Resin: Phenolic.
 - d. Water Absorption: 2 percent.
 - e. Hardness (Rockwell): 100.
 - f. Dielectric Strength: 450 volts per mil.
 - g. Compression Strength: 50,000 pounds per square inch.
 - h. Tensile Strength: 20,000 pounds per square inch.
 - i. Maximum Operating Temperature: 350 degrees Fahrenheit.

2.04 GALVANIZED SURFACE REPAIR

- A. Manufacturers: One of the following or equal:
 - 1. Galvinox.
 - 2. Galvo-Weld.

2.05 THREAD COATING

- A. Manufacturers: One of the following or equal:
 - 1. Never Seez Compound Corporation, Never-Seez.
 - 2. Oil Research, Inc., WLR No. 111.

2.06 SUPPLEMENTARY PARTS

- A. Furnish as required for complete structural steel erection, whether or not such parts and Work are specified or indicated on the Drawings.

2.07 FABRICATION

- A. Shop Assembly:
 - 1. Fabricate structural steel in conformance with AISC "Specification for the Structural Steel Buildings - Allowable Stress Design and Plastic Design," unless otherwise specified or modified by applicable regulatory requirements.
 - 2. Where anchors, connections, or other details of structural steel are not specifically indicated on the Drawings or specified, their material, size and form shall be equivalent in quality and workmanship to items specified.

3. For Structural members such as W shapes, S shapes, channels, angles, and similar members not available in quantity, size, and type of stainless steel specified or indicated on the Drawings:
 - a. Fabricate by welding together pieces of low carbon stainless steel plate, such as Type 316L.
 - b. Make full penetration welds between pieces of plate to attain same or higher section modulus and moment of inertia as members indicated on the Drawings.
4. Where galvanizing is required, hot-dip galvanize structural steel after fabrication in accordance with ASTM A 123:
 - a. Do not electro-galvanize or mechanically-galvanize unless specified or accepted by ENGINEER.
 - b. Restraighten galvanized items that bend or twist during galvanizing.
5. Round off sharp and hazardous projections and grind smooth.
6. Take measurements necessary to properly fit work in the field. Take responsibility for and be governed by the measurements and proper working out of all the details.
7. Take responsibility for correct fitting of all metal work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine Work in place to verify that it is satisfactory to receive the Work of this Section. If unsatisfactory conditions exist, do not begin this Work until such conditions have been corrected.

3.02 ERECTION

- A. General:
 1. Fabricate structural and foundry items to true dimensions without warp or twist.
 2. Form welded closures neatly, and grind off smooth where weld material interferes with fit or is unsightly.
 3. Install structural items accurately and securely, true to level, plumb, in correct alignment and grade, with all parts bearing or fitting structure or equipment for which intended.
 4. Do not cock out of alignment, redrill, reshape, or force fit fabricated items.
 5. Place anchor bolts or other anchoring devices accurately and make surfaces that bear against structural items smooth and level.
 6. Rigidly support and brace structural items needing special alignment to preserve straight, level, even, and smooth lines. Keep structural items braced until concrete, grout, or dry pack mortar has hardened for 48 hours minimum.
 7. Erect structural steel in conformance with AISC "Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design," unless otherwise specified or modified by applicable regulatory requirements.
 8. Where anchors, connections, and other details of structural steel erection are not specifically indicated on the Drawings or specified, form, locate, and attach with equivalent in quality and workmanship to items specified.
 9. Round off sharp or hazardous projections and grind smooth.

- B. Welding - General:
 - 1. Make welds full penetration type, unless otherwise indicated on the Drawings.
 - 2. Remove backing bars and weld tabs after completion of weld. Repair defective welds observed after removal of backing bars and weld tabs.

- C. Welding Stainless Steel:
 - 1. General: Comply with AWS D1.1:
 - a. Perform with electrodes and techniques in accordance with AWS D10.4.

- D. Welding Carbon Steel:
 - 1. General: Comply with AWS D1.1:
 - a. Weld ASTM A 36 and A 992 structural steel, ASTM A 500 and A 501 structural tubing, and ASTM A 53 pipe with electrodes conforming to AWS A5.1, using E70XX electrodes; AWS A5.17, using F7X-EXXX electrodes; or AWS A5.20, using E7XT-X electrodes:
 - a) Field repair cut or otherwise damaged galvanized surfaces to equivalent original condition using a galvanized surface repair.

- E. Interface With Other Products:
 - 1. Where steel fasteners come in contact with aluminum or other dissimilar metals, bolt with stainless steel bolts and separate or isolate from dissimilar metals with isolating sleeves and washers:
 - 1) Prior to installing nuts, coat threads of stainless steel fasteners with thread coating to prevent galling of threads.

- F. Fasteners:
 - 1. General:
 - a. Install bolts, including anchor bolts and concrete anchors, to project 2 threads minimum, but 1/2 inch maximum beyond nut.
 - b. Unless otherwise specified, tighten bolts, including anchor bolts and concrete anchors, to the "snug-tight" condition, defined as tightness attained by a few impacts of an impact wrench or the full effort of a man using an ordinary spud wrench.
 - 2. Anchor Bolts:
 - a. Cast-in-place when concrete is placed.
 - b. Accurately locate anchor bolts embedded in concrete with bolts perpendicular to surface from which they project.
 - c. Do not allow anchor bolts to touch reinforcing steel.
 - d. Where anchor bolts are within 1/4 inch of reinforcing steel, isolate with a minimum of 4 wraps of 10-mil polyvinyl chloride tape in area adjacent to reinforcing steel.
 - e. In anchoring machinery bases subject to heavy vibration, use 2 nuts, with 1 serving as a locknut.
 - f. Where bolts are indicated on the Drawings for future use, first coat thoroughly with nonoxidizing wax, then turn nuts down full depth of thread and neatly wrap exposed thread with waterproof polyvinyl tape.
 - g. Furnish anchor bolts with standard hex bolt head or an equivalent head acceptable to ENGINEER unless otherwise indicated on the Drawings. "L" or "J" anchor bolts are not equivalent to an anchor bolt with a hex bolt head.
 - h. Minimum Anchor Bolt Embedment: 10-bolt diameters, unless longer embedment is indicated on the Drawings.

- i. Where indicated on the Drawings, set anchor bolts in metal sleeves having inside diameter approximately 2 inches greater than bolt diameter and minimum 10-bolt diameters long. Seal top of sleeve to prevent grout from filling sleeve.
 - j. Anchor bolts may be cast in concrete in lieu of using concrete anchors.
3. Chemical Anchors:
- a. Accurately locate concrete anchors and set perpendicular to surfaces from which they project.
 - b. Drilling Holes:
 - 1) Do not damage or cut existing reinforcing bars, electrical conduits, or other items embedded in the existing concrete without acceptance by ENGINEER.
 - 2) Determine location of reinforcing bars, or other obstructions with a non-destructive indicator device.
 - c. Hole Drilling Equipment:
 - 1) Electric or pneumatic rotary type with light or medium impact.
 - 2) Drill Bits: Carbide-tipped in accordance with ANSI B212-15.
 - 3) Hollow drills with flushing air systems are preferred. Air shall be free of oil, water, or other contaminants which will reduce bond.
 - 4) Where edge distances are less than 2 inches, use lighter impact equipment to prevent microcracking and concrete spalling during drilling process.
 - d. Hole Diameter:
 - 1) As recommended by chemical anchor cartridge manufacturer.
 - e. Install all thread rods to depth, spacings, and locations as indicated on the Drawings.
 - f. Cleaning Holes:
 - 1) Insert long air nozzle into hole and blow out loose dust. Use air which is free of oil, water, or other contaminants which will reduce bond.
 - 2) Use a stiff bristle brush to vigorously brush hole to dislodge compacted drilling dust.
 - 3) Repeat step 1.
 - 4) Repeat above steps as required to remove drilling dust or other material which will reduce bond. The hole shall be clean and dry.
 - g. Cleaning All Thread Rods:
 - 1) Degrease over embedment length. The all thread rods shall be free of oil, grease, paint, dirt, mill scale, rust, or other coatings that will reduce bond.
4. Concrete Anchors:
- a. Do not use concrete anchors in lieu of anchor bolts.
 - b. Accurately locate concrete anchors and set perpendicular to surfaces from which they project.
 - c. Minimum embedment lengths:

Diameter Inches	Embedment Length Inches
1/4	2
3/8	2-1/2
1/2	4-1/8
5/8	4-1/2
3/4	6-1/2

- d. Drilling Holes:
 - 1) Do not damage or cut existing reinforcing bars, electrical conduits, or other items embedded in the existing concrete without acceptance by ENGINEER.
 - 2) Determine location of reinforcing bars, or other obstructions with a non-destructive indicator device.
 - 3) Remove dust and debris from hole using compressed air.
 - e. Hole Drilling Equipment:
 - 1) Electric or pneumatic rotary type with light or medium impact.
 - 2) Drill Bits: Carbide-tipped in accordance with ANSI B212-15.
 - 3) Hollow drills with flushing air systems are preferred.
 - 4) Where edge distances are less than 2 inches, use lighter impact equipment to prevent microcracking and concrete spalling during drilling process.
5. Sleeve Anchors:
- a. Do not use sleeve anchors in lieu of anchor bolts.
 - b. The sleeve anchor bolt shall be removable and the expansion sleeve shall be flush with the concrete surface when installed.
 - c. Accurately locate sleeve anchors and set perpendicular to surfaces from which they project.
 - d. Minimum embedment lengths:

Diameter Inches	Embedment Length Inches
1/4	1-3/4
3/8	2-1/2
1/2	3-1/2
5/8	4
3/4	4-1/2

- e. Drilling Holes:
 - 1) Do not damage or cut existing reinforcing bars, electrical conduits, or other items embedded in the existing concrete without acceptance by ENGINEER.
 - 2) Determine location of reinforcing bars, or other obstructions with a non-destructive indicator device.
 - 3) Remove dust and debris from hole using compressed air.
- f. Hole Drilling Equipment:
 - 1) Electric or pneumatic rotary type with light or medium impact.
 - 2) Drill Bits: Carbide-tipped in accordance with ANSI B212-15.
 - 3) Hollow drills with flushing air systems are preferred.
 - 4) Where edge distances are less than 2 inches, use lighter impact equipment to prevent microcracking and concrete spalling during drilling process.

END OF SECTION

SECTION 05190

MECHANICAL ANCHORING AND FASTENING TO CONCRETE AND MASONRY

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Cast-in anchors and fasteners:
 - a. Anchor bolts.
 - b. Anchor rods.
 - c. Concrete inserts.
 - d. Deformed bar anchors.
 - 2. Post-installed steel anchors and fasteners:
 - a. Concrete anchors.
 - 3. Appurtenances for anchoring and fastening:
 - a. Thread coating for threaded stainless steel fasteners.
- B. Related sections:
 - 1. Section 01330 - Submittals.
 - 2. Section 01410 - Regulatory Requirements.
 - 3. Section 01450 - Quality Control.
 - 4. Section 01455 - Special Tests and Inspections.
 - 5. Section 05120 - Structural Steel.
 - 6. Section 05500 - Metal Fabrications.

1.02 REFERENCES

- A. American Concrete Institute (ACI):
 - 1. 355.2 - Qualification of Post-Installed Mechanical Anchors in Concrete & Commentary.
- B. American National Standards Institute (ANSI):
 - 1. B212.15 - Cutting Tools - Carbide-tipped Masonry Drills and Blanks for Carbide-tipped Masonry Drills.
- C. American Welding Society (AWS):
 - 1. D1.1 - Structural Welding Code - Steel.
 - 2. D1.6 - Structural Welding Code - Stainless Steel.
- D. ASTM International (ASTM):
 - 1. A29 - Standard Specification for Steel Bars, Carbon and Alloy, Hot-Wrought, General Requirements for.
 - 2. A36 - Standard Specification for Carbon Structural Steel.
 - 3. A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 4. A108 - Standard Specification for Steel Bars, Carbon and Alloy, Cold Finished.
 - 5. A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

6. A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 7. A240 - Standard Specification for Chromium and Chromium Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 8. A308 - Standard Specification for Steel Sheet, Terne (Lead-Tin Alloy) Coated by the Hot-Dip Process.
 9. A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
 10. A563 - Standard Specification for Carbon and Alloy Steel Nuts.
 11. B633 - Standard Specification for *Electrodeposited* Coatings of Zinc on Iron and Steel.
 12. B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
 13. E488 - Standard Test Methods for Strength of Anchors in Concrete Elements.
 14. F436 - Standard Specification for Hardened Steel Washers.
 15. F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs.
 16. F594 - Standard Specification for Stainless Steel Nuts.
 17. F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55 and 105-ksi Yield Strength.
 18. F2329 - Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners.
- E. International Code Council Evaluation Service, Inc. (ICC-ES):
1. AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements.

1.03 DEFINITIONS

- A. Built-in anchor: Headed bolt or assembly installed in position before filling surrounding masonry units with grout.
- B. Cast-in anchor: Headed bolt or assembly installed in position before placing plastic concrete around.
- C. Overhead installations: Fasteners installed on overhead surfaces where the longitudinal axis of the fastener is more than 60 degrees above a horizontal line so that the fastener resists sustained tension loads.
- D. Passivation: Chemical treatment of stainless steel with a mild oxidant for the purpose of enhancing the spontaneous formation of the steel's protective passive film.
- E. Post-installed anchor: Fastener or assembly installed in hardened concrete or finished masonry construction, typically by drilling into the structure and inserting a steel anchor assembly.

- F. Terms relating to structures or building environments as used with reference to anchors and fasteners:
1. Wet and moist locations: Describes locations that are submerged, are immediately above liquid containment structures, or are subject to frequent wetting, splashing, or wash down. Includes:
 - a. Exterior portions of buildings and structures.
 - b. Liquid-containing structures:
 - 1) Locations at and below the maximum operating liquid surface elevation.
 - 2) Locations above the maximum operating liquid surface elevation and:
 - a) Below the top of the walls containing the liquid.
 - b) At the inside faces and underside surfaces of a structure enclosing or spanning over the liquid (including walls, roofs, slabs, beams, or walkways enclosing the open top of the structure).
 - c. Liquid handling equipment:
 - 1) Bases of pumps and other equipment that handles liquids.
 - d. Indoor locations exposed to moisture, splashing, or routine wash down during normal operations, including floors with slopes toward drains or gutters.
 - e. Other locations indicated on the Drawings.
 2. Other locations:
 - a. Interior dry areas where the surfaces are not exposed to moisture or humidity in excess of typical local environmental conditions.

1.04 SUBMITTALS

- A. General:
1. Submit as specified in Section 01330.
 2. Submit information listed for each type of anchor or fastener to be used.
- B. Action submittals:
1. Product data:
 - a. Cast-in anchors:
 - 1) Manufacturer's data including catalog cuts showing anchor sizes and configuration, materials, and finishes.
 - b. Post-installed anchors:
 - 1) For each anchor type, manufacturer's data including catalog cuts showing anchor sizes and construction, materials and finishes, and load ratings.
 2. Samples:
 - a. Samples of each type of anchor, including representative diameters and lengths, to the Engineer.
 3. Certificates:
 - a. Cast-in anchors:
 - 1) Mill certificates for steel anchors that will be supplied to the site.
 - b. Post-installed anchors:
 - 1) Manufacturer's statement or certified test reports demonstrating that anchors that will be supplied to the site comply with the materials properties specified.

4. Test reports:
 - a. Post-installed anchors: For each anchor type used for the Work:
 - 1) Current ICC-ES Report (ESR demonstrating:
 - a) Acceptance of that anchor for use under the building code specified in Section 01410.
 - b) That testing of the concrete anchor included the simulated seismic tension and shear tests of AC193, and that the anchor is accepted for use in Seismic Design Categories C, D, E, or F and with cracked concrete.
 - b. Concrete anchor pre-installation test report.
 5. Manufacturer's instructions:
 - a. Requirements for storage and handling.
 - b. Recommended installation procedures including details on drilling, hole size (diameter and depth), hole cleaning and preparation procedures, anchor insertion, and anchor tightening.
 - c. Requirements for inspection or observation during installation.
 6. Qualification statements:
 - a. Post-installed anchors: Installer qualifications:
 - 1) Submit list of personnel performing installations and include date of manufacturer's training for each.
- C. Closeout submittals:
1. Test reports.

1.05 QUALITY ASSURANCE

- A. Qualifications:
1. Post installed anchors shall be in accordance with building code specified in Section 01410.
 2. Installers: Post-installed mechanical anchors:
 - a. Conduct a training session with the manufacturer's authorized technical representative for the project on-site:
 - 1) Training shall cover the complete installation process for each type of anchor to be used and shall include, but not be limited to, hole drilling procedures and techniques, hole preparation and cleaning, bolt installation, and bolt proof loading and torquing.
 - 2) Use only trained and qualified personnel for anchor installation.
 - b. Installations shall be performed by trained installers having at least 3 years of experience performing similar installations with similar types of anchors.
- B. Special inspection:
1. Provide special inspection of post-installed anchors as specified in Section 01455 and this Section.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver post-installed anchors in manufacturer's standard packaging with labels visible and intact. Include manufacturer's installation instructions.

- B. Handle and store anchors and fasteners in accordance with manufacturer's recommendations and as required to prevent damage.
- C. Protect anchors from weather and moisture until installation.

1.07 PROJECT CONDITIONS

- A. Seismic Design Category (SDC) for structures is indicated on the Drawings.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

- A. General:
 - 1. Furnish threaded fasteners with flat washers and hex nuts fabricated from materials corresponding to the material used for threaded portion of the anchor:
 - a. Cast-in anchors: Provide flat washers and nuts as listed in the ASTM standard for the anchor materials specified.
 - b. Post-installed anchors: Provide flat washers and nuts supplied for that product by the manufacturer of each anchor.
 - 2. Size of anchors and fasteners, including diameter and length or minimum effective embedment depth: As indicated on the Drawings or as specified in this Section. In the event of conflicts, contact Engineer for clarification.
 - 3. Where anchors and connections are not specifically indicated on the Drawings or specified, their material, size and form shall be equivalent in quality and workmanship to items specified.
- B. Materials:
 - 1. Provide and install anchors of materials as in this Section.

2.02 CAST-IN ANCHORS AND FASTENERS

- A. Anchor bolts:
 - 1. Description:
 - a. Straight steel rod having one end with an integrally forged head, and one threaded end. Embedded into concrete with the headed end cast into concrete at the effective embedment depth indicated on the Drawings or specified, and with the threaded end left to project clear of concrete face as required for the connection to be made.
 - b. Furnish anchor bolts with heavy hex forged head or equivalent acceptable to Engineer:
 - 1) Rods or bars with angle bend for embedment in concrete (i.e., "L" or "J" shaped anchor bolts) are not permitted in the Work.
 - 2. Materials:
 - a. Ship anchor bolts with properly fitting nuts attached.
 - b. Type 316 stainless steel:
 - 1) Bolts: ASTM F593, Group 2, Condition CW, coarse threads.
 - 2) Nuts: ASTM F594. Match alloy (group and UNS designation) and threads of bolts.
 - 3) Washers: Type 316 stainless steel.

- c. Type 304 stainless steel:
 - 1) Bolts: ASTM F593, Group 1, Condition CW, coarse threads.
 - 2) Nuts: ASTM F594. Match alloy (group and UNS designation) and threads of bolts.
 - 3) Washers: Type 304 stainless steel.
 - d. Galvanized steel:
 - 1) Hot-dip galvanized coating in accordance with ASTM F2329.
 - 2) Bolt: ASTM F1554, Grade 36, heavy hex, coarse thread.
 - 3) Nuts: ASTM A563, Grade A, heavy hex, threads to match bolt.
 - 4) Washers: ASTM F436, Type 1.
- B. Anchor rods:
- 1. Description: Straight steel rod continuously threaded from end to end. One threaded end is fitted with nuts or plates and embedded in concrete to the effective depth indicated on the Drawings, leaving the opposite threaded end to project clear of the concrete face as required for the connection to be made at that location.
 - 2. Materials:
 - a. Stainless steel: Type 316:
 - 1) Rod: ASTM F593, Group 2, Condition CW, coarse threads.
 - 2) Nuts: ASTM F594. Match alloy (group and UNS designation) and threads of rods.
 - 3) Washers: Type 316 stainless steel.
 - 4) Plates (embedded): ASTM A240.
 - b. Stainless steel: Type 304:
 - 1) Rod: ASTM F593, Group 1, Condition CW, coarse threads.
 - 2) Nuts: ASTM F594. Match alloy (group and UNS designation) and threads or rods.
 - 3) Washers: Type 304 stainless steel.
 - 4) Plates (embedded): ASTM A240.
 - c. Galvanized: steel:
 - 1) Hot-dip galvanized with coating in accordance with ASTM F2329.
 - 2) Rod: ASTM F1554, Grade 36, coarse thread.
 - 3) Nuts: ASTM A563, Grade A, threads to match rod.
 - 4) Washers: ASTM F436, Type 1.
 - 5) Plates (embedded): ASTM A36.
- C. Concrete insert: Ductile embed:
- 1. Description: 1-piece, integrally hot forged sleeve for embedment in concrete. Provided with flange for nailing to forms and female threaded coupler at the exposed concrete face, and washer-faced hex headed foot to resist pullout from concrete at the embedded end.
 - 2. Manufacturers: One of the following or equal:
 - a. Dayton Superior: F-54 Ductile Embed Insert.
 - 3. Materials:
 - a. Galvanized steel:
 - 1) Hot-dip galvanized coating in accordance with ASTM A123 or A153.
 - 2) Steel: ASTM A29 hot rolled, Grade 1045.

- D. Deformed bar anchors:
 - 1. Description: Steel rod with rebar-like deformations along its length and welding ferrule at one end for attachment to structural steel members (plates or shapes).
 - 2. Manufacturers: One of the following or equal:
 - a. Nelson Stud Welding Company: D2L Deformed Bar Anchors (D2L-DBA).
 - b. Stud Welding Products, Inc.: Deformed Anchor Studs.
 - 3. Materials:
 - a. Galvanized steel:
 - 1) Hot-dip galvanized coating in accordance with ASTM A153.
 - 2) Steel: ASTM A496 wire deformed for concrete reinforcement.

2.03 POST-INSTALLED ANCHORS AND FASTENERS – MECHANICAL

- A. General:
 - 1. Post-installed anchors used for the Work shall hold a current ICC Evaluation Service Report demonstrating acceptance for use under the building code specified in Section 01410. Reports prepared by other recognized evaluation agencies may be submitted for consideration if acceptable to the Engineer and to the authority having jurisdiction:
 - a. Conditions of use: The acceptance report shall indicate acceptance of the product for use under the following conditions:
 - 1) In regions of concrete where cracking has occurred or may occur.
 - 2) To resist short-term loads due to wind forces.
 - 3) To resist short-term loading due to seismic forces for the Seismic Design Category of the structure where the product will be used.
 - 2. Substitutions: When requesting product substitutions, submit calculations, indicating the diameter, effective embedment depth and spacing of the proposed anchors, and demonstrating that the substituted product will provide load resistance that is equal to or greater than that provided by the anchors listed in this Section:
 - a. Calculations shall be prepared by and shall bear the signature and seal of a Professional Engineer (Civil or Structural) licensed in the State of California.
 - b. Decisions regarding the acceptability of proposed substitutions shall be at the discretion of the Engineer.
- B. Concrete anchors:
 - 1. Description. Post-installed anchor assembly consisting of a threaded stud and a surrounding wedge expansion sleeve that is forced outward by torquing the center stud to transfer loads from the stud to the concrete through bearing, friction, or both. (Sometimes referred to as “expansion anchors” or “wedge anchors.”):
 - a. Do not use slug-in, lead cinch, and similar systems relying on deformation of lead alloy or similar materials to develop holding power.
 - 2. Concrete anchors for anchorage to concrete:
 - a. Acceptance criteria:
 - 1) Concrete anchors shall have a current ICC-ES Report demonstrating that the anchors have been tested and qualified for performance in both cracked and un-cracked concrete, and for short-term loading due to wind and seismic forces for Seismic Design Categories A through F in accordance with ACI 355.2 and with ICC-ES AC193

- (including all mandatory tests and optional tests for seismic tension and shear in cracked concrete).
 - 2) Concrete anchor performance in the current ICC-ES Report shall be "Category 1" as defined in ACI 355.2.
 - b. Manufacturers: One of the following or equal:
 - 1) Hilti: Kwik Bolt TZ Expansion Anchor.
 - 2) Powers fasteners: PowerStud+ SD2.
 - 3) Simpson Strong-Tie: Strong Bolt 2 Wedge Anchor.
 - c. Materials. Integrally threaded stud, wedge, washer, and nut:
 - 1) Stainless steel: Type 316.
 - 2) Galvanized: Carbon steel, zinc plated in accordance with ASTM B633, minimum 5 microns (Fe/Zn 5).
- C. Flush shells:
- 1. Description: Post-installed anchor assembly consisting of an internally threaded mandrel that is forced into a pre-drilled concrete hole with a setting tool until the top of the anchor is flush with the face of the concrete. Once installed, a removable threaded bolt is installed in the mandrel.
 - 2. Flush shell anchors are not permitted in the Work.

2.04 APPURTENANCES FOR ANCHORING AND FASTENING

- A. Anchor bolt sleeves:
- 1. Having inside diameter approximately 2 inches greater than bolt diameter and minimum 10-bolt diameters long.
 - 2. Plastic sleeves:
 - a. High-density polyethylene, corrugated sleeve, threaded to provide adjustment of location on the anchor bolt.
 - 3. Fabricated steel sleeves: Construct as specified in Section 05500:
 - a. At galvanized carbon steel anchor bolts, provide galvanized carbon steel sleeves.
 - b. At stainless steel anchor bolts, provide stainless steel sleeves of same Type (304 or 316) as bolt, except that sleeves shall be constructed from low carbon stainless steel for welding (Type 304L or 316L).
 - 4. Fabricated steel sleeves:
 - a. Fabricate to the following dimensions unless otherwise indicated on the Drawings:
 - 1) Inside diameter: At least 2 inches greater than bolt diameter.
 - 2) Inside length: Not less than 10 bolt diameters.
 - 3) Bottom plate:
 - a) Square plate with dimensions equal to the outside diameter of the sleeve plus 1/2 inch each side.
 - b) Thickness equal to or greater than one-half of the anchor bolt diameter.
 - b. Carbon steel anchor bolts:
 - 1) Fabricated from ASTM A36 plate and ASTM A53, Grade B pipe.
 - 2) Welded connections: Conform to requirements of AWS D1.1.
 - 3) Hot dip galvanized in accordance with ASTM A153.
 - c. Stainless steel anchor bolts:
 - 1) Fabricated from ASTM A240 plate and pipe. Type 304L or Type 316L to match Type of the anchor bolt.
 - 2) Welded connections: In accordance with AWS D1.6.

- B. Forged steel hardware:
 - 1. See Section 05120 for forged steel hardware connectors, including clevises, turnbuckles, eye bolts, eye nuts, and sleeve nuts.
- C. Isolating sleeves and washers:
 - 1. Manufacturers: One of the following or equal:
 - a. Central Plastics Company, Shawnee, Oklahoma.
 - b. Corrosion Control Products, PSI Inc., Gardena, CA.
 - 2. Sleeves: Mylar, 1/32-inch thick, 4,000 volts per mil dielectric strength, of proper size to fit bolts and extending half way into both steel washers.
 - 3. One sleeve required for each bolt.
 - 4. Washers: The inside diameter of all washers shall fit over the isolating sleeve, and both the steel and isolating washers shall have the same inside diameter and outside diameter:
 - a. Proper size to fit bolts.
 - b. Two 1/8-inch thick steel washers for each bolt.
 - c. G3 Phenolic: 2 insulating washers are required for each bolt:
 - 1) Thickness: 1/8 inch.
 - 2) Base material: Glass.
 - 3) Resin: Phenolic.
 - 4) Water absorption: 2 percent.
 - 5) Hardness (Rockwell): 100.
 - 6) Dielectric strength: 450 volts per mil.
 - 7) Compression strength: 50,000 pounds per square inch.
 - 8) Tensile strength: 20,000 pounds per square inch.
 - 9) Maximum operating temperature: 350 degrees Fahrenheit.
- D. Coating for repair of galvanized surfaces:
 - 1. Manufacturers: One of the following or approved equal:
 - a. Galvinox.
 - b. Galvo-Weld.
- E. Thread coating: For use with threaded stainless steel fasteners:
 - 1. Manufacturers: One of the following or equal:
 - a. Never Seez Compound Corporation, Never-Seez.
 - b. Oil Research, Inc., WLR No. 111.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine Work in place to verify that it is satisfactory to receive the Work of this Section. If unsatisfactory conditions exist, do not begin this Work until such conditions have been corrected.

3.02 INSTALLATION: GENERAL

- A. Where anchors and fasteners are not specifically indicated on the Drawings or specified, make attachments with materials specified in this Section.

- B. Substitution of anchor types:
 - 1. Post-installed anchors may not be used as an alternative to cast-in/built-in anchors at locations where the latter are indicated on the Drawings.
 - 2. Cast-in/built-in anchors may be used as an alternative to post-installed mechanical anchors at locations where the latter are indicated on the Drawings.
- C. Protect products from damage during installation. Take special care to protect threads and threaded ends.
- D. Accurately locate and position anchors and fasteners:
 - 1. Unless otherwise indicated on the Drawings, install anchors perpendicular to the surfaces from which they project.
 - 2. Install anchors so that at least 2 threads, but not more than 1/2 inch of threaded rod, projects past the top nut.
- E. Interface with other products:
 - 1. Where steel anchors come in contact with dissimilar metals (aluminum, stainless steel, etc.), use stainless steel anchors and separate or isolate dissimilar metals using isolating sleeves and washers.
 - 2. Prior to installing nuts, coat threads of stainless steel fasteners with thread coating to prevent galling of threads.

3.03 INSTALLATION: CAST-IN ANCHORS

- A. General:
 - 1. Accurately locate cast-in and built-in anchors.
 - a. Provide anchor setting templates to locate anchor bolts and anchor rods. Secure templates to formwork.
 - b. Brace or tie off embeddings as necessary to prevent displacement during placement of plastic concrete or of surrounding masonry construction.
 - c. Position and tie cast-in and built-in anchors in place before beginning placement of concrete or grout. Do not “stab” anchors into plastic concrete, mortar, or grout.
 - d. Do not allow cast-in anchors to touch reinforcing steel. Where cast-in anchors are within 1/4 inch of reinforcing steel, isolate the metals by wrapping the anchors with a minimum of 4 wraps of 10-mil polyvinyl chloride tape in area adjacent to reinforcing steel.
 - 2. For anchoring at machinery bases subject to vibration, use 2 nuts, with 1 serving as a locknut.
 - 3. Where anchor bolts or anchor rods are indicated on the Drawings as being for future use, thoroughly coat exposed surfaces that project from concrete or masonry with non-oxidizing wax. Turn nuts down full length of the threads, and neatly wrap the exposed thread and nut with a minimum of 4 wraps of 10-mil waterproof polyvinyl tape.
- B. Anchor bolts:
 - 1. Minimum effective embedment: 10-bolt diameters, unless a longer embedment is indicated on the Drawings.
 - 2. Where indicated on the Drawings, set anchor bolts in plastic, galvanized steel or stainless steel sleeves to allow for adjustment. Seal top of sleeve to prevent

grout from filling sleeve. Fill sleeves with grout when a machine or other equipment is grouted in place.

- C. Anchor rods:
 - 1. Install as specified for anchor bolts.
- D. Concrete inserts:
 - 1. Provide inserts with minimum clear concrete cover not less than that specified for reinforcing bars.
- E. Deformed bar anchors:
 - 1. Butt weld to steel fabrications with automatic stud welding gun as recommended by manufacturer.
 - 2. Ensure that butt weld develops the full strength of the anchor.

3.04 INSTALLATION: POST-INSTALLED MECHANICAL ANCHORS

- A. General:
 - 1. Install anchors in accordance with the manufacturer's instructions, ACI 355.2, the anchor's ICC-ES Report. Where conflict exists between the ICC-ES Report and the requirements in this Section, the requirements of the ICC-ES Report shall control.
 - 2. Where anchor manufacturer recommends the use of special tools and/or specific drill bits for installation, provide and use such tools.
 - 3. After anchors have been positioned and inserted into concrete or masonry, do not:
 - a. Remove and reuse/reinstall anchors.
 - b. Loosen or remove bolts or studs.
- B. Holes drilled into concrete and masonry:
 - 1. Do not drill holes in concrete or masonry until the material has achieved its minimum specified compression strength (f'_c or f'_m).
 - 2. Accurately locate holes:
 - a. Before drilling holes, use a reinforcing bar locator to identify the position of all reinforcing steel, conduit, and other embedded items within a 6-inch radius of each proposed hole.
 - b. If the hole depth exceeds the range of detection for the rebar locator, the Engineer may require radiographs of the area designated for investigation before drilling commences.
 - 3. Exercise care to avoid damaging existing reinforcement and other items embedded in concrete and masonry:
 - a. If embedments are encountered during drilling, immediately stop work and notify the Engineer. Await Engineer's instructions before proceeding.
 - 4. Unless otherwise indicated on the Drawings, drill holes perpendicular to the concrete surface into which they are placed.
 - 5. Drill using anchor manufacturer's recommended equipment and procedures:
 - a. Unless otherwise recommended by the manufacturer, drill in accordance with the following:
 - 1) Drilling equipment: Electric or pneumatic rotary type with light or medium impact. Where edge distances are less than 2 inches, use lighter impact equipment to prevent micro-cracking and concrete spalling during drilling process.

- 2) Drill bits: Carbide-tipped in accordance with ANSI B212-15. Hollow drills with flushing air systems are preferred.
6. Drill holes at manufacture's recommended diameter and to depth required to provide the effective embedment indicated.
7. Clean and prepare holes as recommended by the manufacturer and as required by the ICC-ES Report for that anchor:
 - a. Unless otherwise recommended by anchor manufacturer, remove dust and debris using brushes and clean compressed air.
 - b. Repeat cleaning process as required by the manufacturer's installation instructions.
 - c. When cleaning holes for stainless steel anchors, use only stainless steel or non-metallic brushes.
- C. Insert and tighten (or torque) anchors in full compliance with the manufacturer's installation instructions:
 1. Once anchor is tightened (torque), do not attempt to loosen or remove its bolt or stud.
- D. Concrete anchors: Minimum effective embedment lengths unless otherwise indicated on the Drawings:

Concrete Anchors			
Nominal Diameter	Minimum Effective Embedment Length		Minimum Member Thickness
	In Concrete	In Grouted Masonry	
3/8 inch	2 1/2 inch	2 5/8 inch	8 inch
1/2 inch	3 1/2 inch	3 1/2 inch	8 inch
5/8 inch	4 1/2 inch	4 1/2 inch	10 inch
3/4 inch	5 inch	5 1/4 inch	12 inch

- E. Flush shell anchors:
 1. Flush shell anchors are not permitted in the Work.
 2. If equipment manufacturer's installation instructions recommend the use of flush shell anchors, contact Engineer for instructions before proceeding.
- F. Sleeve anchors:
 1. Minimum effective embedment lengths unless otherwise indicated on the Drawings:

Sleeve Anchors			
Nominal Diameter	Minimum Effective Embedment Length		Minimum Member Thickness
	In Concrete	In Grouted Masonry	
M8 (1/2 inch)	70 mm (2 3/4 inch)	Not accepted	100 mm (8 inch)
M10 (5/8 inch)	76 mm (3 inch)	Not accepted	250 mm (10 inch)
M12 (3/4 inch)	80 mm (3 1/4 inch)	Not accepted	300 mm (12 inch)

2. Install with the sleeve fully engaged in the base material.

G. Screw anchors:

1. Minimum effective embedment lengths unless otherwise indicated on the Drawings:

Screw Anchors			
Nominal Diameter	Minimum Effective Embedment Length		Minimum Member Thickness
	In Concrete	In Grouted Masonry	
3/8 inch	2 1/2 inch	3 1/4 inch	8 inch
1/2 inch	3 1/4 inch	4 1/2 inch	8 inch
5/8 inch	4 inch	5 inch	10 inch
3/4 inch	5 1/2 inch	6 1/4 inch	12 inch

2. Install screw anchors using equipment and methods recommended by the manufacturer. Continue driving into hole until the washer head is flush against the item being fastened.

H. Undercut concrete anchors:

1. Minimum effective embedment lengths unless otherwise indicated on the Drawings:

Undercut Anchors			
Nominal Diameter (bolt)	Minimum Effective Embedment Length		Minimum Member Thickness⁽¹⁾
	In Concrete	In Grouted Masonry	
M10 (3/8 inch)	100 mm (4 inch)	Not accepted	200 mm (8 inch)
M12 (1/2 inch)	125 mm (5 inch)	Not accepted	350 mm (14 inch)
M16 (5/8 inch)	190 mm (7 1/2 inch)	Not accepted	460 mm (18 inch)
M20 (7/8 inch)	250 mm (10 inch)	Not accepted	510 mm (20 inch)

Notes:

(1) Thickness indicated is for pre-set units. If through-set units are accepted, obtain minimum member thickness requirements from the Engineer.

2. Installations of undercut anchors shall not be allowed where edge distances are less than 12 times the nominal diameter of the anchor stud.
3. Undercut bottom of hole using cutting tools manufactured for this purpose by the manufacturer of the undercut anchors being placed.

3.05 FIELD QUALITY CONTROL

- A. Contractor shall provide quality control over the Work of this Section as specified in Section 01450:
1. Expenses associated with work described by the following paragraphs shall be paid by the Contractor.

- B. Post-installed anchors:
 - 1. Review anchor manufacturer's installation instructions and requirements of the Evaluation Service Report (hereafter referred to as "installation documents") for each anchor type and material.
 - 2. Observe hole-drilling and cleaning operations for conformance with the installation documents.
 - 3. Certify in writing to the Engineer that the depth and location of anchor holes, and the torque applied for setting the anchors conforms to the requirements of the installation documents.

- C. Field-testing Load tests on installed anchors:
 - 1. In addition to special inspections for field quality assurance, the Engineer may select up to 10 percent of each type and size of cast-in anchor, built-in anchor, and post-installed mechanical anchor for proof-load testing (pullout or shear). Tests will be non-destructive whenever possible.
 - 2. Testing procedures and acceptance criteria are described under Field Quality Assurance.
 - 3. Cooperate in providing access and anchors for testing.

3.06 FIELD QUALITY ASSURANCE

- A. Owner will provide on-site observation and field quality assurance for the Work of this Section:
 - 1. Expenses associated with work described by the following paragraphs shall be paid by the Owner.

- B. Field inspections and special inspections:
 - 1. Required inspections: Observe construction for conformance to the approved Contract Documents, the accepted submittals, and manufacturer's installation instructions for the products used.
 - 2. Record of inspections:
 - a. Maintain record of each inspection.
 - b. Submit copies to Engineer upon request.
 - 3. Statement of special inspections: At the end of the project, prepare and submit to the Engineer and the authority having jurisdiction inspector's statement that the Work was constructed in general conformance with the approved Contract Documents, and that deficiencies observed during construction were resolved.

- C. Special inspections: Anchors cast into concrete and built into masonry:
 - 1. Provide special inspection during positioning of anchors and placement of concrete or masonry (including mortar and grout) around the following anchors:
 - a. Anchor bolts.
 - b. Anchor rods.
 - 2. During placement, provide continuous special inspection at each anchor location to verify that the following elements of the installation conform to the requirements of the Contract Documents:
 - a. Anchor:
 - 1) Type and dimensions.
 - 2) Material: Galvanized steel, Type 304 stainless steel, or Type 316 stainless steel as specified in this Section or indicated on the Drawings.

- 3) Positioning: Spacing, edge distances, effective embedment, and projection beyond the surface of the construction.
 - 4) Reinforcement at anchor: Presence, positioning, and size of additional reinforcement at anchors indicated on the Drawings.
3. Following hardening and curing of the concrete or masonry surrounding the anchors, provide periodic special inspection to observe and confirm the following:
- a. Base material (concrete or grouted masonry):
 - 1) Solid and dense concrete or grouted masonry material within required distances surrounding anchor.
 - 2) Material encapsulating embedment is dense and well-consolidated.

- D. Special Inspections: Post-installed mechanical anchors placed in hardened concrete and in grouted masonry:
1. Provide special inspection during installation of the following anchors:
 - a. Concrete anchors.
 2. Unless otherwise noted, provide periodic special inspection during positioning, drilling, placing, and torquing of anchors:
 - a. Provide continuous special inspection for post-installed anchors in “overhead installations” as defined in this Section.
 3. Requirements for periodic special inspection:
 - a. Verify items listed in the following paragraphs for conformance to the requirements of the Contract Documents and the Evaluation Report for the anchor being used. Observe the initial installation of each type and size of anchor, and subsequent installation of the same anchor at intervals of not more than 4 hours:
 - 1) Any change in the anchors used, in the personnel performing the installation, or in procedures used to install a given type of anchor shall require a new “initial inspection.”
 - b. Substrate: Concrete or masonry surfaces receiving the anchor are sound and of a condition that will develop the anchor’s rated strength.
 - c. Anchor:
 - 1) Manufacturer, type, and dimensions (diameter and length).
 - 2) Material (galvanized, Type 304 stainless steel, or Type 316 stainless steel).
 - d. Hole:
 - 1) Positioning: Spacing and edge distances.
 - 2) Drill bit type and diameter.
 - 3) Diameter, and depth.
 - 4) Hole cleaned in accordance with manufacturer’s required procedures. Confirm multiple repetitions of cleaning when recommended by the manufacturer.
 - 5) Anchor’s minimum effective embedment.
 - 6) Anchor tightening/installation torque.
 4. Requirements for continuous special inspection:
 - a. The special inspector shall observe all aspects of anchor installation, except that holes may be drilled in his/her absence provided that he/she confirms the use of acceptable drill bits before drilling, and later confirms the diameter, depth, and cleaning of drilled holes.

E. Field tests:

Owner may, at any time, request testing to confirm that materials being delivered and installed conform to the requirements of the Specifications:

- a. If such additional testing shows that the materials do not conform to the specified requirements, the Contractor shall pay the costs of these tests.
- b. If such additional testing shows that the materials do conform to the specified requirements, the Owner shall pay the costs of these tests.

2. Field testing: Post-installed anchors:

a. Proof load testing:

- 1) In addition to performing special inspections, the Engineer may select up to 10 percent of each type and size of post-installed mechanical anchor for proof-load testing for pullout or shear. Tests shall be non-destructive whenever possible.
- 2) Perform tension testing in accordance with ASTM E488. Apply proof loads using a calibrated hydraulic ram.

b. Torque load testing:

- 1) Using a calibrated torque wrench, apply manufacturer's recommended installation torque.

c. Acceptance criteria:

- 1) Minimum anchor embedment, proof load for pullout and shear, and torque shall be as specified in this Section.
- 2) Anchors that fail to resist their designated proof load or installation torque requirements shall be regarded as non-performing.
- 3) If 1 or more of the tested anchors fail to achieve their specified torque or proof load, all anchors of the same diameter and type as the failed anchors shall be tested.
- 4) Remediate non-performing anchors as specified in "non-conforming work."

3.07 NON-CONFORMING WORK

- A. Remove misaligned or non-performing anchors.
- B. Fill empty anchor holes and repair failed anchor locations using high-strength, non-shrink, non-metallic grout.
- C. If tested anchors of a given diameter and type fail to achieve their specified torque or proof load, the Engineer will provide directions for required modifications. Make such modifications, up to and including replacement of all anchors, at no additional cost to the Owner.

3.08 SCHEDULES

- A. Stainless steel. Provide and install stainless steel anchors at the following locations:
 1. "Corrosive locations" as defined in this Section: Type 316 stainless steel.
 2. "Wet and moist locations" as defined in this Section: Type 316 stainless steel.
 3. "Other locations:"
 - a. For connecting steel or stainless steel members to concrete: Type 304 stainless steel.
 4. At locations indicated on the Drawings.

- B. Galvanized: Provide and install galvanized carbon steel anchors at the following locations:
1. Locations not requiring stainless steel.
 2. At locations indicated on the Drawings.
- C. Provide and install anchor materials as scheduled in the following Table:

Table – Required Anchoring Materials by Location		
Location/Exposure	Materials	Notes
1. Anchors into concrete and grouted masonry for attachment of carbon steel, including structural steel and other steel fabrications, including welded steel tank:		
a) Interior dry areas	Carbon steel – galvanized	
b) Locations with galvanized steel structures or fabrications	Stainless steel – Type 304 or 316	1
c) Exterior and interior wet and moist locations	Stainless steel – Type 316	1
d) Corrosive locations	Stainless steel – Type 316	1
e) Welded steel tank	Stainless steel – Type 316	1
2. Anchors into concrete and grouted masonry for attachment of aluminum, stainless steel, or fiber-reinforced plastic (FRP) shapes and fabrications:		
a) Interior dry areas	Stainless steel – Type 304 or 316	1
b) Exterior and interior wet and moist locations	Stainless steel – Type 316	1
c) Corrosive locations	Stainless steel – Type 316	1
3. Anchors for attaching equipment and its appurtenances:		
a) All locations	Stainless steel – Type 316 (unless Type 304 is specifically indicated in the specifications for the equipment.)	1
Notes:		
(1) Where anchors are in contact with a metal that differs from that of the anchor, provide isolation sleeves and washers.		

END OF SECTION

SECTION 05500

METAL FABRICATIONS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Concrete inserts.
 - 2. Metal gratings
 - 3. Miscellaneous metals.
 - 4. Associated accessories to the above items.

- B. Related Sections:
 - 1. Section 09960 - High Performance Coatings.
 - 2. Section 15061 - Pipe Supports.

1.02 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. Standard Specifications for Highway Bridges.

- B. American Society for Testing and Materials (ASTM):
 - 1. A 36/A 36M - Standard Specification for Structural Steel.
 - 2. A 48 - Standard Specification for Grey Iron Castings.
 - 3. A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded, and Seamless.
 - 4. A 123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 5. A 240 - Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.
 - 6. A 269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
 - 7. A 276 - Standard Specification for Stainless Steel Bars and Shapes.
 - 8. A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - 9. A 325 - Standard Specification for High-Strength Bolts for Structural Steel Joints.
 - 10. A 489 - Standard Specification for Carbon Steel Lifting Eyes.
 - 11. A 490 - Standard Specification for Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength.
 - 12. A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 - 13. A 501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
 - 14. A 569 - Standard Specification for Steel, Carbon (0.15 Maximum, Percent) Hot-Rolled Sheet and Strip Commercial Quality.
 - 15. A 570/A 570M - Standard Specification for Steel, Sheet and Strip, Carbon. Hot-Rolled, Structural Quality.

- 16. A 635/A 635M - Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot-Rolled.
 - 17. A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 18. B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - 19. B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 20. B 308 - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
 - 21. B 429 - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
- C. American Welding Society (AWS):
 - 1. Standard Symbols for Welding, Brazing, and Nondestructive Examination.
 - D. National Association of Architectural Metal Manufacturers (NAAMM):
 - 1. Metal Finishes Manual.
 - E. Occupational Safety and Health Administration (OSHA):
 - 1. Code of Federal Regulations (CFR), Title 29, Labor, Pt. 1900-1990.

1.03 SUBMITTALS

- A. Product Data:
 - 1. Metal grating.
- B. Shop Drawings:
 - 1. Miscellaneous metals.
- C. Quality control submittals:
 - 1. Design data.
 - 2. Test reports:
 - a. Gratings:
 - 1) Grating manufacturers' calculations showing that gratings will meet specified design load, stress, and deflection requirements for each size grating for each span.
 - 2) Reports of tests performed.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General: Unless otherwise specified or indicated on the Drawings, structural and miscellaneous metals shall conform with the standards of the ASTM, including the following:

Item	ASTM Standard No.	Class, Grade Type or Alloy No.
Cast Iron		

Item	ASTM Standard No.	Class, Grade Type or Alloy No.
Cast Iron		
Cast Iron	A 48	Class 40B
Steel		
Steel		
Galvanized sheet iron or steel	A 653	Coating G90
Black steel, sheet or strip	A 569 A 570	--
Coil (plate)	A 635	--
Structural plate, bars, rolled shapes, and miscellaneous items	A 36	--
Standard bolts, nuts, and washers	A 307	--
High strength bolts, nuts, and hardened flat washers	A 325 A 490	--
Tubing, cold-formed	A 500	--
Tubing, hot-formed	A 501	--
Steel pipe	A 53	Grade B
Stainless steel		
Plate, sheet, and strip	A 240	Type 304* or 316**
Bars and shapes	A 276	Type 304* or 316**
Aluminum		
Flashing sheet aluminum	B 209	Alloy 5005-H14, 0.032 inches minimum thickness
Structural sheet aluminum-	B 209	Alloy 6061-T6
Structural aluminum	B 209 B 308	Alloy 6061-T6
Extruded aluminum	B 221	Alloy 6063-T42
* Use Type 304L if material will be welded.		
** Use Type 316L if material will be welded.		

1. Stainless steels are designated by type or series defined by ASTM.
2. Where stainless steel is welded, use low-carbon stainless steel.

2.02 MANUFACTURED UNITS

A. Concrete Inserts:

1. Concrete inserts for supporting pipe and other applications are specified in Section 15061.
- B. Metal gratings:
1. General:
 - a. Fabricate grating to cover areas indicated on the Drawings.
 - b. Unless otherwise indicated on the Drawings, grating over an opening shall cover entire opening.
 - c. Make cutouts in grating where required for equipment access or protrusion, including valve operators or stems, and gate frames.
 - d. Band ends of grating and edges of cutouts in grating:
 - 1) End banding: 1/4 inch less than height of grating, with top of grating and top edge of banding flush.
 - 2) Cutout banding: Full-height of grating.
 - 3) Use banding of same material as grating.
 - 4) Panel layout: Enable installation and subsequent removal of grating around protrusions or piping.
 - 5) Openings 6 inches and larger: Lay out grating panels with edges of 2 adjacent panels located on centerline of opening.
 - 6) Openings smaller than 6 inches: Locate opening at edge of single panel.
 - 7) Where an area requires more than 1 grating section to cover area, clamp adjacent grating sections together at 1/4-points with fasteners acceptable to Engineer.
 - 8) Fabricate aluminum grating sections in units of weighing not more than 50 pounds each.
 - 9) Gaps between adjacent grating sections shall not be more than the clear spacing between bearing bars.
 - e. When requested by Engineer, test 1 section of each size grating for each span length involved on the job under full load:
 - 1) Furnish a suitable dial gauge for measuring deflections.
 - f. Grating shall be aluminum, unless otherwise specified or indicated on the Drawings.
 2. Aluminum grating:
 - a. Material for gratings, shelf angles, and rebates: 6061-T6 or 6063-T6 aluminum alloy, except crossbars may be 6063-T5 aluminum alloy.
 - b. Shelf angle concrete anchors: Type 304 or Type 316 stainless steel.
 - c. Grating rebate rod anchors: 6061-T6 or 6063-T6 aluminum alloy.
 - d. Bar size and spacing: As determined by manufacturer to enable grating to support design load.
 - e. Design live load: A minimum of 100 pounds per square foot uniform live load on entire grating area, but not less than the live load indicated on the Drawings for the area where grating is located.
 - f. Maximum fiber stress for design load: 12,000 pounds per square inch.
 - g. Maximum deflection due to design load: 1/240 of grating clear span.
 - h. Maximum spacing of main grating bars: 1-1/8 inches clear between bars.
 - i. Minimum grating height: 1-1/2 inches.
 - j. Manufacturers: One of the following or equal:
 - 1) IKG Borden Industries, grooved aluminum I-bar.
 - 2) Brodhead Steel Products, Inc., grooved aluminum I-bar.

- C. Miscellaneous Metal:
 - a. Miscellaneous Cast Iron:
 - 1) General:
 - a) Tough, gray iron, free from cracks, holes, swells, and cold shuts.
 - b) Quality such that hammer blow will produce indentation on rectangular edge of casting without flaking metal.
 - c) Before leaving the foundry, clean castings and apply 16-mil dry film thickness coating of coal-tar epoxy, unless otherwise specified or indicated on the Drawings.
 - 2. Miscellaneous Stainless Steel:
 - a. Provide miscellaneous stainless steel items not specified herein as indicated on the Drawings or specified elsewhere. Fabricate and install in accordance with the best practices of the trade.
 - 3. Miscellaneous Structural Steel:
 - a. Provide miscellaneous steel items not specified herein as indicated on the Drawings or specified elsewhere. Fabricate and install in accordance with the best practices of the trade.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Examine work in place to verify that it is satisfactory to receive the work of this Section.
- B. If unsatisfactory conditions exist, do not begin this work until such conditions have been corrected.

3.02 INSTALLATION

- A. General:
 - 1. Install products as indicated on the Drawings, and in accordance with shop drawings and manufacturer's printed instructions, as applicable except where specified otherwise.
 - 2. Interface between materials:
 - a. Dissimilar metals: Where steel comes in contact with dissimilar metals (aluminum, stainless steel, etc.), separate or isolate the dissimilar metals.
 - 1) Make application so that the isolating or protective barrier is not visible in the completed construction.
 - 2) Isolating sleeves and washers: As specified in Section 05190.
 - b. Aluminum in contact with concrete or masonry: Coat aluminum surfaces as specified in Section 09960.
 - c. Aluminum in contact with concrete or masonry.
- B. Metal gratings:
 - 1. General:
 - a. Allow 1/8-inch maximum clearance between ends of grating and inside face of vertical leg of shelf angles.
 - b. Horizontal bearing leg of shelf angles shall be 2 inches minimum.
 - c. Install aluminum plate or angles where necessary to fill openings at changes in elevation and at openings between equipment and grating.
 - d. Install angle stops at ends of grating.

- e. Installed grating shall not slide out of rebate or off support.
 - f. Weld stops in place, unless otherwise specified or **indicated on the Drawings.**
 - g. Top surfaces of grating sections adjacent to each other shall lie in same plane.
2. Aluminum grating:
- a. Aluminum grating: Support on aluminum shelf angles or rebates.

END OF SECTION

SECTION 07110

DAMPPROOFING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Dampproofing.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. D 1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
- B. California Air Resources Board (ARB):
 - 1. Architectural Coatings Suggested Control Measure.

1.03 SUBMITTALS

- A. Product data.
- B. Shop drawings.
- C. Manufacturer's Installation Instructions.
- D. Warranty.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Store materials in original, unopened containers in compliance with manufacturer's printed instructions.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Conform to volatile organic compound limits specified in Table 1 of the California ARB Architectural Coatings Suggested Control Measure.

1.06 PROJECT/SITE CONDITIONS

- A. Environmental requirements: Do not apply bituminous dampproofing when temperatures are 40 degrees Fahrenheit or lower or when rain is forecast for the 24 hours following application.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Dampproofing: ASTM D 1227, Asbestos Free, Emulsified Asphalt Coatings.
 - 1. Manufacturers: One of the following or equal:
 - a. Karnak Corp., Karnak 220 AF.
 - b. W.R. Meadows, Inc., Sealmastic Type 2 Asphalt Emulsion Dampproofing.
- B. Sealing mastic: Type compatible with dampproofing and free of toxic solvents with thick mastic consistency and smooth and uniform in composition product as recommended by dampproofing manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that conditions are satisfactory for application of products in accordance with manufacturer's recommendations.
- B. Verify that surfaces to receive dampproofing are clean, dry, reasonably smooth, free of dust, dirt, voids, cracks, or sharp projections.

3.02 APPLICATION

- A. Completely cover surfaces to receive dampproofing with 2 coats.
 - 1. Applied by brush or spray.
 - 2. Apply dampproofing at manufacturer's recommended rate of application or minimum 2 gallons per square per coat, whichever is greater.
- B. Extend dampproofing to 6 inches above finish grade.
- C. Apply each coat evenly so surfaces have uniform black appearance.
- D. Apply second coat at right angles to first, allowing not less than 24 hours between coats.
- E. Seal around items and services projecting through dampproofing surfaces in accordance with manufacturer's recommendations.
- F. Ensure sealed areas are moisture tight.
- G. Backfill completely against dampproofing application within time recommended by manufacturer.

END OF SECTION

SECTION 07900

JOINT SEALANTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Acrylic-Latex sealant.
 - 2. Precast concrete joint sealant.
 - 3. Silicone sealant.
 - 4. Synthetic rubber sealing compound.
 - 5. Synthetic sponge rubber filler.
 - 6. Related materials.

1.02 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. M 198 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
- B. ASTM International (ASTM):
 - 1. C920 - Standard Specification for Elastomeric Joint Sealants.
 - 2. C990 – Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
 - 3. C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants.
 - 4. C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.
 - 5. D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
 - 6. D624 - Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.

1.03 SUBMITTALS

- A. Product data.
- B. Samples, include color selections.
- C. Manufacturer's Installation Instructions.
- D. Warranty.

1.04 QUALITY ASSURANCE

- A. Manufacturer qualifications: Manufacturer of proposed product for minimum 5 years with satisfactory performance record.

- B. Installer qualifications: Manufacturer approved installer of products similar to specified products on minimum 5 projects of similar scope as Project with satisfactory performance record.

1.05 PROJECT/SITE CONDITIONS

- A. Environmental requirements: Do not apply sealant on wet or frosty surfaces or when surface temperature is higher than 100 degrees Fahrenheit or lower than recommended by the manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products in accordance with manufacturer's recommendations.
- B. Code date packages. Do not use material older than manufacturer's published shelf life. Store materials at temperatures lower than 80 degrees Fahrenheit. Condition materials in accordance with manufacturer's instructions prior to installation.

1.07 SEQUENCING AND SCHEDULING

- A. Caulk joints prior to painting.

1.08 WARRANTY

- A. Warrant to correct defective products for minimum 1 year in accordance with manufacturer's standard warranty.

PART 2 PRODUCTS

2.01 SEALANTS

- A. General:
 - 1. Provide colors matching materials being sealed.
 - 2. Where compound is not exposed to view in finished work, provide manufacturer's color which has best performance.
 - 3. Nonsagging sealant for vertical and overhead horizontal joints.
 - 4. Sealants for horizontal joints: Self-leveling pedestrian/traffic grade.
 - 5. Joint cleaner, primer, bond breaker: As recommended by sealant manufacturer.
 - 6. Sealant backer rod and/or compressible filler made from closed cell polyethylene, polyethylene jacketed polyurethane foam, or other flexible, nonabsorbent, non-bituminous material recommended by sealant manufacturer to:
 - a. Control joint depth.
 - b. Break bond of sealant at bottom of joint.
 - c. Provide proper shape of sealant bead.
 - d. Serve as expansion joint filler.

2.02 ACRYLIC-LATEX SEALANT

- A. Permanently flexible, nonstaining, and nonbleeding latex modified acrylic sealant compound, colors as selected by Engineer from manufacturer's standard options. Manufacturers: One of the following or equal:
1. Tremco, Tremflex 834.
 2. Pecora Corp., Number AC-20.
 3. Sonneborn, Sonolac.

2.03 PRECAST CONCRETE JOINT SEALANT

- A. Preformed, cold-applied, ready-to-use, flexible joint sealant in accordance with ASTM C990 and AASHTO M 198. Manufacturers: One of the following or equal.
1. Henry Corporation, Ram-Nek.
 2. Concrete Sealants Division, ConSeal.

2.04 SILICONE SEALANT

- A. ASTM C920, Type S, Grade NS, Class 25, single component silicone sealant. Manufacturers: One of the following or equal:
1. Tremco, Proglaze.
 2. Pecora Corp., Number 864.
 3. Dow Corning, Number 795.
 4. General Electric, Number 1200 Series.

2.05 SYNTHETIC RUBBER SEALING COMPOUND

- A. Manufacturer: One of the following or equal:
1. Sika Corporation, Sikaflex 2c NS or SL.
 2. Pacific Polymers, Elastothane 227R.
- B. Material: In accordance with ASTM C920 Type M, Grade P (pourable), Class 25 and Type M, Grade NS (non-sag), Class 25; multi-part polyurethane; able to cure at room temperature to firm, highly resilient polymer; able to perform satisfactory when continuously submerged in water or sewage and exposed to direct sunlight in dry condition; with the following properties determined at 75 degrees Fahrenheit and 50 percent relative humidity:
1. Base: Polyurethane rubber.
 2. Application time: Minimum 2 hours.
 3. Cure time: Maximum 3 days.
 4. Tack free time: Maximum 24 hours.
 5. Ultimate hardness: Non-sag 25, Pourable/SL 40, within 5 Shore A.
 6. Tensile strength: Non-sag 95 pounds per square inch minimum and self-leveling minimum 170 pounds per square inch when tested in accordance with ASTM D412.
 7. Ultimate elongation: Minimum 340 percent when tested in accordance with ASTM D412.
 8. Tear resistance: Non-sag 45 pounds per inch minimum and self-leveling minimum 85 pounds per inch when tested in accordance with ASTM D624, Die C.
 9. Service temperature range: Minus 25 degrees to 158 degrees Fahrenheit.
- C. Color: Gray to match concrete, unless indicated on the Drawings.

2.06 SYNTHETIC SPONGE RUBBER FILLER

- A. Closed-cell expanded sponge rubber manufactured from synthetic polymer neoprene base, or resilient polyethylene foam backer rod. In accordance with ASTM C1330, Type O:
 - 1. Manufacturers: The following or equal:
 - a. Presstite, Number 750.3 Ropax Rod Stock.
- B. Characteristics:
 - 1. Suitable for application intended.
 - 2. Strength: As necessary for supporting sealing compound during application.
 - 3. Resiliency: Resistance to environmental conditions of installation.
 - 4. Bonding: No bonding to the sealing compound.
 - 5. Structure: Cellular, prevents absorption of water.
 - 6. Compatibility with other materials in joint and acceptance by manufacturer of sealing compound.
 - 7. Size: Minimum 25 percent greater than nominal joint width.

2.07 RELATED MATERIALS

- A. Primer: Nonstaining type, recommended by sealant manufacturer to suit application.
- B. Joint cleaner: Noncorrosive, nonstaining, compatible with joint forming materials and as recommended by sealant manufacturer.
- C. Bond breaker tape: Pressure-sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify acceptability of joint dimensions, physical, and environmental conditions.
- B. Verify that surfaces are dry, clean, and free of dirt, grease, curing compound, and other residue which might interfere with adhesion of sealants.

3.02 PREPARATION

- A. Allow concrete to cure thoroughly before caulking.
- B. Synthetic sponge rubber filler:
 - 1. Prepare surfaces designated to receive filler in accordance with manufacturer's installation instructions.
 - 2. Do not stretch filler beyond its normal length during installation.
- C. Caulking:
 - 1. Verify that surfaces are dry, clean, and free of dirt, grease, curing compounds, and other residue that might interfere with adhesion of sealant.
 - 2. Concrete, masonry, wood, and steel surfaces: Clean and prime in accordance with manufacturer's instructions prior to caulking.

- D. Synthetic rubber sealing compound:
 - 1. Ensure surfaces to which synthetic rubber must bond are dry and free of dust, dirt, and other foreign residue.
 - 2. Heavy sandblasted caulking groove to sound surface, and prime with manufacturer's recommended primer for particular surface.
- E. For sidewalks, pavements, and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to depth equal to 75 percent of joint width, but neither more than 5/8 inches deep nor less than 3/8 inches deep.
- F. For normal moving building joints sealed with elastomeric sealants not subject to traffic, fill joints to depth equal to 50 percent of joint width, but neither more than 1/2 inch deep nor less than 1/4 inch deep.
- G. For joints sealed with acrylic-latex sealants, fill joints to depth in range of 75 percent to 125 percent of joint width.
- H. Use joint filler to achieve required joint depths, to allow sealants to perform properly.
- I. Prepare surfaces and install synthetic sponge rubber filler in accordance with manufacturer's recommendations.
- J. Do not stretch filler beyond normal length during installation.
- K. Apply bond breaker when recommended by joint sealer manufacturer.

3.03 INSTALLATION

- A. Synthetic sponge rubber filler: Install filler in accordance with manufacturer's installation instructions.
- B. Caulking, joints, and sealing:
 - 1. Construct expansion, contraction, and construction joints as indicated on the Drawings.
 - 2. Install pipe and conduit in structures as indicated on the Drawings.
 - 3. Caulk doors, windows, louvers, and other items installed in or over concrete openings inside and out.
 - 4. Use synthetic rubber sealing compound for caulking where indicated on the Drawings or as specified, except for masonry construction and where specified otherwise.
 - 5. Complete caulking prior to painting.
 - 6. Verify that concrete is thoroughly cured prior to caulking.
 - 7. When filler compressible material is used, use untreated type.
 - 8. Apply caulking with pneumatic caulking gun.
 - 9. Use nozzles of proper shape and size for application intended.
 - 10. Maintain continuous bond between caulking and sides of joint to eliminate gaps, bubbles, or voids and fill joint in continuous operation without layering of compound.
 - 11. Employ experienced applicators to caulk joints and seams in neat workmanlike manner.

12. To hasten curing of compound when used on wide joints subject to movement, apply heat with infrared lamps or other convenient means.
13. Apply synthetic rubber sealing compound with pneumatic caulking tool or other acceptable method.

3.04 CLEANING

- A. Clean surfaces adjacent to sealant as work progresses.
- B. Remove excess uncured sealant by soaking and scrubbing with sealant cleaning solvent.
- C. Remove excess cured sealant by sanding with Number 80 grit sandpaper.
- D. Leave finished work in neat, clean condition.

3.05 SCHEDULE

- A. Acrylic latex:
 1. Use where indicated on the Drawings.
 2. Interior joints with movement less than 7.5 percent and not subject to wet conditions.
- B. Silicone:
 1. Use where indicated on the Drawings.
 2. Joints and recesses formed where window, door, louver and vent frames, and sill adjoin masonry, concrete, stucco, or metal surfaces.
 3. Door threshold bedding.
 4. Moist or wet locations, including joints around plumbing fixtures.
 5. Stainless steel doors and frames, including joints between applied stops and frames, and around anchor bolts.
 6. Plenum joints.
- C. Synthetic rubber sealing compound, non-sag Type II:
 1. Use where indicated on the Drawings.
 2. Water-bearing and earth-bearing concrete structures.
 3. Joints in masonry, concrete vertical surfaces, and metal-faced panels in vertical surfaces.
 4. Joints between sheet metal flashing and trim.
 5. Joints between sheet metal flashing and trim, and vertical wall surfaces.
 6. Small voids between materials requiring filling for weathertight performance in vertical surfaces.
 7. Perimeters of frames of doors, windows, louvers, and other openings where bonding is critical to airtight performance.
 8. Expansion and control joints in masonry vertical surfaces.
- D. Synthetic rubber sealing compound, self-leveling Type I:
 1. Use where indicated on the Drawings.
 2. Expansion and control joints in masonry, concrete horizontal surfaces, and metal panels in horizontal surfaces.
 3. Small voids between materials requiring filling for weathertight performance in horizontal surfaces.

4. Pavement joints.
5. Perimeters of frames of doors, windows, louvers, and other openings in horizontal surfaces where bonding is critical to airtight performance.

3.06 FIELD QUALITY CONTROL

- A. Adhesion testing:
 1. Perform adhesion tests in accordance with ASTM C1521 per the following criteria:
 - a. Water bearing structures: 1 test per every 1,000 LF of joint sealed.
 - b. Exterior precast concrete wall panels: 1 test per every 2,000 LF of joint sealed.
 - c. Chemical containment areas: 1 test per every 1,000 LF of joint sealed.
 - d. Building expansion joints: 1 test per every 500 LF of joint sealed.
 - e. All other type of joints except butt glazing joints: 1 test per every 3,000 LF of joint sealed.
 - f. Manufacturer's authorized factory representative provide written recommendations for remedial measures on failing tests.

END OF SECTION

- E. Compressors shall have suitable traps and filters to remove water and oils from air. Equipment shall be subject to acceptance by Engineer.
- F. Application of first coat shall follow immediately after surface preparation and cleaning within an 8-hour working day:
 - 1. Any cleaned areas not receiving first coat within an 8-hour period shall be recleaned prior to application of the coat.

3.02 SURFACE PREPARATION

- A. General surface preparation:
 - 1. All surfaces shall be prepared in accordance with coating manufacturer's current Product Data Sheets and as described below.
 - 2. Weld splatter:
 - a. Weld splatter shall be removed using a chipping hammer, spud bar, or scraper.
 - b. Tightly adhering weld splatter may require removal by grinding.
 - 3. Sharp edges:
 - a. Remove sharp edges, such as those normally occurring on rolled structural members or plates, as well as those resulting from flame cutting, welding, grinding, and especially shearing, by any suitable method such as grinding, mechanical sanding, and filing.
 - b. Ensure that during removing operations new sharp edges are not created.
 - 4. Pits: Deep corrosion pits, gouges, clamp marks, or other surface discontinuities may require grinding prior to coating application, and will require filling with seam sealer or equal.
 - 5. Laminations, slivers:
 - a. Rolling discontinuities (laps) with sharp protruding edges, deep penetrating crevices, and such defects shall be eliminated prior to coating.
 - b. Eliminate minor slivers by scraping and grinding. All sharp fins, projections, or edges shall be removed.
 - 6. All surfaces shall be prepared in accordance with coating manufacturer's instructions:
 - a. All steel surfaces to be coated must be abrasive blast cleaned to a minimum "Near White Metal" in accordance with SSPC SP10.
 - b. A "Near White Metal" blast is removal of all rust, mill scale, paint, and other foreign matter to a near white metal.
 - c. Limit staining to less than 5 percent of surface area.
 - 7. A profile or anchor pattern is required to assure best possible adhesion of coating system to steel:
 - a. Use proper mesh size angular abrasive to obtain profile required for each individual type of coating system.
 - b. Profile shall be 2.0 mils.
 - c. Only clean, fresh grit, or abrasive shall be used.
 - 8. In general, select smallest size abrasive that will produce desired cleaning results.
 - 9. After abrasive blasting, remove all dust, foreign particles, and spent abrasives by blowing down with clean, dry, oil free air, brushing, and vacuum cleaning.
 - 10. All workers and/or inspectors who will be in contact with abrasive blasted surfaces shall wear clean gloves, clothing, and shoe coverings to prevent contamination of abrasive blasted surfaces.

11. Apply primer or first coat of coating system as soon as possible after abrasive blasting operation is finished and before surface starts to rust:
 - a. If abrasive blasted surface changes color or rust bloom begins to form, re-blast surface to "Near White Metal."
12. Clean and coat ladders, pipes, pipe connections, flanges, and any other structures in or connected to water tank:
 - a. All edges shall be brush striped prior to spray application of coating.
13. Blast a sample area with abrasive to be used to check surface preparation and proposed equipment to ensure that surface can be cleaned according to specification and that abrasive will provide a profile suitable for application of coating to be used.
14. No coating work shall begin before prepared surfaces and manner of preparation is accepted by Engineer.

3.03 COATING APPLICATION

- A. Coating application shall be in accordance to requirements of SSPC-PA 1, latest revision, coating manufacturer's printed literature, and as specified.
- B. Thinning of coating materials shall only be permitted as recommended by manufacturer and accepted by Engineer.
- C. Apply each application of coating evenly, free of brush marks, sags, and runs, and with no evidence of poor workmanship:
 1. Coating shall be sharply cut to lines.
 2. Finished surfaces shall be free from defects and blemishes.
- D. Protective coverings and drop cloths shall be used to protect floors, fixtures, equipment, prepared surfaces, and previously-applied coatings:
 1. Personnel entering water tank or walking on exterior roof of water tank shall take precautions to prevent damage or contamination of coated surfaces.
 2. Exercise care to prevent coating from being spattered onto surfaces which are not to be coated.
 3. Recoat surfaces from which material cannot be removed satisfactorily as required to produce a finish acceptable to Engineer.
- E. Welds, seams, edges, and irregular surfaces shall receive a brush (stripe) coat prior to spray application of coating.
- F. Application of first coat shall follow immediately after surface preparation and cleaning within an 8-hour period.
- G. Coating components shall be mixed in exact proportions as specified by manufacturer:
 1. Ensure all materials are removed from containers during mixing and metering operations.
- H. Thoroughly mix coatings utilizing an approved slow-speed power mixer until all components are thoroughly combined and are of a smooth consistency:
 1. Do not apply coatings beyond pot-life limits specified by manufacturer.
- I. Add thinners to coating materials only as required in accordance with manufacturer's printed literature and in presence of Engineer.

- J. Strictly observe drying time between coats as stated in manufacturer's printed instructions.
- K. When 2 or more coats are specified, each coat shall contain sufficient approved color additive to act as an indicator of coverage, or coats must be of contrasting color.
- L. Upon completion of coating operations, perform coating thickness tests and holiday detection testing using a non-destructive, magnetic type thickness gauge, and an approved holiday detection device:
 - 1. Pinholes or other irregularities are not permitted in the coating.
 - 2. Holiday detection testing shall be accomplished over 100 percent of interior and exterior coated surfaces.
- M. Perform mixing, thinning, application, coating thickness testing, and holiday detection testing of coatings in presence of Engineer.
- N. Required cure duration shall be based on applied thickness, temperature, and relative humidity during curing period before placing epoxy-coating systems into service:
 - 1. Allow time element equivalent to 7 days curing time at 70 degrees Fahrenheit and 50 percent relative humidity.
 - 2. Contractor shall provide minimum 7 days curing.
- O. Contractor to furnish letter to Engineer stating coating is properly cured and ready for service. Engineer may perform tests to verify proper cure.

3.04 DISINFECTION

- A. Disinfection is not required.

END OF SECTION

SECTION 09960

HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Field-applied coatings.
- B. Related sections:
 - 1. Section 01140 - Work Restrictions.
 - 2. Section 01312 - Project Meetings.
 - 3. Section 01330 - Submittal Procedures.
 - 4. Section 01600 - Product Requirements.
 - 5. Section 01770 - Closeout Procedures.
 - 6. Section 15075 - Equipment Identification.
 - 7. Section 16075 - Identification for Electrical Systems.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.
 - 2. D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
- B. International Concrete Repair Institute (ICRI):
 - 1. Guideline 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.
- C. NACE International (NACE):
 - 1. SP0178 - Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to Be Lined for Immersion Service.
 - 2. SP0188 - Discontinuity (Holiday) Testing of Protective Coatings.
- D. National Association of Pipe Fabricators (NAPF):
 - 1. 500-03 - Surface Preparation Standard for Ductile Iron Pipe and Fittings Receiving Special External Coatings and/or Special Internal Linings.
- E. NSF International (NSF):
 - 1. 61 - Drinking Water System Components - Health Effects.
- F. Society for Protective Coatings (SSPC):
 - 1. SP COM - Surface Preparation Commentary for Steel and Concrete Substrates.
 - 2. SP 1 - Solvent Cleaning.
 - 3. SP 2 - Hand Tool Cleaning.
 - 4. SP 3 - Power Tool Cleaning.
 - 5. SP 5 - White Metal Blast Cleaning.
 - 6. SP 6 - Commercial Blast Cleaning.
 - 7. SP 7 - Brush-Off Blast Cleaning.

8. SP 10 - Near-White Blast Cleaning.
 9. SP 13 - Surface Preparation of Concrete.
- G. United States Environmental Protection Agency (EPA):
1. Method 24 - Surface Coatings.

1.03 DEFINITIONS

- A. Submerged metal: Steel or iron surfaces below tops of channel or structure walls that will contain water even when above expected water level.
- B. Submerged concrete and masonry surfaces: Surfaces that are or will be:
1. Underwater.
 2. In structures that normally contain water.
 3. Below tops of walls of water-containing structures.
- C. Exposed surface: Any metal or concrete surface, indoors or outdoors, that is exposed to view.
- D. Dry film thickness (DFT): Thickness of fully cured coating, measured in mils.
- E. Volatile organic compound (VOC): Content of air polluting hydrocarbons in uncured coating product measured in units of grams per liter or pounds per gallon, as determined by EPA Method 24.
- F. Ferrous: Cast iron, ductile iron, wrought iron, and all steel alloys except stainless steel.
- G. Where SSPC surface preparation standards are specified or implied for ductile iron pipe or fittings, the equivalent NAPF surface preparation standard shall be substituted for the SSPC standard.

1.04 PERFORMANCE REQUIREMENTS

- A. Coating materials shall be especially adapted for use in water and recycled water facilities.
- B. Coating materials used in contact with potable water supply systems shall be certified to NSF 61.

1.05 SUBMITTALS

- A. General: Submit as specified in Section 01330.
- B. Shop drawings:
1. Schedule of proposed coating materials.
 2. Schedule of surfaces to be coated with each coating material.
- C. Product data: Include description of physical properties of coatings including solids content and ingredient analysis, VOC content, temperature resistance, typical exposures and limitations, and manufacturer's standard color chips:
1. Regulatory requirements: Submit data concerning the following:
 - a. VOC limitations.

- b. Coatings containing lead compounds and polychlorinated biphenyls.
 - c. Abrasives and abrasive blast cleaning techniques, and disposal.
 - d. NSF certification of coatings for use in potable water supply systems.
- D. Samples: Include 8-inch square drawdowns or brush-outs of topcoat finish when requested. Identify each sample as to finish, formula, color name and number, sheen name, and gloss units.
- E. Certificates: Submit in accordance with requirements for Product Data.
- F. Manufacturer's instructions: Include the following:
 - 1. Special requirements for transportation and storage.
 - 2. Mixing instructions.
 - 3. Shelf life.
 - 4. Pot life of material.
 - 5. Precautions for applications free of defects.
 - 6. Surface preparation.
 - 7. Method of application.
 - 8. Recommended number of coats.
 - 9. Recommended DFT of each coat.
 - 10. Recommended total DFT.
 - 11. Drying time of each coat, including prime coat.
 - 12. Required prime coat.
 - 13. Compatible and non-compatible prime coats.
 - 14. Recommended thinners, when recommended.
 - 15. Limits of ambient conditions during and after application.
 - 16. Time allowed between coats (minimum and maximum).
 - 17. Required protection from sun, wind, and other conditions.
 - 18. Touch-up requirements and limitations.
 - 19. Minimum adhesion of each system submitted in accordance with ASTM D4541.
- G. Manufacturer's Representative's Field Reports.
- H. Operations and Maintenance Data: Submit as specified in Section 01770.
 - 1. Reports on visits to project site to view and approve surface preparation of structures to be coated.
 - 2. Reports on visits to project site to observe and approve coating application procedures.
 - 3. Reports on visits to coating plants to observe and approve surface preparation and coating application on items that are "shop coated."
- I. Quality Assurance Submittals:
 - 1. Quality assurance plan.
 - 2. Qualifications of coating applicator including List of Similar Projects.
- J. Certifications:
 - 1. Submit notarized certificate that:
 - a. All paints and coatings to be used on this project comply with current federal, state, and local VOC regulations.
 - 2. California certifications:

- a. All paints and coatings to be used on this project comply with the current VOC regulations of the State of California Air Management District in which the coatings will be used.

1.06 QUALITY ASSURANCE

- A. Applicator qualifications:
 1. Minimum of 5 years of experience applying specified type or types of coatings under conditions similar to those of the Work:
 - a. Provide qualifications of applicator and references listing 5 similar projects completed in the past 2 years.
 2. Manufacturer-approved applicator when manufacturer has approved applicator program.
- B. Regulatory requirements: Comply with governing agencies regulations by using coatings that do not exceed permissible VOC limits and do not contain lead:
 1. Do not use coal-tar epoxy in contact with drinking water or exposed to ultraviolet radiation.
- C. Field samples:
 1. Prepare and coat a minimum 100-square-foot area between corners or limits such as control or construction joints of each system.
 2. Approved field sample may be part of the Work.
 3. Obtain approval before painting other surfaces.
- D. Pre-installation conference: Conduct as specified in Section 01312.
- E. Compatibility of coatings: Use products by same manufacturer for prime coats, intermediate coats, and finish coats on same surface, unless specified otherwise.
- F. Services of coating manufacturer's representative: Arrange for coating manufacturer's representative to attend pre-installation conferences. Make periodic visits to the project site to provide consultation and inspection services during surface preparation and application of coatings, and to make visits to coating plants to observe and approve surface preparation procedures and coating application of items to be "shop-primed and coated."

1.07 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products as specified in Section 01600.
- B. Remove unspecified and unapproved paints from Project site immediately.
- C. Deliver new unopened containers with labels identifying the manufacturer's name, brand name, product type, batch number, date of manufacturer, expiration date or shelf life, color, and mixing and reducing instructions.
 1. Do not deliver materials aged more than 12 months from manufacturing date.
- D. Store coatings in well-ventilated facility that provides protection from the sun weather, and fire hazards. Maintain ambient storage temperature between 45 and 90 degrees Fahrenheit, unless otherwise recommended by the manufacturer.
- E. Take precautions to prevent fire and spontaneous combustion.

1.08 PROJECT CONDITIONS

- A. Surface moisture contents: Do not coat surfaces that exceed manufacturer-specified moisture contents, or when not specified by the manufacturer, with the following moisture contents:
 - 1. Concrete: 12 percent.
 - 2. Concrete floors: 7 percent.

- B. Do not apply coatings:
 - 1. Under dusty conditions or adverse environmental conditions, unless tenting, covers, or other such protection is provided for structures to be coated.
 - 2. When light on surfaces measures less than 15 foot-candles.
 - 3. When ambient or surface temperature is less than 55 degrees Fahrenheit unless manufacturer allows a lower temperature.
 - 4. When relative humidity is higher than 85 percent.
 - 5. When surface temperature is less than 5 degrees Fahrenheit above dew point.
 - 6. When surface temperature exceeds the manufacturer's recommendation.
 - 7. When ambient temperature exceeds 90 degrees Fahrenheit, unless manufacturer allows a higher temperature.
 - 8. Apply clear finishes at minimum 65 degrees Fahrenheit.

- C. Provide fans, heating devices, dehumidifiers, or other means recommended by coating manufacturer to prevent formation of condensate or dew on surface of substrate, coating between coats and within curing time following application of last coat.

- D. Provide adequate continuous ventilation and sufficient heating facilities to maintain minimum 55 degrees Fahrenheit for 24 hours before, during, and 48 hours after application of finishes.

1.09 SEQUENCING AND SCHEDULING

- A. Sequence and Schedule: As specified in Section 01140.

1.10 MAINTENANCE

- A. Extra materials: Deliver as specified in Section 01770. Include minimum 1 gallon of each type and color of coating applied:
 - 1. When manufacturer packages material in gallon cans, deliver unopened labeled cans as comes from factory.
 - 2. When manufacturer does not package material in gallon cans, deliver material in new gallon containers, properly sealed and identified with typed labels indicating brand, type, and color.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Special coatings: One of the following or equal:
 - 1. Carboline: Carboline, St. Louis, MO.
 - 2. Ceilcote: International Protective Coatings, Berea, OH.
 - 3. Dampney: The Dampney Company, Everett, MA.

4. Devoe: International Protective Coatings, Louisville, KY.
5. Dudick: Dudick, Inc., Streetsboro, OH.
6. GET: Global Eco Technologies, Pittsburg, CA.
7. Henkel: Henkel North America, Madison Heights, MI.
8. IET: Integrated Environmental Technologies, Santa Barbara, CA.
9. PPC: Polymorphic Polymers Corp., North Miami, FL.
10. PPG Amercoat: PPG Protective & Marine Coatings, Brea, CA.
11. Rustoleum: Rustoleum Corp., Sommerset, NJ.
12. Sanchem: Sanchem, Chicago, IL.
13. Superior: Superior Environmental Products, Inc., Addison, TX.
14. S-W: Sherwin-Williams Co., Cleveland, OH.
15. Tnemec: Tnemec Co., Kansas City, MO.
16. Wasser: Wasser High Tech Coatings, Kent, WA.
17. ZRC: ZRC Worldwide Innovative Zinc Technologies, Marshfield, MA.

2.02 PREPARATION AND PRETREATMENT MATERIALS

- A. Metal pretreatment: As manufactured by one of the following or equal:
 1. Henkel: Galvaprep 5.
 2. International: AWLGrip Alumiprep 33.
- B. Surface cleaner and degreaser: As manufactured by one of the following or equal:
 1. Carboline Surface Cleaner No. 3.
 2. Devoe: Devprep 88.
 3. S-W: Clean and Etch.

2.03 COATING MATERIALS

- A. Alkali-resistant bitumastic: As manufactured by one of the following or equal:
 1. Carboline: Bitumastic No. 50.
 2. S-W: Targuard.
 3. Wasser: MC-Tar.
- B. High solids epoxy (self-priming) not less than 72 percent solids by volume: As manufactured by one of the following or equal:
 1. Carboline: Carboguard 891.
 2. Devoe: Bar Rust 233H.
 3. PPG Amercoat: Amerlock 2.
 4. S-W: Macropoxy 646.
- C. Aliphatic or aliphatic-acrylic polyurethane: As manufactured by one of the following or equal:
 1. Carboline: Carbothane 134 VOC.
 2. Devoe: Devthane 379.
 3. PPG Amercoat: Amershield VOC.
 4. Non-submerged: S-W High Solids Polyurethane **[CA]**.
 5. Tnemec: Endura-Shield II Series 1075 (U).
- D. Protective coal tar: As manufactured by one of the following or equal:
 1. Carboline: Bitumastic No. 50.
 2. PPG Amercoat: 78HB

- E. Concrete floor coatings: As manufactured by one of the following or equal:
 - 1. Carboline: Semstone 140SL.
 - 2. Devoe: Devran 124.
 - 3. Dudick: Polymer Alloy 1000.
 - 4. Tnemec: Tneme-Glaze Series 282.
- F. Galvanizing zinc compound: As manufactured by one of the following or equal:
 - 1. ZRC: Cold Galvanizing Compound.

2.04 MIXES

- A. Mix in accordance with manufacturer's instructions.

PART 3 EXECUTION

3.01 GENERAL PROTECTION

- A. Protect adjacent surfaces from coatings and damage. Repair damage resulting from inadequate or unsuitable protection.
- B. Protect adjacent surfaces not to be coated from spatter and droppings with drop cloths and other coverings:
 - 1. Mask off surfaces of items not to be coated or remove items from area.
- C. Furnish sufficient drop cloths, shields, and protective equipment to prevent spray or droppings from fouling surfaces not being coated and, in particular, surfaces within storage and preparation areas.
- D. Place cotton waste, cloths, and material that may constitute a fire hazard in closed metal containers and remove daily from site.
- E. Remove electrical plates, surface hardware, fittings, and fastenings prior to application of coating operations. Carefully store, clean, and replace on completion of coating in each area. Do not use solvent or degreasers to clean hardware that may remove permanent lacquer finish.

3.02 GENERAL PREPARATION

- A. Prepare surfaces in accordance with coating manufacturer's instructions, unless more stringent requirements are specified in this Section.
- B. Protect the following surfaces from abrasive blasting by masking or other means:
 - 1. Threaded portions of valve and gate stems, grease fittings, and identification plates.
 - 2. Machined surfaces for sliding contact.
 - 3. Surfaces to be assembled against gaskets.
 - 4. Surfaces of shafting on which sprockets are to fit.
 - 5. Surfaces of shafting on which bearings are to fit.
 - 6. Machined surfaces of bronze trim, including slide gates.
 - 7. Cadmium-plated items except cadmium-plated, zinc-plated, or sherardized fasteners used in assembly of equipment requiring abrasive blasting.
 - 8. Galvanized items, unless scheduled to be coated.

- C. Protect installed equipment, mechanical drives, and adjacent coated equipment from abrasive blasting to prevent damage caused by entering sand or dust.
- D. Concrete:
 - 1. Allow new concrete to cure for minimum of 28 days before coating.
 - 2. Clean concrete surfaces of dust, mortar, fins, loose concrete particles, form release materials, oil, and grease. Fill voids so that surface is smooth. Prepare concrete surface for coating in accordance with SSPC SP 13. Provide ICRI 310.2 CSP-3 surface profile, or as recommended by coating manufacturer. All concrete surfaces shall be vacuumed clean prior to coating application.
- E. Ferrous metal surfaces:
 - 1. Remove grease and oil in accordance with SSPC SP 1.
 - 2. Remove rust, scale, and welding slag and spatter, and prepare surfaces in accordance with appropriate SSPC standard as specified.
 - 3. Abrasive blast surfaces prior to coating.
 - a. When abrasive blasted surfaces rust or discolor before coating, abrasive blast surfaces again to remove rust and discoloration.
 - b. When metal surfaces are exposed because of coating damage, abrasive blast surfaces and feather in to a smooth transition before touching up.
 - c. Ferrous metal surfaces not to be submerged: Abrasive blast in accordance with SSPC SP 10, unless blasting may damage adjacent surfaces, prohibited, or specified otherwise. Where not possible to abrasive blast, power tool clean surfaces in accordance with SSPC SP 3.
 - d. Ferrous metal surfaces to be submerged: Unless specified otherwise, abrasive blast in accordance with SSPC SP 5 to clean and provide roughened surface profile of not less than 2 mils and not more than 4 mils in depth when measured with Elcometer 123, or as recommended by the coating manufacturer.
 - 4. All abrasive blast cleaned surfaces shall be blown down with clean dry air and/or vacuumed.
- F. Ductile iron pipe and fittings to be lined or coated: Abrasive blast clean in accordance with NAPF 500-03.
- G. Sherardized, aluminum, copper, and bronze surfaces: Prepare in accordance with coating manufacturer's instructions.
- H. Galvanized surface:
 - 1. Degrease or solvent clean (SSPC SP 1) to remove oily residue.
 - 2. Power tool or hand tool clean or whip abrasive blast.
 - 3. Test surface for contaminants using copper sulfate solution.
 - 4. Apply metal pretreatment within 24 hours before coating galvanized surfaces that cannot be thoroughly abraded physically, such as bolts, nuts, or preformed channels.
- I. Shop-primed metal:
 - 1. Certify that primers applied to metal surfaces in the shop are compatible with coatings to be applied over such primers in the field.
 - 2. Remove shop primer from metal to be submerged by abrasive blasting in accordance with SSPC SP 10, unless greater degree of surface preparation is required by coating manufacturer's representative.

3. Correct abraded, scratched, or otherwise damaged areas of prime coat by sanding or abrasive blasting to bare metal in accordance with SSPC SP 2, SP 3, or SP 6, as directed by the Engineer. When entire shop priming fails or has weathered excessively (more than 25 percent of the item), or when recommended by coating manufacturer's representative, abrasive blast shop prime coat to remove entire coat and prepare surface in accordance with SSPC SP 10.
 4. When incorrect prime coat is applied, remove incorrect prime coat by abrasive blasting in accordance with SSPC SP 10.
 5. When prime coat not authorized by Engineer is applied, remove unauthorized prime coat by abrasive blasting in accordance with SSPC SP 10.
 6. Shop applied bituminous paint or asphalt varnish: Abrasive blast clean shop applied bituminous paint or asphalt varnish from surfaces scheduled to receive non-bituminous coatings.
- J. Cadmium-plated, zinc-plated, or sherardized fasteners:
1. Abrasive blast in the same manner as unprotected metal when used in assembly of equipment designated for abrasive blasting.
- K. Abrasive blast components that are to be attached to surfaces that cannot be abrasive blasted before components are attached.
- L. Grind sharp edges to approximately 1/16-inch radius before abrasive blast cleaning.
- M. Remove and grind smooth all excessive weld material and weld spatter before blast cleaning in accordance with NACE SP0178.
- N. Cleaning of previously coated surfaces:
1. Utilize cleaning agent to remove soluble salts such as chlorides and sulfates from concrete and metal surfaces:
 - a. Cleaning agent: Biodegradable non-flammable and containing no VOC.
 - b. Manufacturer: The following or equal:
 - 1) CHLOR*RID International, Inc.
 2. Cleaning of surfaces utilizing the decontamination cleaning agent may be accomplished in conjunction with abrasive blast cleaning, steam cleaning, high-pressure washing, or hand washing as approved by the coating manufacturer's representative and the Engineer.
 3. Test cleaned surfaces in accordance with the cleaning agent manufacturer's instructions to ensure all soluble salts have been removed. Additional cleaning shall be carried out as necessary.
 4. Final surface preparation prior to application of new coating system shall be made in strict accordance with coating manufacturer's printed instructions.

3.03 MECHANICAL AND ELECTRICAL EQUIPMENT PREPARATION

- A. Identify equipment, ducting, piping, and conduit as specified in Section 15075 and Section 16075.
- B. Remove grilles, covers, and access panels for mechanical and electrical system from location and coat separately.
- C. Prepare and finish coat primed equipment with color selected by the Engineer.

- D. Prepare and prime and coat insulated and bare pipes, conduits, boxes, insulated and bare ducts, hangers, brackets, collars, and supports, except where items are covered with prefinished coating.
- E. Replace identification markings on mechanical or electrical equipment when coated over or spattered.
- F. Prepare and coat interior surfaces of air ducts, and convector and baseboard heating cabinets that are visible through grilles and louvers with 1 coat of flat black paint, to limit of sight line.
- G. Prepare and coat dampers exposed immediately behind louvers, grilles, and convector and baseboard heating cabinets to match face panels.
- H. Prepare and coat exposed conduit and electrical equipment occurring in finished areas with color and texture to match adjacent surfaces.
- I. Prepare and coat both sides and edges of plywood backboards for electrical equipment before installing backboards and mounting equipment on them.
- J. Color code equipment, piping, conduit, and exposed ductwork and apply color banding and identification, such as flow arrows, naming, and numbering, in accordance with the Contract Documents.

3.04 GENERAL APPLICATION REQUIREMENTS

- A. Apply coatings in accordance with manufacturer's instructions.
- B. Coat metal unless specified otherwise:
 1. Aboveground piping to be coated shall be empty of contents during application of coatings.
- C. Verify metal surface preparation immediately before applying coating in accordance with SSPC SP COM.
- D. Allow surfaces to dry, except where coating manufacturer requires surface wetting before coating.
- E. Wash coat and prime sherardized, aluminum, copper, and bronze surfaces, or prime with manufacturer's recommended special primer.
- F. Prime shop-primed metal surfaces. Spot prime exposed metal of shop-primed surfaces before applying primer over entire surface.
- G. Multiple coats:
 1. Apply minimum number of specified coats.
 2. Apply additional coats when necessary to achieve specified thicknesses.
 3. Apply coats to thicknesses specified, especially at edges and corners.
 4. When multiple coats of same material are specified, tint prime coat and intermediate coats with suitable pigment to distinguish each coat.
 5. Lightly sand and dust surfaces to receive high-gloss finishes, unless instructed otherwise by coating manufacturer.
 6. Dust coatings between coats.

- H. Coat surfaces without drops, overspray, dry spray, runs, ridges, waves, holidays, laps, or brush marks.
- I. Remove spatter and droppings after completion of coating.
- J. Apply coating by brush, roller, trowel, or spray, unless particular method of application is required by coating manufacturer's instructions or these Specifications.
- K. Plural component application: Drums shall be premixed each day. All gauges shall be in working order prior to the start of application. Ratio checks shall be completed prior to each application. A spray sample shall be sprayed on plastic sheeting to ensure set time is complete prior to each application. Hardness testing shall be performed after each application.
- L. Spray application:
 - 1. Stripe coat edges, welds, nuts, bolts, and difficult-to-reach areas by brush before beginning spray application, as necessary, to ensure specified coating thickness along edges.
 - 2. When using spray application, apply coating to thickness not greater than that recommended in coating manufacturer's instructions for spray application.
 - 3. Use airless spray method, unless air spray method is required by coating manufacturer's instruction or these Specifications.
 - 4. Conduct spray coating under controlled conditions. Protect adjacent construction and property from coating mist, fumes, or overspray.
- M. Drying and recoating:
 - 1. Provide fans, heating devices, or other means recommended by coating manufacturer to prevent formation of condensate or dew on surface of substrate, coating between coats and within curing time following application of last coat.
 - 2. For submerged service, the Contractor shall provide a letter to the Engineer that the lining system is fully cured and ready to be placed into service.
 - 3. Limit drying time to that required by these Specifications or coating manufacturer's instructions.
 - 4. Do not allow excessive drying time or exposure, which may impair bond between coats.
 - 5. Recoat epoxies within time limits recommended by coating manufacturer.
 - 6. When time limits are exceeded, abrasive blast clean and de-gloss clean prior to applying another coat.
 - 7. When limitation on time between abrasive blasting and coating cannot be met before attachment of components to surfaces that cannot be abrasive blasted, coat components before attachment.
 - 8. Ensure primer and intermediate coats of coating are unscarred and completely integral at time of application of each succeeding coat.
 - 9. Touch-up suction spots between coats and apply additional coats where required to produce finished surface of solid, even color, free of defects.
 - 10. Leave no holidays.
 - 11. Sand and feather in to a smooth transition and recoat scratched, contaminated, or otherwise damaged coating surfaces so damages are invisible to the naked eye.

- N. Concrete:
 - 1. Apply first coat (primer) only when surface temperature of concrete is decreasing in order to eliminate effects of off-gassing on coating.

3.05 ALKALI-RESISTANT BITUMASTIC

- A. Preparation:
 - 1. Prepare surfaces in accordance with general preparation requirements.
- B. Application:
 - 1. Apply in accordance with general application requirements and as follows:
 - a. Apply at least 2 coats, 8 to 14 mils DFT each.

3.06 HIGH SOLIDS EPOXY SYSTEM

- A. Preparation:
 - 1. Prepare surfaces in accordance with general preparation requirements and as follows:
 - a. Abrasive blast ferrous metal surfaces to be submerged at jobsite in accordance with SSPC SP 5 prior to coating. When cleaned surfaces rust or discolor, abrasive blast surfaces in accordance with SSPC SP 10.
 - b. Abrasive blast non-submerged ferrous metal surfaces at jobsite in accordance with SSPC SP 10, prior to coating. When cleaned surfaces rust or discolor, abrasive blast surfaces in accordance with SSPC SP 6.
 - c. Abrasive blast clean ductile iron surfaces at jobsite in accordance with SSPC SP 7.
- B. Application:
 - 1. Apply coatings in accordance with general application requirements and as follows:
 - a. Apply minimum 2-coat system with minimum total DFT of 12 mils.
 - b. Recoat or apply succeeding epoxy coats within time limits recommended by manufacturer. Prepare surfaces for recoating in accordance with manufacturer's instructions.
 - c. Coat metal to be submerged before installation when necessary, to obtain acceptable finish, and to prevent damage to other surfaces.
 - d. Coat entire surface of support brackets, stem guides, pipe clips, fasteners, and other metal devices bolted to concrete.
 - e. Coat surface of items to be exposed and adjacent 1 inch to be concealed when embedded in concrete or masonry.

3.07 HIGH SOLIDS EPOXY AND POLYURETHANE COATING SYSTEM

- A. Preparation:
 - 1. Prepare surfaces in accordance with general preparation requirements and as follows:
 - a. Prepare concrete surfaces in accordance with general preparation requirements.
 - b. Touch up shop-primed steel and miscellaneous iron.
 - c. Abrasive blast ferrous metal surfaces at jobsite prior to coating. Abrasive blast clean rust and discoloration from surfaces.
 - d. Degrease or solvent clean, whip abrasive blast, power tool, or hand tool clean galvanized metal surfaces.

e. Abrasive blast clean ductile iron surfaces.

B. Application:

1. Apply coatings in accordance with general application requirements and as follows:
 - a. Apply a 3-coat system consisting of:
 - 1) Primer: 4 to 5 mils DFT high solids epoxy.
 - 2) Intermediate coat: 4 to 5 mils DFT high solids epoxy.
 - 3) Topcoat: 2.5 to 3.5 mils DFT aliphatic or aliphatic-acrylic polyurethane topcoat.
2. Recoat or apply succeeding epoxy coats within 30 days or within time limits recommended by manufacturer, whichever is shorter. Prepare surfaces for recoating in accordance with manufacturer's instructions.

3.08 ASPHALT VARNISH

A. Preparation:

1. Prepare surfaces in accordance with general preparation requirements.

B. Application:

1. Apply coatings in accordance with general application requirements and as follows:
 - a. Apply minimum 2 coats.

3.09 PROTECTIVE COAL TAR

A. Preparation:

1. Prepare surfaces in accordance with general preparation of coal-tar requirements.

B. Application:

1. Apply coatings in accordance with general application requirements and as follows:
 - a. Apply minimum 20 mils DFT coating.

3.10 CONCRETE FLOOR COATINGS

A. Preparation:

1. Prepare surfaces in accordance with general application requirements and in strict accordance with coating manufacturer's instructions.

B. Application:

1. Apply primer if required by coating manufacturer.
2. Apply 1 or more coats as recommended by coating manufacturer to receive a minimum total DFT of 25 mils; color as selected by the Owner.

- C. Final topcoat shall include non-skid surface, applied in strict accordance with coating manufacturer's instructions.

3.11 FIELD QUALITY CONTROL

- A. Each coat will be inspected. Strip and remove defective coats, prepare surfaces, and recoat. When approved, apply next coat.

- B. Control and check DFT and integrity of coatings.
- C. Measure DFT with calibrated thickness gauge.
- D. DFT on ferrous-based substrates may be checked with Elcometer Type 1 Magnetic Pull-Off Gauge or PosiTector® 6000.
- E. Verify coat integrity with low-voltage sponge or high-voltage spark holiday detector, in accordance with NACE SP0188. Allow Engineer to use detector for additional checking.
- F. Arrange for services of coating manufacturer's field representative to provide periodic field consultation and inspection services to ensure proper surface preparation of facilities and items to be coated, and to ensure proper application and curing:
 - 1. Notify Engineer 24 hours in advance of each visit by coating manufacturer's representative.
 - 2. Provide Engineer with a written report by coating manufacturer's representative within 48 hours following each visit.

3.12 SCHEDULE OF ITEMS NOT REQUIRING COATING

- A. General: Unless specified otherwise, the following items do not require coating:
 - 1. Items that have received final coat at factory and are not listed to receive coating in field.
 - 2. Aluminum, brass, bronze, copper, plastic (except PVC pipe), rubber, stainless steel, chrome, Everdur, or lead.
 - 3. Buried or encased piping or conduit.
 - 4. Exterior concrete.
 - 5. Galvanized steel wall framing, galvanized electrical conduits, galvanized pipe trays, galvanized cable trays, and other galvanized items:
 - a. Areas on galvanized items or parts where galvanizing has been damaged during handling or construction shall be repaired as follows:
 - 1) Clean damaged areas by SSPC SP 1, SP 2, SP 3, or SP 7 as required.
 - 2) Apply 2 coats of a galvanizing zinc compound in strict accordance with manufacturer's instructions.
 - b. If coating of galvanized steel has been specified, prepare surface prior to coating by removing all oils and waxes from post-galvanizing treatment.
 - 6. Grease fittings.
 - 7. Steel to be encased in concrete or masonry.

3.13 SCHEDULE OF SURFACES TO BE COATED IN THE FIELD

- A. In general, apply coatings to steel, iron, galvanized surfaces, and wood surfaces unless specified or otherwise indicated on the Drawings. Coat concrete surfaces and anodized aluminum only when specified or indicated on the Drawings. Color coat all piping as specified in Section 15075.
- B. The following schedule is incomplete. Coat unlisted surfaces with same coating system as similar listed surfaces. Verify questionable surfaces.

- C. Concrete:
 - 1. High solids epoxy:
 - a. Safety markings.
 - b. Valves.
 - 2. Concrete floor coating

- D. Metals:
 - 1. Alkali-resistant bitumastic:
 - a. Aluminum surfaces to be placed in contact with wood, concrete, or masonry.
 - 2. High solids epoxy and polyurethane system: exterior non immersed ferrous metal surfaces including:
 - a. Pipe, valves, pipe hangers, supports and saddles, conduit, cable tray hangers, and supports.
 - b. Motors and motor accessory equipment.
 - c. Drive gear, drive housing, coupling housings, and miscellaneous gear drive equipment.
 - d. Valve and gate operators and stands.
 - e. Structural steel including galvanized structural steel.
 - f. Mechanical equipment supports, drive units, and accessories.
 - g. Other miscellaneous metals.
 - 3. High solids epoxy system:
 - a. Field priming of ferrous metal surfaces with defective shop-prime coat where no other prime coat is specified; for non-submerged service.
 - b. Bell rings, underside of manhole covers and frames.
 - c. Sump pumps and grit pumps, including underside of base plates and submerged suction and discharge piping.
 - d. Exterior of submerged piping and valves other than stainless steel or PVC piping.
 - e. Submerged pipe supports and hangers.
 - f. Stem guides.
 - g. Other submerged iron and steel metal unless specified otherwise.
 - h. Interior surface of suction inlet and volute of submersible influent pumps. Apply coating prior to pump testing.
 - i. Submerged piping.
 - j. Exterior of influent pumps and influent pump submerged discharge piping.
 - 4. Asphalt varnish:
 - a. Underground valve boxes.
 - 5. Protective coal tar:
 - a. Underground pipe flanges, excluding pipe, corrugated metal pipe couplings, flexible pipe couplings and miscellaneous underground metals not otherwise specified to receive another protective coating.

END OF SECTION

SECTION 09974

COATING FOR WELDED STEEL WATER STORAGE TANKS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Surface preparation and application of protective coatings to welded steel water storage tanks, including accessories, exposed piping, valves, and miscellaneous appurtenances:
 - 1. Provide full coating of all roof structure elements, including top flange of roof structure, prior to erection of tank.
 - 2. Provide caulking of bottom chime of tank at exterior prior to application of exterior coating.
- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents:
 - a. Section 01330 - Submittal Procedures.
 - b. Section 01770 - Closeout Procedures.
- C. Contractor shall furnish all material, equipment, labor, and services required for all surface preparation and application of protective coatings to project water storage tank, including accessories, exposed piping, valves, and miscellaneous appurtenances.
- D. Preparation and application of coatings specified in this Section shall be in strict accordance with coating manufacturer's instructions as supplemented by these specifications:
 - 1. Contractor shall have a minimum of 5 years practical experience and successful history in application of protective coatings to steel storage tanks used for storage of potable water.
 - 2. Contractor shall substantiate this requirement by furnishing a list of references.
- E. All materials and applications for coating interior surfaces of water storage tank shall be certified in accordance with NSF International (NSF) Standard 61.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. D 4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.

- B. Environment Protection Agency (EPA):
 - 1. 524.2 - Measurement of Purgeable Organic Compounds in Water by Capillary Column Gas Chromatography/Mass Spectrometry.
- C. NACE International:
 - 1. SP0188 - Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
- D. National Fire Protection Association (NFPA):
 - 1. 70 - National Electric Code (NEC).
- E. NSF International (NSF):
 - 1. 61 - Drinking Water System Components - Health Effects.
- F. Occupational Safety and Health Administration (OSHA).
- G. Society for Protective Coatings (SSPC):
 - 1. PA 1 - Shop, Field, and Maintenance Painting of Steel.
 - 2. PA Guide 10 - Safety and Health Requirements.
 - 3. PS 17.00 – Guide for Selecting Urethane Painting Systems.
 - 4. SP-10 - Near-White Blast Cleaning.
 - 5. VIS 1 - Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning.
- H. Underwriters' Laboratory, Inc. (UL).

1.03 SUBMITTALS

- A. General: Submit as specified in Section 01330.
- B. Shop drawings:
 - 1. Schedule of proposed coating materials.
 - 2. Schedule of surfaces to be coated with each coating material.
- C. Product Data: Include description of physical properties of coatings including solids content and ingredient analysis, VOC content, temperature resistance, typical exposures and limitations, and manufacturer's standard color chips:
 - 1. Regulatory requirements: Submit data concerning the following:
 - a. Volatile organic compound limitations.
 - b. Coatings containing lead compounds and PCBs.
 - c. Abrasives and abrasive blast cleaning techniques, and disposal.
 - d. NSF certification of coatings for use in potable water supply systems.
- D. Samples: Include 8-inch square drawdowns or brush-outs of topcoat finish when requested. Identify each sample as to finish, formula, color name and number and sheen name and gloss units.
- E. Manufacturer's Instructions: Include the following:
 - 1. Special requirements for transportation and storage.
 - 2. Mixing instructions.
 - 3. Shelf life.
 - 4. Pot life of material.

5. Precautions for applications free of defects.
6. Surface preparation.
7. Method of application.
8. Recommended number of coats.
9. Recommended dry film thickness (DFT) of each coat.
10. Recommended total dry film thickness (DFT).
11. Drying time of each coat, including prime coat.
12. Required prime coat.
13. Compatible and non-compatible prime coats.
14. Recommended thinners, when recommended.
15. Limits of ambient conditions during and after application.
16. Time allowed between coats (minimum and maximum).
17. Required protection from sun, wind, and other conditions.
18. Touch-up requirements and limitations.
Minimum adhesion of each system submitted in accordance with ASTM D 4541.

F. Manufacturer's Representative's Field Reports.

G. Operations and Maintenance Data: Submit as specified in Section 01770:

1. Reports on visits to project site to view and approve surface preparation of structures to be coated.
2. Reports on visits to project site to observe and approve coating application procedures.
3. Reports on visits to coating plants to observe and approve surface preparation and coating application on items that are "shop coated."

H. Quality Assurance Submittals:

1. Quality Assurance plan.
2. Qualifications of coating applicator including List of Similar Projects.

I. Certifications:

1. Submit notarized certificate that:
 - a. All paints and coatings to be used on this project comply with current federal, state, and local VOC regulations.
 - b. All paints and coatings in contact with potable water have NSF or UL certification.
 - c. All paints and coatings to be used on this project comply with the current VOC regulations of the State of California Air Management District in which the coatings will be used.
 - d. Coating is properly cured and ready for service.

1.04 QUALITY ASSURANCE

A. Quality assurance procedures and practices shall be utilized to monitor all phases of surface preparation, application of coatings, and inspection throughout duration of project:

1. Procedures or practices not specifically defined in this Section may be utilized, provided they meet recognized and acceptable professional standards and are accepted by Engineer:
 - a. Services of coating manufacturer's representative:

- 1) Arrange for coating manufacturer's representative to attend preconstruction conferences and make periodic visits at the construction site to provide consultation and inspection services during surface preparation work and application of coatings.
- B. All materials furnished shall be subject to inspection by Engineer:
1. Data for all coating materials, solvents, and thinners to be used on project shall be submitted.
 2. Hold strictly to true intent of specifications in regard to quality of materials, workmanship, and diligent execution of Contract:
 - a. Compatibility of coatings: Use products by the same manufacturer for all coats on same surface, unless specified otherwise.
- C. Water tank interior surface preparation shall be based upon compliance with SSPC-VIS 1, and as described below:
1. Anchor profile for prepared surfaces shall be measured by using a nondestructive instrument such as a Keane-Tater Surface Profile Comparator or Testex Press-O-Film System.
 2. Provide said items for measuring anchor profile.
- D. Apply coatings in strict accordance with manufacturer's material data sheets with particular attention to curing and drying times and temperatures:
1. Apply no coating when surrounding air temperature of surface to be coated is below minimum temperature allowed by manufacturer's recommendations for coating application or when it is expected that air temperature will drop below minimum 8 hours after coating application.
 2. Apply no coating when surrounding air temperature is forecasted to be less than 5 degrees Fahrenheit above dew point within 8 hours after coating application.
 3. Apply no coating to steel which is 5 degrees Fahrenheit below air temperature or which is at a temperature over 125 degrees Fahrenheit, nor shall coating be applied to steel which is at a temperature that will cause blistering or porosity or otherwise will be detrimental to the life of the coating.
 4. No coating shall be applied to wet or damp surfaces or in rain, snow, fog, or mist.
 5. Coating shall not be applied on frosted or ice-coated surfaces.
 6. Dew point shall be measured by use of an instrument such as a Sling Psychrometer in conjunction with U.S. Department of Commerce Weather Bureau Psychrometric Tables or equivalent:
 - a. Exterior tank surfaces:
 - 1) If above conditions are prevalent, coating application shall be delayed or postponed until conditions are favorable.
 - 2) Complete day's coating application time to permit coating sufficient drying time prior to damage by atmospheric conditions.
 - b. Interior tank surfaces: If above conditions are prevalent, Contractor shall provide fans, heaters, and dehumidification equipment as necessary to provide suitable conditions for application and curing of coating products in strict accordance with coating manufacturer's instructions.

- E. Thickness of coatings shall be checked with a nondestructive, magnetic-type thickness gauge:
 - 1. Use an instrument such as a Tooke Gauge if a destructive tester is deemed necessary.
 - 2. Test coating integrity of all interior wetted surfaces with an approved inspection device.
 - 3. Holiday detectors shall not exceed voltage recommended by manufacturer of coating system.
 - 4. For thickness between 10 and 20 mils, add a non-sudsing type wetting agent to water prior to wetting detector sponge.
 - 5. No pinholes or other irregularities will be permitted in final coating:
 - a. Holiday detection testing: Shall be accomplished over 100 percent of interior and exterior coated surfaces, and in strict accordance with NACE SP0188.

- F. Inspection of applied coating will be accomplished as a joint effort involving Contractor and Engineer.

- G. Provide following testing devices to be jointly used on this project by Contractor and Engineer. Devices shall remain property of Contractor during and after project:
 - 1. Surface profile Comparator or Testex Tape to measure surface profile prior to coating application.
 - 2. Psychrometer and psychrometric tables or charts for humidity/dew point determination.
 - 3. Dry film thickness gauge and calibration blocks for coating thickness testing.
 - 4. Wet film thickness gauge for coating thickness testing.
 - 5. 10 times magnifier for examination.
 - 6. Holiday detector and associated equipment for coating defect determination.
 - 7. Combustible gas analyzer (sniffer) for safety.

- H. Engineer will witness all testing as performed by Contractor.

- I. Preparation of all surfaces and application of coatings specified in this Section shall be in strict accordance with coating manufacturer's instructions as supplemented by these specifications:
 - 1. Contractor shall have a minimum of 5 years practical experience and successful history in application of protective coatings to steel water tanks used for storage of potable water.
 - 2. Upon request, Contractor shall substantiate this requirement by furnishing a list of references:
 - a. Contractor shall substantiate this requirement by furnishing a list of references.

- J. Unless otherwise specified, all materials and applications for coating interior surfaces of water tank shall be certified in accordance with NSF 61.

1.05 WARRANTY INSPECTION

- A. A warranty inspection shall be conducted during the eleventh month following completion of all coating work:
 - 1. Contractor shall be present at inspection.
 - 2. All defective work shall be repaired in strict accordance with coating manufacturer's instructions, this specification, and to satisfaction of Engineer.

- B. Notification:
1. Owner shall establish date for inspection at least 30 days in advance.
 2. If an inspection date has not been established within 12 months after coating work was completed, first anniversary inspection shall be considered to be waived and Contractor's work completed.
- C. Owner shall drain water tank and Contractor shall provide, at his own expense, suitable and necessary scaffolding and ladders, suitable lighting, and ventilation for inspection:
1. Inspection-interior:
 - a. Entire interior coating system shall be visually inspected as specified in Quality Assurance.
 - b. All defective coating, as well as damaged and rusting spots in water tank shall be satisfactorily repaired by and at sole expense of Contractor.
 2. Inspection-exterior:
 - a. Entire exterior coating system shall be inspected as specified in Quality Assurance.
 - b. All defective, damaged, or rusting areas shall be satisfactorily repaired by and at sole expense of Contractor.
 3. Coating manufacturer's representative: Contractor shall have coating manufacturer's representative present during inspection of work to assist with assessment of condition of interior and exterior coating and make recommendations for methods of repair of coating systems as may be required.
- D. Inspection Report: Prepare and submit an inspection report covering first anniversary inspection, setting forth number and type of failures observed, percentage of surface area where failures have occurred, and names of persons making inspection.
- E. Schedule:
1. Upon completion of inspection and receipt of an Inspection Report as noted in this Section, Owner shall establish a date for Contractor to proceed with remedial work.
 2. Any delay on part of Contractor to meet schedule established by Owner shall constitute breach of this Contract and Owner may proceed to have defects remedied, with costs involved paid by the Contractor.
- F. Remedial work:
1. Any location where coating has peeled, bubbled, or cracked, and any location where rusting is evident shall be considered to be a failure of coating system. Contractor shall make repairs at all points where failures are observed by removing deteriorated coating, cleaning surface, and recoating with same coating system.
 2. If area of failure exceeds 25 percent of total coated surface, entire coating system may be required to be removed and recoated in accordance with original Specification.
- G. Costs:
1. All costs for Contractor's testing and all costs for repair shall be borne by Contractor.

2. In preparing his bid, Contractor shall include an appropriate amount for testing and repair.
3. No additional allowance will be paid by Owner for said testing and repair.

1.06 SAFETY AND HEALTH REQUIREMENTS

- A. Conform with all safety requirements set forth by regulatory agencies applicable to construction industry and coating manufacturer's printed instructions and appropriate technical bulletins and manuals:
 1. Provide and require use of personal protective life-saving equipment for persons working in or about project site.
- B. Observe proper safety precautions to protect against potential toxicity and flammability of coatings:
 1. Safe handling and application practices are required and should include, but not be limited to, provisions of:
 - a. SSPC-PA Guide 10.
 - b. SSPC-PS17.00.
 - c. Coating Manufacturer's Material Safety Data Sheets.
- C. Ladders, scaffolding, and rigging shall be designed for intended uses:
 1. Erect ladders and scaffolding where requested by Engineer to facilitate inspection and be moved by Contractor to locations requested by Engineer.
- D. Where ventilation is used to control hazardous exposure, all equipment shall be explosion proof:
 1. Ventilation shall reduce concentrations of air contaminants to ensure that a hazard does not exist.
 2. Continue air circulation and exhausting of solvent vapors until coatings have fully cured.
 3. Forced air ventilation during surface preparation and coating application operations is mandatory.
 4. Operate ventilation during entire period of application and continue after spraying has been halted until there is no coating vapor present.
 5. Air in enclosed coating space shall be safe at all times from fire and explosion hazards:
 - a. When required, utilize dehumidification equipment to provide proper temperature and humidity conditions inside the water tank, as recommended by coating manufacturer, to ensure proper application and curing of coatings.
- E. During coating application, capacity of ventilating fans shall be at least 300 cubic feet per minute per gallon of coating applied per hour.
- F. Continuous forced ventilation at a rate of at least 1 complete air change every 4 hours shall be provided for at least 48 hours after coating application is completed or until coating is completely cured, in accordance with coating manufacturer's recommendations.

- G. Air shall be exhausted from lowest portions of water tank with top openings kept open and clear:
 - 1. During blasting operations, nozzle-men shall wear air-supplied helmets and all other persons who are exposed to blasting dust shall wear filter-type respirators and safety goggles.
- H. When coatings are applied inside water tank, all persons exposed to toxic vapors shall wear air-supplied masks.
- I. Provide 2 sets of filter-type respirators and safety goggles, and an air-supplied mask to be used by Owner's personnel and Engineer when required for inspection purposes:
 - 1. All devices shall be kept in good working condition.
- J. Ground hoses to prevent accumulation of charges of static electricity:
 - 1. All nozzles shall be equipped with dead man triggers.
 - 2. Dead man triggers shall be in good working condition and shall not be tied down or otherwise modified by any means that prohibits functioning of automatic feature of nozzle.
- K. Provide spark-proof artificial lighting for all work in confined spaces:
 - 1. Light bulbs shall be guarded to prevent breakage.
- L. Lighting fixtures and flexible cords used in any coating operation shall comply with requirements of NEC for atmosphere in which they will be used:
 - 1. Whenever required by Engineer, provide additional illumination and necessary supports to cover all areas to be inspected.
 - 2. Level of illumination for inspection purposes shall be determined by Engineer.
- M. Maximum allowable concentration of vapor shall be kept below maximum safe concentration for 8-hour exposure.
- N. When handling and mixing coatings, workmen shall wear protective clothing required by OSHA and/or recommended by coating manufacturer.
- O. During mixing and application of coatings, all flames, welding, and smoking shall be prohibited in vicinity:
 - 1. Appropriate type fire extinguishers shall be kept nearby.
- P. Whenever occupational noise exposure exceeds the maximum allowable sound level, provide and require use of approved ear protective devices for all persons exposed to the noise, including Owner personnel.
- Q. Maintain a solvent drum on-site to store all used solvents:
 - 1. Do not dump solvents and/or thinners on ground.
 - 2. Remove solvent drum from job site by and at sole expense of Contractor.
- R. Enclosure of the exterior of the storage tank shall be required during coating operation to contain abrasive blast material and paint overspray:
 - 1. Enclosure shall be in accordance with SSPC requirements for safety and ventilation in accordance with SSPC PA Guide 10.

PART 2 PRODUCTS

2.01 GENERAL

- A. All materials shall be brought to job site in original sealed containers with manufacturer's name, brand, color, and identification number clearly legible:
 - 1. Containers shall not be opened or used until Engineer has physically inspected contents and obtained necessary data from information printed on containers or labels.
 - 2. Materials exceeding storage life recommended by manufacturer shall be rejected.
- B. Manufacturer shall identify flammability, toxicity, and allergenic properties:
 - 1. Any other characteristics requiring field precautions and specific safety practices shall be stipulated.
- C. All coatings shall be stored in enclosed structures for protection from weather and excessive heat or cold:
 - 1. Flammable coatings must be stored to conform with city, county, state, and federal safety codes for flammable coating and paint materials.
- D. All coating products shall be from same manufacturer.
- E. Submit coating samples prior to ordering any coating products:
 - 1. All interior and exterior coating products shall bear same batch numbers.
 - 2. Do not mix batch numbers.

2.02 INTERIOR COATING MATERIALS

- A. Epoxy coating materials used for interior of water tank shall be in accordance with the NSF 61 and shall be certified by NSF for use in potable water:
 - 1. Coatings shall have a minimum solids-by-volume content of not less than 80 percent, and conform to requirements of local and state air pollution regulatory agencies.
- B. Interior coating system shall be one of the following or accepted equal:

Manufacturer	Shop Prime Coat	Strip Coat	Intermediate Coat	Finish Coat	Total DFT
Tnemec	Hydro-Zinc Series 91-H2O or 94-H2O (2.5 to 3.5 mils DFT)	Hydro-Zinc Series 91-H2O or 94-H2O (2.5-3.5 mils DFT) Brushed-applied to all welds and sharp edges.	Pota-Pox Plus Series V140F-1211 Red Oxide or Pota-Pox Plus Series L140LF-1255 Beige. (4.0 to 6.0 mils DFT)	Pota-Pox Plus Series V140F-15BL Tank White. (4.0 to 6.0 mils DFT)	10.5 to 15.5 mils

2.03 EXTERIOR COATING MATERIALS

- A. Coating materials for exterior of water tanks shall consist of a 2-coat system utilizing a 2 component high solids epoxy coating with a minimum solids content of 80 percent by volume, and a 2 component aliphatic acrylic polyurethane finish coating with a minimum solids content of 60 percent by volume:
 - 1. Finish coating used shall provide superior color and gloss retention, resistance to splash from acid, alkaline chemicals, chemical fumes, and severe weathering.
 - 2. Coatings used shall conform to requirements of local and state air pollution regulatory agencies.
 - 3. Coating system used shall be one of following listed systems.
 - 4. Finish coat color shall be per Owner’s choice and must be accepted by Engineer prior to ordering of coating.

B. Exterior coating system shall be one of the following listed systems:

Manufacturer	Shop Prime Coat	Strip Coat	Intermediate Coat	Finish Coat	Total DFT
Tnemec	Hydro-Zinc Series 91-H2O or 94-H2O (2.5 to 3.5 mils DFT)	Hydro-Zinc Series 91-H2O or 94-H2O (2.5-3.5 mils DFT) Brushed-applied to all welds and sharp edges.	Pota-Pox Plus Series V140F-1211 Red Oxide or Pota-Pox Plus Series L140LF-1255 Beige. (4.0 to 6.0 mils DFT)	Endura-Shield Series 740-Color (3.0 to 5.0 mils DFT) applied in one or two coats.	9.5 to 14.5 mils

PART 3 EXECUTION

3.01 GENERAL

- A. All surface preparation and coating application shall conform to applicable SSPC standards and coating manufacturer's printed instructions:
 - 1. Material applied prior to acceptance of surface by the Engineer shall be removed and reapplied to satisfaction of Engineer at expense of Contractor:
 - a. Coating manufacturer’s representative shall be present at the project site at beginning of surface preparation operations and at beginning of coating application operations, to approve Contractor procedures and provide direction as may be required.
- B. All work shall be performed by skilled craftsmen qualified to perform required work in a manner comparable with best standards of practice.
- C. Dust, dirt, oil, grease, or any foreign matter which will affect adhesion or durability of coatings must be removed by washing with clean cloths dipped in an approved cleaning solvent and wiped dry with clean cloths.
- D. Coating application equipment shall be designed for application of materials specified and shall be maintained in first-class working condition.

SECTION 10400
IDENTIFICATION DEVICES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Plastic and metal signs for building and site use.
- B. Related Sections:
 - 1. Section 15075 - Mechanical Identification.
 - 2. Section 16075 - Electrical Identification.

1.02 SUBMITTALS

- A. Product Data.
- B. Shop Drawings: Include lists of sign types, sizes, text, and colors; mounting details; locations; and cast metal plaque rubbings and templates.
- C. Samples: Include actual materials.
- D. Manufacturer's Installation Instructions.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of proposed products for minimum 5 years with satisfactory performance record of minimum 5 years.
- B. Regulatory Requirements: California Regulation Related to Drinking Water, Title 22, latest edition.

PART 2 PRODUCTS

2.01 EXTERIOR INFORMATION SIGNS

- A. Able to Withstand 100 mph Wind Load Without Damage:
 - 1. Manufacturers: One of the following or equal:
 - a. Best Mfg Sign Systems: Montrose, CO; equivalent product.
 - b. Andco Industries Corp.; Greensboro, NC; equivalent product.
 - c. Vomar Products, Inc.; Sepulveda, CA; equivalent product.
- B. Text: Helvetica Medium, size and wording as indicated in attached schedule.
- C. Fasteners: Round head galvanized on stainless steel, bolt, nuts, screws and washers.

PART 3 EXECUTION

3.01 PREPARATION

- A. Protect adjacent surfaces which may be damaged by installation of signs.

3.02 INSTALLATION

- A. Install signs in accordance with sign manufacturer's instructions.
- B. Fasten signs securely in level, plumb, and true to plane positions.
- C. Install signs where indicated on the Drawings or as indicated in the following schedules.

3.03 SCHEDULES

- A. Metal Safety Sign Schedule.

END OF SECTION

SCHEDULE A

METAL SAFETY SIGN SCHEDULE

A. NONPOTABLE WATER:

1. Location: At impure water and nonpotable water hose valves and fill stations in accordance with Typical Detail M276.
2. Height: In accordance with Typical Detail.
3. Size: 10 inches wide by 7 inches high.
4. Heading: RECYCLED WATER
5. Wording: DO NOT DRINK
6. Spanish: AVISO AGUA IMPURA NO TOMAR

END OF SCHEDULE A
METAL SAFETY SIGN SCHEDULE

SECTION 11312D

VERTICAL TURBINE SHORT SETTING CENTRIFUGAL PUMPS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Pump systems including vertical turbine pumps with radial, mixed flow, or axial (propeller) type impellers and drivers as scheduled.
- B. Related sections:
 - 1. Section 01140 - Work Restrictions.
 - 2. Section 01600 - Product Requirements.
 - 3. Section 01756 - Testing, Training, and Facility Start-Up.
 - 4. Section 01782 - Operation and Maintenance Data.
 - 5. Section 15050 - Common Work Results for Mechanical Equipment.
 - 6. Section 15958 - Mechanical Equipment Testing.
 - 7. Section 16222 - Low Voltage Motors up to 500 Horsepower.

1.02 REFERENCES

- A. American Bearing Manufacturers Association (ABMA):
 - 1. 9 - Load Ratings and Fatigue Life for Ball Bearings.
 - 2. 11 - Load Ratings and Fatigue Life for Roller Bearings.
- B. American Society of Mechanical Engineers (ASME):
 - 1. B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, and 250.
 - 2. B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through 24.
- C. American Water Works Association (AWWA):
 - 1. C205 - Standard for Cement-Mortar Protective Lining and Coating for Steel Water Pipe, 4 In. (100 mm) and Larger-Shop Applied.
- D. ASTM International (ASTM):
 - 1. A48 - Standard Specification for Gray Iron Castings.
 - 2. A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 3. A108 - Standard Specification for Steel Bars, Carbon and Alloy, Cold-Finished.
 - 4. A276 - Standard Specification for Stainless Steel Bars and Shapes.
 - 5. A278 - Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650°F (350°C).
 - 6. A283 - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
 - 7. A516 - Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate-and Lower-Temperature Service.
 - 8. A582 - Standard Specification for Free-Machining Stainless Steel Bars.
 - 9. A743 - Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.

10. B30 – Standard Specification for Copper Alloys in Ingot Form.
11. B505 - Standard Specification for Copper Alloy Continuous Castings.
12. B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
13. F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
14. F594 - Standard Specification for Stainless Steel Nuts.

E. Hydraulic Institute (HI):

1. 2.1-2.2 - Vertical Pumps for Nomenclature and Definitions.
2. 2.3 - Vertical Pumps for Design and Application.
3. 2.4 - Vertical Pumps for Installation Operation and Maintenance.
4. 9.1-9.5 - Pumps - General Guidelines for Types, Definitions, Application, and Sound Measurement and Decontamination.
5. 14.6 – Rotodynamic Pumps For Hydraulic Performance Acceptance Tests.

F. International Standards Organization (ISO):

1. ISO 9001 Certified.

1.03 DEFINITIONS

- A. Pump head (total dynamic head, TDH), flow capacity, pump efficiency, net positive suction head available (NPSHa), and net positive suction head required (NPSHr): As defined in HI 2.1-2.2, 2.3, 9.1-9.5, and 14.6 and as modified in the Specifications. The pump head and efficiency are evaluated at the outlet of the discharge head and include the net losses in the pump column and discharge.
- B. Flow, head, efficiency, and motor horsepower specified in this Section are minimums unless stated otherwise.
- C. Suction head: Gauge pressure available at pump intake flange or bell in feet of fluid above atmospheric.
- D. Tolerances: This Section and related sections contain tolerances that may be more stringent than Hydraulic Institute Standard tolerances. Where tolerances are not mentioned, Hydraulic Institute Standards 2.1-2.2, 2.3, 2.4, and 9.1-9.5 shall apply.

1.04 SYSTEM DESCRIPTION

- A. Components: Pump, driver, motors, and drive arrangements as specified or as scheduled with shafts, columns, barrels, intermediate bearings, seals or packing, couplings, base plates, guards, supports, anchor bolts, necessary valves, gauges, taps, lifting eyes, stands, and other items as required for a complete and operational system.
- B. Design requirements:
 1. Pump performance characteristics:
 - a. As specified in the Pump Schedule.
 - b. Performance tolerances shall be the same as the test tolerances specified in Section 15958.
 - c. Pump curve shall be continuously rising throughout the design conditions listed in the pump schedule.
 2. Motor characteristics: As specified in the Pump Schedule.

1.05 SUBMITTALS

- A. Submit as specified in Section 15050.
- B. Torsional analysis: Submit as specified in Section 15050 when scheduled.
- C. Furnish motor submittals as specified in Section 16222:
 - 1. Manufacturer's Representatives qualifications as specified in Section 01756.
 - 2. Pump certification per Section 01600.
 - 3. Weighted average lead calculations Section 01600.
- D. Provide vendor operation and maintenance manual as specified in Section 01782.

1.06 QUALITY ASSURANCE

- A. General: As specified in Section 15050.
- B. Provide pumps specified in this Section from same manufacturer.
- C. Manufacture's Certificate of Installation and Functionality Compliance as specified in Section 01756.
- D. Pump manufacturer must be ISO 9001 certified.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. As specified in Section 15050.

1.08 PROJECT CONDITIONS

- A. Environmental requirements: As specified in Section 01610.

1.09 SEQUENCING AND SCHEDULING

- A. Coordinate work with restrictions as specified in Section 01140.
- B. Coordinate work with Commissioning and Start-up as specified in Section 01756.

1.10 WARRANTY

- A. CONTRACTOR shall provide written warranty against defects in materials or workmanship for a period of not less than 1 year upon completion of Work.

1.11 MAINTENANCE

- A. Special tools: Deliver 1 set for each furnished pump type and size needed to assemble and disassemble pump system.
- B. Spare parts: Deliver the following spare parts to Owner; pack and label for storage:
 - 1. Line shaft rubber bearings: 1 set for each type pump.
 - 2. Bowl assembly & stuffing box bronze bearings: 1 set for each type pump
 - 3. Impeller and bowl wear rings: 1 set for each type of pump.
 - 4. Mechanical seal: 1 complete seal of each type.

5. Motor/gear thrust bearing set: 1 for each type of pump.
6. Motor radial bearing set: 1 for each size of motor (if specified).
7. Line shaft: 1 length of each size and type.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. One of the following:
 1. Weir/Floway; similar to scheduled model.
 2. Or equal.

2.02 MATERIALS

- A. General:
 1. Pump Schedule materials: As specified in this Section.
 2. Drinking water pumps: Provide materials as specified in Section 15050.
- B. Cast iron: ASTM A 48, Class 30 minimum.
- C. Nickel cast iron: ASTM A 48, minimum Class 30, cast iron with 3 percent nickel.
- D. Gray iron casting: ASTM A 278, Class 30.
- E. Iron-chromium alloy: ASTM A 743, Grade CA40; ASTM A 276, Type 420 Stainless Steel may be substituted; Brinell Hardness Number of 350 to 380.
- F. Lead-free bronze with only bearings that required lead for lubricity: ASTM B 584.
- G. Leaded tin bronze: ASTM B 505, Alloy C92700.
- H. Bronze or high lead tin bronze: ASTM B 584, Alloy 93800.
- I. Leaded red brass: ASTM B 584, Alloy C83600, leaded red brass.
- J. Type 416 stainless: ASTM A 582, Type 416 Stainless Steel.
- K. Neoprene: Polychloroprene rubber.
- L. Steel: ASTM A 283, Grade D or ASTM A 516 Gr. 70.
- M. Steel pipe: ASTM A 53, Grade B.
- N. Aluminum bronze meeting the requirements of Section 15050.
- O. Lead-free aluminum bronze: ASTM B 30.

2.03 GENERAL PUMP CONSTRUCTION

- A. Type: Industrial, heavy duty, vertical turbine, centrifugal type pumps meeting performance requirements and features as scheduled and as specified.

- B. Discharge flange: ASME B16.1 or B16.5 drilled; rated for 1.2 times the pump shutoff head at 150 degrees Fahrenheit.
- C. Discharge nozzles: Provide 1/2-inch NPT taps for pressure gauges; install nipple and gauge with block valve.
- D. Bearings:
 - 1. Design driver/motor bearings to support the line shaft assembly and rated for ABMA L10 life of 60,000 hours at Design Rated Point flow and head in accordance with ABMA 9 or ABMA 11.
 - 2. Design motor to withstand continuous duty full load thrust and momentary upthrust that may occur during pump on/off or other operations.
- E. Fasteners: Provide Type 316 stainless steel fasteners in accordance with ASTM F 593 or ASTM F 594.

2.04 PUMP SUCTION ASSEMBLY

- A. Pump suction assembly: Provide suction bell. Provide anti-vortex baffles and strainer when scheduled.
- B. Design suction bells and provide strainers and anti-vortex baffles to minimize solids plugging and vortexing. Screens to have a flow area at least 4 times the suction pipe area.
- C. Materials:
 - 1. Pump suction bell: As scheduled.
 - 2. Anti-vortex baffles: Same material as scheduled for pump suction bell.
 - 3. Pump suction bell bearing: As scheduled.
 - 4. Pump suction strainer: When strainer scheduled, provide Type 316 stainless steel.

2.05 PUMP IMPELLER BOWL ASSEMBLIES

- A. Pump impeller assembly:
 - 1. Type: As scheduled.
 - 2. Maximum number of vanes: As scheduled.
 - 3. Number of stages: As scheduled.
 - 4. Required balance: As specified in Section 15050 to meet vibration criteria as specified in Section 15958.
 - 5. Method of securing impellers to shafts: Keyed and secured by a bronze nut locked in place or locked by other methods acceptable to the Engineer. Provide any special tools required for removal and installation of pump impellers.
 - 6. Provisions for adjustment of axial clearance: Make such adjustment through use of motor adjusting nut or adjustable coupling.
 - 7. Impeller thrust: When appropriate for the specified impeller type, provide hydraulically balanced impeller to minimize down thrust.
- B. Intermediate and discharge impeller cases:
 - 1. Material: As scheduled.
 - 2. Attached with bolting.

- C. Pump impeller bowl bearings: Provide bearing for each impeller; material as scheduled.
- D. Diffusion vanes: Provide vanes cast into bowl.
- E. Suction bowl bearings:
 - 1. Provide bronze sleeved bearings with self-contained lubrication system filled with graphite type non-soluble grease when grease lubrication scheduled; provide bearing with sand cap.
- F. Design with smooth water passages to reduce clogging by stringy or fibrous materials on impellers or shafting.
- G. Design replaceable wear rings for both the bowl and impeller on each impeller bowl.
- H. Design capable of passing solids with a sphere size as scheduled or larger.

2.06 LINE SHAFTS

- A. Open line shaft, product lubricated:
 - 1. Shaft and couplings:
 - a. Provide keyed shaft type mechanical couplings with key or set screw locking of shaft couplings.
 - b. Shaft threaded connections are not allowed.
 - 2. Bearings and bearing retainers: Provide bearings and retainers spaced as scheduled, but not to exceed 10 feet; provide at least 1 bearing for each line shaft length; provide grease fitting for top bearing extended to outside any guards when grease lubrication specified.
 - 3. Materials:
 - a. Shaft and couplings: As scheduled; where hard faced steel shaft is specified, hard face at sleeve bearings to 550 Brinell minimum.
 - b. Bearings and bearing retainers: As scheduled; when not scheduled, Neoprene rubber bearings with bronze retainers.
- B. Design strength: Able to withstand minimum 1.5 times maximum operating torque and other loads.
- C. Resonant frequency: As specified in Sections 15050 and 15958.
- D. Sleeves: Provide shafting with Type 316 stainless steel sleeve or hardened sleeves where shafts pass through bearings or stuffing boxes as scheduled; Brinell 550 or higher for hardened shaft; when the specified mechanical seals cannot be installed on a hardened shaft, hardened shafts are not required in the area of the mechanical seal.
- E. Design pump line shafting in interchangeable lengths as scheduled, but not to exceed 10 feet; shaft lengths to match scheduled pump column lengths.
- F. Coupling strength: Design driver to pump line shaft coupling of sufficient length and strength to maintain line shaft alignment.

- G. Adjustment:
 - 1. Design a means to adjust shaft position to adjust impeller position.
 - 2. For motor driven units with solid shaft motors, design driver to pump line shaft coupling to allow adjustment of the impeller position.
 - 3. For motor driven units with hollow shafts, an adjusting nut may be provided at the top of the motor shaft.
- H. Spacer coupling: When mechanical seals are scheduled, provide an adjustable spacer coupling to allow removal of the seal without driver removal.

2.07 PUMP COLUMN PIPE

- A. Pump column pipe: Thickness and material as scheduled.
- B. Head connection: Design with flanged and bolted connection to discharge head and flanged and bolted connection to impeller assembly to permit removal of impeller bowl assembly without disturbing the column or discharge connections.
- C. Design Working Pressure: Design to withstand a design working pressure not less than 1.20 times the maximum shutoff total dynamic head with the maximum diameter impeller at the maximum operating speed plus the maximum suction static head.
- D. Pressure test: Design to withstand a 5 minute hydrostatic test pressure not less than 1.5 times the design working pressure; perform test at source.
- E. Lengths and connections: Design with maximum 10 foot length, or less if scheduled, interchangeable column sections with flanged or threaded with registered fit screwed connections as scheduled.
- F. Diameter: Design column inside diameter for no more than 4 feet of fluid friction loss per 100 feet of column length.

2.08 PUMP BARREL/CAN

- A. Pump barrel/can: Pipe thickness and material as scheduled and shall be provided by manufacturer; inlet as indicated on the Drawings.
- B. Mounting flange: Sufficient strength and thickness to withstand 1.5 times the imposed loads under any operating condition.
- C. Can lining: When scheduled, provide cement mortar lining in accordance with AWWA C205.
- D. Can diameter: Provide can diameter so that free flow cross-sectional area in the can after lining or coating is at least 10 percent more than the can inlet nozzle flow area.

2.09 PUMP DISCHARGE HEAD ASSEMBLY

- A. Design the discharge head for above or base discharge as scheduled.
- B. Design the discharge vertical to horizontal flow transition as a smooth pipe elbow or from a minimum of 3 pipe pieces mitered to form the elbow.

- C. Design discharge head to mate with the driver as scheduled.
- D. Head and base plate construction: Sufficient strength, weight, and thickness to provide accurate alignment, prevent excessive deflection and support the drive motor.
- E. Stuffing box and seal:
 - 1. Design the discharge head with a stuffing box to accommodate mechanical seals.
 - 2. Mechanical seal: When scheduled, provide stuffing box suitable for the specified seal and provide solid shaft motor with spacer coupling.
 - 3. Additional seal or packing requirements: As specified in Section 15050.
 - 4. Drain: Provide drain, minimum 3/4 inch size, for pump stuffing box leakage, together with drain line to the pump can.
- F. Discharge vent: Provide 3/4 inch NPT threaded high point vent on discharge; install pipe nipple with threaded gate valves in vent.
- G. Materials: As scheduled; when not scheduled, provide:
 - 1. Pump discharge head/driver stand: Steel, ASTM A 283, Grade B and/or ASTM A 53, Grade B; or Cast iron, ASTM A 48, Class 30 minimum.
 - 2. Pump discharge head sleeve bearing: Bronze.
 - 3. Stuffing box and seal: Container and gland, Cast iron, ASTM A 48, Class 30 minimum; Neoprene top shaft seal.

2.10 EQUIPMENT GUARDS

- A. Provide equipment safety guards as specified in Section 15050.

2.11 DRIVERS

- A. Horsepower:
 - 1. As scheduled.
 - 2. Listed driver horsepower is the minimum to be supplied:
 - a. Increase driver horsepower if required to prevent driver overload while operating at any point of the supplied pump operating head-flow curve including runout.
 - b. When scheduled driver is a motor, increase motor horsepower if required to prevent operation in the service factor.
 - c. Make all structural, mechanical, and electrical changes required to accommodate increased horsepower.
- B. Motors: Provide motors as specified in Section 16222 and as specified in this Section:
 - 1. RPM: As scheduled.
 - 2. Enclosure: As scheduled.
 - 3. Electrical characteristics: As scheduled.
 - 4. Efficiency, service factor, insulation, and other motor characteristics: As specified in Section 16222.
 - 5. Motor accessories: As specified in Section 16222 and in this Section.
 - 6. Coordinate motors with the variable frequency drive manufacturer to ensure compatibility between the motor and variable frequency drive.

- C. Other drivers: As scheduled and as specified in sections listed in the Schedule.
- D. Non-reverse ratchets: When scheduled, provide driver with nonreverse ratchets or pin mechanism to prevent reverse rotation of the pump and driver in the event of discharge valve failure.

2.12 SUPPORTS

- A. Strength: Design pump discharge head and driver (motor or engine) supports to withstand a minimum of 1.5 times the maximum imposed operating loads or the imposed seismic loads, whichever is greater.
- B. Resonant frequency: Design supports in conjunction with the pump, shafting, drivers, bearings, and other components to avoid natural resonant frequencies, either torsional, radial, or axial as specified in Section 15958.
- C. Coordinate pump and drive system supports with the foundation designs as indicated on the Drawings.

2.13 FINISHES

- A. Prepare surfaces and apply protective coatings as recommended by manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Installation shall be as indicated on the Drawings, in accordance with written instructions of the manufacturer, and as specified in Section 15050.

3.02 COMMISSIONING

- A. As specified in Section 01756 and this Section.
- B. Manufacturer services:

			Manufacturer Rep Onsite					
Source Testing (Witnessed or Non-witnessed)	Training Requirements		Installation Testing		Functional Testing		Process Operational Period	
	Maintenance (hrs per session)	Operation (hrs per session)	Trips	Days (each trip)	Trips	Days (each trip)	Trips	Days (each trip)
Witnessed	4	2	1	1	1	1	24 hour on-call	

- C. Source Testing:
 - 1. Pump:
 - a. Test witnessing: As scheduled and as specified in Section 01756.
 - b. Performance test: Test level as scheduled; test as specified in Section 15958.

- c. Vibration test: Test level as scheduled; test as specified in Section 15958.
 - d. Noise test: Test level as scheduled; test as specified in Section 15958.
 - 2. Pump casing: Hydrostatic pressure tests if specified in this Section.
 - 3. Motor: Test as specified in Section 16222.
- D. Functional Testing:
- 1. Pump assembly:
 - a. Performance test: Test level as scheduled; test as specified in Section 15958.
 - b. Vibration test: Test level as scheduled; test as specified in Section 15958.
 - c. Noise test: Test level as scheduled; test as specified in Section 15958.
 - 2. Motor: Test as specified in Section 16222.

3.03 PUMP SCHEDULE

Tag Numbers	PMP-1900
Application	Recycled Water
Service	Reclaimed Water Pumps
Quantity	1
First Named Manufacturer's Model Number	12DOM
Maximum Noise, dBA at 3 feet	85
Torsional Analysis	Not Required
Minimum Pumped Fluid Degrees Fahrenheit	50
Normal Pumped Fluid Degrees Fahrenheit	70
Maximum Pumped Fluid Degrees Fahrenheit	85
Number of Stages	1
Impeller Type	Enclosed
Pass Minimum Sphere Size, Inch	0
Pump Impeller Bowl Bearing Lubrication	Product
Suction Bowl Bearing Lubrication	Product
Suction Strainer	Required
Anti-Vortex Baffle	Required
Line Shaft Type	Enclosed
Minimum Line Shaft Bearing Spacing, Feet	10
Line Shaft Lubrication	Product
Discharge Shaft Seal Type	Single Mechanical
Column Connection Type	Flanged
Maximum Column Section Lengths, Feet	10
Pump Barrel or Can	Required

Tag Numbers	PMP-1900
Discharge Arrangement	Above
Coupling Type	Space
Speed Control	Fixed
Maximum Pump rpm	1770
Minimum Pump rpm	1770
Flow, gpm	1,100
Head, Feet	37
Minimum Efficiency, Percent	74
Shut Off Head, Feet	66
Maximum NPSHr at every Specified Flow, Feet	12
Suction Bell	Cast Iron
Suction Bell Bearing	Bronze
Impeller Cases	Cast Iron
Impeller	Bronze
Impeller Bearing	Bronze
Impeller Shaft Key	Stainless Steel
Line Shaft and Coupling	416 SS
Line Shaft Bearings	SBR
Shaft Enclosing Tube	N/A
Shaft Sleeve	Hardened Chrome
Column Material and Thickness, Inch or Schedule	Steel Pipe (A53 Gr B), Sch 40/.322
Can Material and Thickness, Inch or Schedule	Steel Pipe (A53), A240 plate
Can Lining	Epoxy
Can Coating	Epoxy
Discharge Head/Driver Stand	Steel
Discharge Head Bearing	Bronze
Discharge Stuffing Box	Cast Iron
Driver Type	Electric Motor
Drive Arrangement	Vertical, Coupled
Non-Reverse Ratchets	None Required
Minimum Driver Horsepower	15
Maximum Driver rpm	1800
Inverter Duty Rated	No

Tag Numbers	PMP-1900
Motor Voltage/Phases/Hertz	460/3/60
Enclosure Type	TEFC
Test Witnessing	Witnessed
Performance Test Level	1
Vibration Test Level	1
Noise Test Level	1

END OF SECTION

SECTION 13206Q
WELDED STEEL TANKS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Welded, ground-supported, flat-bottom, mechanically anchored steel tank with concrete ring-wall type foundation and concrete column footings.
- B. Related sections:
 - 1. Section 01455 - Special Tests and Inspections
 - 2. Section 01612 - Seismic Design Criteria.
 - 3. Section 03300 - Cast-in-Place Concrete.
 - 4. Section 05190 -Mechanical Anchoring and Fastening to Concrete and Masonry
 - 5. Section 09974 - Coating for Welded Steel Water Tanks.
 - 6. Section 16640 - Cathodic Protection - Water Reservoir Interior.

1.02 REFERENCES

- A. American Institute of Steel Construction (AISC):
 - 1. 360 - Specification for Structural Steel Buildings.
- B. American Water Works Association (AWWA):
 - 1. D100 - 11 Standard for Welded Carbon Steel Tanks for Water Storage.
- C. ASTM International (ASTM):
 - 1. A36 -Standard Specification for Carbon Structural Steel.
 - 2. A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - 3. A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - 4. D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - 5. D4318 - Standard Test Methods for Liquid Limit Plastic Limit, and Plasticity Index of Soils.
- D. California Code of Regulations (CCR):
 - 1. Title 22 - Social Security.
- E. NACE International (NACE):
 - 1. SP0178 - Design, Fabrication, and Surface Finish Practices for Tanks and Vessels to be Lined for Immersion Service.
- F. NSF International (NSF):
 - 1. 61 - Drinking Water System Components - Health Effects.

1.03 DEFINITIONS

- A. Bottom capacity level (BCL): Water level (elevation) above which the specified capacity is provided. BCL is water level (elevation) when tank is emptied through discharge fittings.
- B. Maximum operation level (MOL): MOL is equal to TCL.
- C. Tank capacity: Net volume, in gallons, that may be removed from a tank filled to top capacity level and emptied to bottom capacity level.
- D. Top capacity level (TCL): Water level (elevation) equal to lip of overflow.

1.04 SYSTEM DESCRIPTION

- A. Design requirements:
 - 1. General:
 - a. Tank design and workmanship: In accordance with AWWA D100 and NACE SP0178, except as modified in this Section.
 - b. In accordance with CCR, Title 22, Division 4, Chapter 16, Article 6, §64585 Design and Construction.
 - c. In accordance with applicable portions of AISC 360.
 - d. Inlet pipe flow rate: 5,300 gallons per minute.
 - e. Design vent for sufficient airflow to allow tank to drain at a flow rate of 8,800 gallons per minute with a pressure loss across the vent of less than 1.5 inches of water.
 - f. Tank shall be in accordance with NSF 61.
 - g. Tank shall be designed by a civil or structural engineer registered in the state of California.
 - h. The primary use of the tank will be to store recycled water; however, the tank may be used in the future as a potable water storage tank. Therefore, the tank will be designed to accommodate the following seismic design criteria:
 - 1) Recycled water storage tank:
 - a) Seismic Use Group: II.
 - b) Seismic importance factor: 1.25.
 - c) Top capacity level: Elevation 515.60.
 - 2) Potable water storage tank:
 - a) Seismic Use Group: III.
 - b) Seismic importance factor: 1.50.
 - c) Top capacity level: Elevation 512.50.
 - 2. Tank dimensions and capacity:
 - a. Inside diameter: 104'-6" feet.
 - b. Net capacity:
 - 1) Recycled water storage tank: 2.00 million gallons (MG).
 - 2) Potable water storage tank: 1.80 MG.
 - c. Bottom capacity level: Elevation indicated on the Drawings.
 - d. Maximum operating level: Base structural and seismic design of tank on maximum operating level being equal to top capacity level.
 - e. Top capacity level: See Paragraph 13206Q-1.04-A.1.h.

3. Design loads:
 - a. Nozzle connections:
 - 1) Capable of resisting following loads:
 - a) Dead loads.
 - b) Hydraulic thrust loads.
 - c) Wind loads.
 - d) Seismic loads.
 - e) Moments and forces due to movement of flexible piping connections to tank shell.
 - 2) Reinforce shell in accordance with AWWA D100.
 - b. Pressure:
 - 1) Design tank for pressure loss for air flowing in and out of the vent.
 - c. Roof live load:
 - 1) 20 pounds per square foot.
 - d. Seismic:
 - 1) Design in accordance with AWWA D100 using pseudo dynamic approach in Section 13. Design for vertical seismic acceleration.
 - 2) Vertical accelerations: 67 percent of horizontal acceleration.
 - 3) Seismic importance factor: See Paragraph 13206Q-1.04-A.1.h.
 - 4) Simultaneously combined vertical and horizontal accelerations.
 - 5) Combine wall shell hoop stresses using the square root of the sum of the squares.
 - 6) Column seismic lateral load: 100 pounds per square foot.
 - 7) Seismic Use Group: See Paragraph 13206Q-1.04-A.1.h.
 - 8) Spectral response coefficients S_{DS} , S_{D1} , and soil profile type as specified in Section 01612.
 - e. Wind:
 - 1) Basic wind speed: 115 miles per hour.
 - 2) Velocity pressure exposure coefficient: C.
4. Assembly bolts:
 - a. Bolted connection shall be avoided wherever a suitable welded connection can be provided.
 - b. In accordance with ASTM A307, Grade B, or ASTM A325.
 - c. Hot-dip galvanize.
5. Column base plates:
 - a. Seal weld column base plates to the tank bottom plate with a 1/4-inch minimum fillet weld.
6. Copper bearing steel: Not required.
7. Corrosion allowance:
 - a. 1/8 inch.
 - b. In accordance with AWWA D100, Section 3.9.
 - c. In addition to minimum plate thickness specified or required.
 - d. Cannot be used in design calculations for strength and stiffness. Dead loads shall include weight of corrosion allowance.
 - e. Apply to tank shell plates, roof plates, floor plates, and all other structural members such as rafters and columns.
8. Floor plates:
 - a. Minimum thickness: 1/4 inch, plus specified corrosion allowance.
 - b. Minimum thickness of marginal sketch plates under shell bottom ring: 5/16 inch, plus specified corrosion allowance.

9. Anchor bolts and chairs:
 - a. Anchor bolts:
 - 1) As specified in Section 05190, except that material shall be Type 316 stainless steel.
 - 2) Maximum allowable anchor bolt stress: 15,000 pounds per square inch plus a 1/3 increase for load combinations that included wind and seismic loads.
 - 3) Minimum anchor bolt diameter: 1-1/4 inches.
 - 4) Maximum anchor bolt spacing: 8 feet.
 - b. Anchor bolt chairs: Design anchor bolt chairs for an ultimate strength of not less than 1.25 times the ultimate strength of the anchor bolts.
10. Openings in tank shell:
 - a. Locate openings in the tank shell where indicated on the Drawings.
 - b. Provide suitable reinforcement and welding around openings in the tank shell.
 - c. Submit design calculations for all reinforcements of openings.
11. Pipe connections:
 - a. Locate pipe connections where indicated on the Drawings.
 - b. Provide suitable reinforcement and welding around pipe connections to the tank shell.
 - c. Submit design calculation for all pipe connections.
12. Ring walls concrete footing:
 - a. As indicated on the Drawings.
 - b. Top of concrete ring wall footing shall meet the tolerance of AWWA D100, Section 12.6.2.
 - c. Mechanically-anchored tanks:
 - 1) Support tank above concrete ring wall footing on 1 inch minimum thickness of grout.
 - 2) Use grout mix with 1-1/2 parts sand to 1 part cement by weight. Sand and cement shall be as specified in Section 03300.
13. Roof:
 - a. Weathertight steel construction. Roof plates may be lapped and-welded at the exterior-side only in accordance with AWWA D100. Roof plates shall be lap-welded both sides or butt-welded.
 - b. Roof pitch: 3/4 inch in 12 inches.
 - c. No eave projections.
 - d. Minimum roof plate thickness: 1/4 inch, plus specified corrosion allowance.
 - e. Support roof plates with steel rafters.
 - f. Supported rafters at their outer ends by an angle or similar support welded to the inside face of the tank shell plates and at their inner ends by 1 or more columns.
 - g. Provide 2'-6" foot radius knuckle around edge of roof.
14. Roof columns:
 - a. Carry roof loads by a system of columns.
 - b. Type: tubular.
 - c. Hermetically seal weld.
 - d. Distribute column loads at the base of columns using a concrete foundation:
 - 1) Allowable bearing pressure for column dead load plus live load: 3,000 pounds per square foot (including weight of water).

- 2) Allowable bearing pressure for column dead load plus live load plus wind or seismic load: 4,000 pounds per square foot (including weight of water).
15. Roof system:
 - a. Provide roof support system utilizing 1 center column and intermediate ring of interior columns.
 - b. Maximum spacing of roof rafters supporting roof plates: 7 feet at tank periphery or at any other point.
 - c. Maximum deflection in the roof structure: 1/200 of the span under the combined condition of live and dead loads.
 - d. Seismic design of the roof framing and columns is required.
 - e. Make provisions for distribution of column loads at the column base plates and to prevent buckling of the base plates.
 - f. Select roof beams with adequate lateral stiffness to prevent buckling, or provide bridging:
 - 1) Do not consider friction between the roof beams and roof plates for determining roof beam stability.
 - 2) The specified primer coat of the roof beams shall be applied in the shop. As specified in Section 09974 for coating requirements.
 16. Shell plates:
 - a. Roll curved shell plates to the required radius regardless of thickness.
 17. Tank anchorage:
 - a. Mechanically anchored tank on a ringwall footing.
 18. Tank cushion under the tank bottom inside ring wall:
 - a. Minimum base for subgrade area inside the concrete ring wall: As indicated on the Drawings.
 - b. Minimum base for subgrade area inside the concrete ring wall: 12 inches of clean washed sand:
 - 1) Sand:
 - a) Compatible with cathodic protection manufacturer's recommendations.
 - b) Free of oil, salts, and other impurities.
 - c) Minimum resistivity: 4,000 ohm-centimeter.
 - d) Maximum resistivity: 30,000 ohm-centimeter.
 - e) Clean, coarse, natural sand.
 - f) Nonplastic when tested in accordance with ASTM D4318.
 - g) Particle size:
 - (1) 100 percent passing a 1/2-inch sieve.
 - (2) Not more than 20 percent passing Number 200 sieve.
 19. Tank overflow:
 - a. The maximum flow rate to the tank is 2,800/3,900 gallons per minute.
 - b. Design the tank overflow for 1.25 times the maximum flow rate.
 - c. Maximum water level at the full overflow rate: 6 inches above the weir. Water level, when overflowing at the full flow rate, shall not reach the bottom of the roof beams or roof beam connections.
 - d. Overflow type and details as indicated on the Drawings.
 20. Welding:
 - a. Butt joints: Complete penetration welds.

1.05 SUBMITTALS

A. Calculations:

1. Submit design calculations at same time that the detailed tank drawings are submitted.
 2. Design calculations shall be signed and sealed by a civil or structural engineer registered in the state of California.
- B. Certifications.
- C. Certified mill tests for steel plate and structural members.
- D. Product data.
- E. Radiographic weld inspection reports and film.
- F. Shop drawings.
- G. Welding details.
- H. Welding procedures.

1.06 QUALITY ASSURANCE

- A. Qualifications:
1. Tank fabricator:
 - a. Regularly engaged in the design, fabrication, and erection of welded steel tanks of the type specified in this Section for a period of not less than 10 years.
 - b. Provide a list of all tank projects completed in the last 5 years, including names, addresses, and telephone numbers of the reference for each project.
- B. Certifications:
1. Submit certificate that the tank and accessories have been properly designed, fabricated, erected, installed, inspected, and tested in accordance with AWWA D100, and is ready for full-time service.

1.07 PRE-INSTALLATION MEETING

- A. Fabrication conference:
1. Convene prior to fabrication of the tank.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Reject tank plates which show signs of corrosion or pitting.
- B. Handling plates: Do not drag or otherwise handle plates in any manner that might cause scratching or gouging of the metal.

1.09 PROJECT CONDITIONS

- A. Existing conditions:
1. Compressed air is not available at the construction site.
 2. Electricity is available at the construction site.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. One of the following or equal:
 - 1. Chicago Bridge and Iron (CBI).
 - 2. Crosno Constructors.
 - 3. Pacific Tanks.
 - 4. Paso Robles Tank.

2.02 ACCESSORIES

- A. Drain pipe:
 - 1. As shown on the Drawings.
- B. Ladders:
 - 1. Coat ladders and appurtenances with the same coating as specified for adjacent tank surfaces.
 - 2. Provide safety devices on interior and exterior ladders.
 - 3. Construct ladders and brackets using steel in accordance with ASTM A36.
 - 4. Exterior Ladder:
 - a. Provide an exterior steel ladder and roof hatch access platform with guardrail as indicated on the Drawings.
 - b. Fit ladder with a safety cage that has a lockable access.
 - 5. Interior Ladder: Provide an interior steel ladder as indicated on the Drawings.
- C. Ladder safety devices:
 - 1. Provide a safety system on both ladders complete with stainless steel safety rail, safety sleeve, and 2 safety harnesses.
 - 2. Install catholically isolated from tank ladder using rubber gaskets.
 - 3. Manufacturers: One of the following or equal:
 - a. North, SAF-T-CLIMB.
 - b. DBI, RAILOK.
- D. Liquid level indicator:
 - 1. Provide a sight gauge
 - 2. Install catholically isolated from tank ladder using rubber gaskets.
 - 3. Manufacturer: Varec.
- E. Locate accessories where indicated on the Drawings.
- F. Manway in shell:
 - 1. Two 36-inch diameter bolted manways located in the bottom shell ring.
 - 2. Locate center of manholes 3 feet 0 inches above bottom of tank.
 - 3. Provide suitable means to hold the manway cover in an open position by means of a davit or hinges.
 - 4. Use loose hinges, if used, to allow for easy bolting.
 - 5. Provide gaskets for a watertight seal.
- G. Name plate: Provide name plate which identifies the tank and includes information required in Section 14.2 of AWWA D100.
- H. Overflow nozzle: see Drawings.

- I. Roof hatch:
 - 1. Size: 2 feet 6 inches by 3 feet 0 inches.
 - 2. Locking roof hatch with compression spring operators and automatic positive action hold-open arm.
 - 3. Locate hatch where indicated on the Drawings.

- J. Roof vent:
 - 1. Provide 2 foot maximum height, umbrella-type, lightproof, screened vent at least 12 inches in diameter.
 - 2. Locate vents at the center of the tank.
 - 3. Cover vent with a Number 14 bronze screen.
 - 4. Provide special freeze resistant insert screen.
 - 5. Provide pressure-vacuum relief mechanism that will operate if the screen frosts over or becomes clogged.

- K. Sampling cabinet:
 - 1. Provide a stainless steel lockable panel with 3 sample taps placed inside.
 - 2. Mount the cabinet 3 feet 6 inches above finish grade.
 - 3. Sample taps:
 - a. Type: 3/4 inch ball valve:
 - 1) Heights: Sample tap 1: 5 feet above tank floor.
 - 2) Sample tap 2: 10 feet above tank floor.
 - 3) Sample tap 3: 20 feet above tank floor.
 - 4. Piping inside the tank:
 - a. 1-inch schedule 80 PVC.
 - b. Mounted to the inside of the tank.
 - 5. Piping outside the tank:
 - a. Stainless steel.
 - b. Cathodically isolated from the tank shell.
 - 6. Piping connections into the tank:
 - a. 3/4 inch welded coupling connections.

- L. Sample tap:
 - 1. 1/4-inch threaded connection.
 - 2. Location: 2 foot – 6 inches above tank floor.

PART 3 EXECUTION

3.01 CONSTRUCTION

- A. Assembly devices:
 - 1. Do not use fitting-up holes.
 - 2. Assembly devices may be welded to the adjoining parts during erection, but must be carefully removed after erection by chipping, or burning and chipping, in a manner which will not deface the metal surface of the tank plates.

- B. Cathodic protection:
 - 1. Provide cathodic protection as specified in Section 13110.

- C. Coating:
 - 1. Prepare surfaces and coat tank as specified in Section 09974.

- D. Grade preparation:
 - 1. Construct subgrade and tank floor to the grade and shape indicated on the Drawings.
- E. Provide bracing and support of the tank while under construction:
 - 1. Design and install bracing and supports for wind protection.
 - 2. For mechanically anchored tanks, Contractor shall remove shim plates from below chime plate prior to grouting.
- F. Tolerances:
 - 1. Tank wall plumbness: Less than 1 inch in 200 inches.
 - 2. Column plumbness: Less than 1 inch in 500 inches.
 - 3. Tank roundness: Within 1/2 inch of the tank radius indicated on the Drawings.
 - 4. Peaking: Less than 1/2 inch in 36 inches.
 - 5. Banding: Less than 1/2 inch in 36 inches.
 - 6. Local deviation:
 - a. Less than 1/2 inch in 36 inches.
 - b. Local deviations will be determined by use of a 36-inch straight edge and a 36-inch radius board.
 - c. Local deviations include dings and dents.
- G. Welding:
 - 1. Do not weld poor fitting, wet, oily, or dirty steel.
 - 2. Do not weld in high winds or during weather such that the operator cannot work in physical comfort.
 - 3. Thoroughly clean each layer of weld metal with a power-driven wire brush:
 - a. Peen welds to prevent excessive residual stresses in welds that are not free to move as the weld metal cools.
 - b. Peening may be used to loosen slag.

3.02 FIELD QUALITY CONTROL

- A. Certified welders:
 - 1. Welds shall be performed by a certified welder.
 - 2. Submit up-to-date certification papers.
- B. Damaged plates: Tank plates with pitting or deep gouges will be rejected.
- C. Leak tests:
 - 1. Test tank floor in accordance with AWWA D100 after welding and before coating.
 - 2. Repair leaks appearing in the shell or bottom of the tank when it is first filled after coating. Recoat the affected areas after repairing leaks.
 - 3. Owner will provide water for testing the tanks for the first test at no cost to the Contractor. Contractor is responsible for the cost for water for subsequent tests.
 - 4. Provide all equipment, piping, valves, pumps, and other facilities required to fill the tanks for any and all test work.
- D. Submit welding procedures.

E. Weld tests:

1. Inspect welds as specified in Section 01455. Inspect complete penetration butt welds using radiographic procedures.
2. Engineer may be present to witness the inspection of welds.
3. Engineer has the right at any time to call for and witness the radiographic inspection of welds.
4. Contractor responsible for cost of radiographic inspection.
5. Repair welds found to be defective, at no additional cost to the Owner.
6. Field inspect of welds in accordance with AWWA D100.

3.03 CLEANING

- A. Clean all interior surfaces of the tank and piping in accordance with the following:
1. Remove all debris and material not associated with the tank prior to cleaning.
 2. Clean all wall, floor, ceiling, and attached surfaces by use of high-pressure water jet, sweeping, scrubbing, or equally effective means.
 3. Remove all water, paint flakes, sediment, dirt, and foreign material accumulated during cleaning.
 4. Remove by flushing or other means, soil and debris from pipes.

END OF SECTION

SECTION 13446

VALVE AND GATE OPERATORS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Valve and Gate Operators.
 - 2. Handwheel Operators.
 - 3. Key Operated Valves.
 - 4. Bench Stands.
 - 5. Floor Stands.
 - 6. Accessory Equipment and Floor Boxes.

1.02 REFERENCES

- A. Aluminum Association (AA):
 - 1. DAF-45 - Designation System for Aluminum Finishes.

1.03 SUBMITTALS

- A. Shop Drawings: Include shop drawings for hydraulic gate lifts with shop drawings for gates as integrated units.

1.04 QUALITY ASSURANCE

- A. Provide valve operators integral with valve or gate, except for valve operators utilizing T-wrenches or keys, and portable operators intended to operate more than 1 valve.
- B. Provide similar operators by 1 manufacturer.
- C. Provide gates and hand operating lifts by 1 manufacturer.
- D. Provide hydraulic gate lifts by 1 manufacturer.
- E. Provide hydraulic valve operators and motorized operators by 1 manufacturer.

1.05 MAINTENANCE

- A. Extra Materials:
 - 1. Key Operated Valve Keys or Wrenches: Furnish a minimum 4 keys with 4 foot shafts and 3 foot pipe handles or wrenches with 4 foot shafts and 3 foot handles for operating key operated valves.

PART 2 PRODUCTS

2.01 VALVE AND GATE OPERATORS

- A. Stem Covers:
 - 1. Aluminum pipe; threaded cap on top; bolted aluminum flange on bottom; 1 by 12 inch slots cut at 18 inches on center in front and back of pipe; capable of covering threaded portion of greased stems that project above operators when gates or valves are opened or closed.
- B. Stem Cover Flanges, Pipes and Caps:
 - 1. Etched and anodized to produce chemical finishes in accordance with AA C 22, medium matte finish, and AA A 41 clear anodic coating, or described in AA publication 45, after fabrication.
- C. Gate Stem Covers: Concentric with stem.
- D. Position Indicators:
 - 1. Tail rods on hydraulic cylinders, or dial indicators with clear full-open and closed position indicators, calibrated in number of turns or percentage of opening.
- E. Manual or Power Operator Size:
 - 1. Sized to deliver maximum force required under most severe specified operating condition, including static and dynamic forces, seat and wedge friction, and seating and unseating forces with safety factor of 5, unless otherwise specified.
- F. Operator Size: Capable of supporting weight of suspended shafting unless carried by bottom thrust bearings; shaft guides with wall mounting brackets.
- G. Provisions for Alternate Operation: Where specified or indicated on the Drawings, position and equip crank or handwheel operated geared valve operators or lifts for alternate operation with tripod mounted portable gate operators.
- H. Operation: Counterclockwise to open with suitable and adequate stops, capable of resisting at least twice normal operating force to prevent overrun of valve or gate in open or closed position.
- I. Open Direction Indicator: Cast arrow and legend indicating direction to rotate operator on handwheel, chain wheel rim, crank, or other prominent place.
- J. Buried Operator Housing: Oil and watertight, specifically designed for buried service, factory packed with suitable grease, completely enclosed space between operator housing and valve body so that no moving parts are exposed to soil; provide operators with 2 inch square AWWA operating nut.
- K. Worm Gear Operators: Provide gearing on worm gear operators that is self-locking with gear ratio such that torque in excess of 160 foot-pounds will not need to be applied to operate valve at most adverse conditions for which valve is designed.

- L. Traveling Nut Operators: Capable of requiring maximum 100 foot-pounds of torque when operating valve under most adverse condition; limit stops on input shaft of manual operators for fully open and closed positions; non-moving vertical axis of operating nut when opening or closing valve.

2.02 HANDWHEEL OPERATORS

- A. Manufacturers: One of the following or equal:
 - 1. Rodney Hunt Company.
 - 2. Waterman Industries, Incorporated.
- B. Mounting: Floor stand or bench stand. Unless otherwise indicated on the Drawings position operator 36 inches (nominal) above top of walkway surface.
- C. Bearings above and below Finished Threaded Bronze Operating Nut: Ball or roller.
- D. Wheel Diameter: Minimum 24 inch.
- E. Indicator: Counterclockwise opening with arrow, and word OPEN cast on top of handwheel indicating direction for opening.
- F. Pull to Operate: Maximum 40 pounds pull at most adverse design condition.
- G. Stem Travel Limiting Device: Setscrew locked stop nuts above and below lift nut.
- H. Grease Fittings: Suitable for lubrication of bearings.

2.03 HAND-CRANKED GEARED OPERATORS

- A. Type: Single removable crank; fully enclosed.
- B. Mounting: Floor and Bench Stand. Unless otherwise indicated on the Drawings position operator 36 inches (nominal) above top of walkway surface.
- C. Operating Nut: When scheduled for portable operators.
- D. Geared Lifts: 2-speed with minimum ratio of 4 to 1.
- E. Teeth on Gears, Spur Pinions, Bevel Gears, and Bevel Pinions: Cut.
- F. Lift Nuts: Cast manganese bronze.
- G. Exterior Surfaces on Cast-Iron Lift Parts: Smooth.
- H. Bearings above and below Flange on Lift Nuts: Ball or roller; capable of taking thrust developed by opening and closing of gates under maximum operating head; with bronze sleeve bearings and sufficient grease fittings for lubrication of moving parts, including bearings and gears.
- I. Crank Rotation Indicator: Cast arrow with word OPEN in prominent location readily visible indicating correct rotation of crank to open gate.

- J. Hand Cranks: 15 inch radius; requiring maximum 25 pounds pull to operate gate at maximum operating head; with:
 - 1. Revolving brass sleeves.
 - 2. Gears, spur pinions, bevel gears, and bevel pinions with cut teeth.
 - 3. Cast manganese bronze lift nuts.
 - 4. Cast-iron lift parts with smooth exterior surfaces.
- K. Indicator: Dial position type mounted on gear operator; enclosed in cast-iron or aluminum housing with clear plastic cover; marked with fully open, 3/4, 1/2, 1/4, and closed positions.

2.04 FLOOR STAND

- A. Manufacturers: One of the following or equal:
 - 1. Rodney Hunt Company.
 - 2. Waterman industries, Inc.
- B. Floor Stand Assemblies: Heavy-duty cast-iron, suitable for mounting specified operator.

2.05 BENCH STANDS

- A. Manufacturers: One of the following or equal:
 - 1. Rodney Hunt Company.
 - 2. Waterman industries, Inc.
- B. Bench Stands: Handwheel operators or hand crank, geared operators conforming to hand-cranked geared operator requirements, except capacity to be mounted on haunch, wall bracket, or self-contained gate yoke.

2.06 ACCESSORY EQUIPMENT

- A. Wall Brackets or Haunches: As indicated on the Drawings.
- B. Stems: Stainless steel; sized to match output of operator; minimum gate or valve operating stem diameter; maximum 200 slenderness ratio.
- C. Stem Couplings: Stainless steel; internally threaded to match stem; lockable to stem by set screw.
- D. Stem Guides: Cast-iron with silicon bronze bushing; maximum 200 slenderness ratio; capable of being mounted with wall bracket; adjustable in 2 directions.
- E. Wall Brackets: Cast-iron, capable of withstanding output of operator, adjustable in 2 directions.
- F. Stem Stuffing Boxes: Cast-iron, with adjustable gland and packing.
- G. Fasteners and Anchor Bolts: 316 stainless steel.
- H. Geared Valve Operators: Provided with cut gears, either spur or worm; sized to operate valves at most adverse design condition; with maximum 40 pound pull at handwheel or chain wheel rim.

- I. Geared Valve Traveling Nut Operators: Acceptable only where specified or indicated on the Drawings.
- J. Accessory Equipment for Valves and Gates Requiring Remote Operators: Operating stems, stem couplings, stem guides, wall brackets, and stem stuffing boxes.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install floor boxes in concrete floor with lid flush with floor.
- B. After installation of gate and stem covers, mark stem covers at point where top of stems are at full-open position and at closed position.
- C. Attach floor stand to structure with anchor bolts.
- D. Install stem stuffing boxes where operating stems pass through intermediate concrete floor slabs.

3.02 SCHEDULES

- A. Geared Operators: Provide geared operators for following valves:
 - 1. Butterfly valves larger than 6 inches, nominal size, on liquid service.
 - 2. Plug valves 6 inches, nominal size, and larger.
- B. Handwheel Operators: Provide handwheel operators for valves mounted 6 feet or less above floors.
- C. Chain Wheel Operators: Provide chain wheel operators for valves mounted more than 6 feet to center line above floors.

END OF SECTION

SECTION 15050

BASIC MECHANICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Basic design and performance requirements for mechanical equipment.
- B. Related Sections:
 - 1. Section 01612 - Seismic Design Criteria.
 - 2. Section 01756 - Testing, Training, and Facility Start-Up.
 - 3. Section 01770 - Closeout Procedures.
 - 4. Section 01782 - Operating and Maintenance Data.
 - 5. Section 03600 - Grouts.
 - 6. Section 05120 - Structural Steel.
 - 7. Section 05500 - Metal Fabrications.
 - 8. Section 10400 - Identification Devices.
 - 9. Section 11312D - Vertical Turbine Short Setting Centrifugal Pumps.
 - 10. Section 15958 - Mechanical Equipment Testing.

1.02 REFERENCES

- A. American Gear Manufacturer's Association (AGMA) Standards:
 - 1. AGMA 2001-B88 - Fundamental Rating Factors and Calculation Methods for Involute Spur and Helical Gear Teeth.
 - 2. AGMA 6000-A88 - Specification for Measurement of Linear Vibration on Gear Units.
 - 3. AGMA 6010-E88 - Standard for Spur, Helical, Herringbone, and Bevel Enclosed Drives.
 - 4. AGMA 6019-E89 - Standard for Gear motors using Spur, Helical, Herringbone, Straight Bevel or Spiral Bevel Gears.
 - 5. AGMA 6025-C90 - Sound for Enclosed Helical, Herringbone, and Spiral Bevel Gear Drives.
- B. American Society of Mechanical Engineers (ASME):
 - 1. ASME PTC 8.2 - Performance Test Code for Centrifugal Pumps.
 - 2. ASME PTC 10 - Performance Test Code - Compressors and Exhausters.
 - 3. ASME PTC 17 - Performance Test Code - Reciprocating Internal-Combustion Engines.
 - 4. ASME PTC 11 - Performance Test Code - Measurement of Shaft Horsepower - Instruments and Apparatus.
- C. American Bearing Manufacturers Association (ABMA) Standards:
 - 1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
 - 2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

- D. American Society for Testing and Materials (ASTM):
 - 1. A 36 - Standard Specification for Structural Steel.
 - 2. A 48 - Standard Specification for Gray Iron Castings.
 - 3. A 526 - Standard Specification for Steel Sheet, Zinc Coated by the Hot Dip Process, Commercial Quality.
 - 4. B 61 - Standard Specification for Steam or Valve Bronze Castings.
 - 5. B 62 - Standard specification for Composition Bronze or Ounce Metal Castings.
 - 6. E 527 - Standard Practice for Numbering Alloys and Metals (UNS).

- E. Hydraulic Institute Standards (HI):
 - 1. HI 1.1-1.5 - Centrifugal Pumps - Nomenclature, Definitions, Application, and Operation.
 - 2. HI 1.6 - Centrifugal Pump Tests.
 - 3. HI 2.1-2.5 - Vertical Pumps - Nomenclature, Definitions, Application, and Operation.
 - 4. HI 2.6 - Vertical Pump Tests.
 - 5. HI 3.1-1.5 - Rotary Pumps - Nomenclature, Definitions, Application, and Operation.
 - 6. HI 3.6 - Rotary Pump Tests.
 - 7. HI 4.1-4.6 - Sealless Rotary Pumps - Nomenclature, Definitions, Application, Operation, and Test.
 - 8. HI 5.1-1.6 - Sealless Centrifugal Pumps - Nomenclature, Definitions, Application, Operation, and Test.
 - 9. HI 6.1-6.5 - Reciprocating Power Pumps - Nomenclature, Definitions, Application, and Operation.
 - 10. HI 7.1-7.5 - Controlled Volume Pumps - Nomenclature, Definitions, Application, and Operation.
 - 11. HI 9.1-9.5 - Pumps - General Guidelines for Types, Definitions, Application, and Sound Measurement.

- F. American Petroleum Institute (API):
 - 1. ANSI/API 682 - Shaft Sealing Systems for Centrifugal and Rotary Pumps.

1.03 DEFINITIONS

- A. Special Tools: Tools that have been specifically made for use on unit of equipment for assembly, disassembly, repair, or maintenance.

- B. Resonant Frequency: That frequency at which a small driving force produces an ever-larger vibration if no dampening exists.

- C. Rotational Frequency: The revolutions per unit of time usually expressed as revolutions per minute.

- D. Critical Frequency: Same as resonant frequency for the rotating elements or the installed machine and base.

- E. Peak Vibration Velocity: The root mean square average of the peak velocity of the vibrational movement times the square root of 2 in inches per second.

- F. Rotational Speed: Same as rotational frequency.

- G. Maximum Excitation Frequency: The excitation frequency with the highest vibration velocity of several excitation frequencies that are a function of the design of a particular machine.
- H. Critical Speed: Same as critical frequency.
- I. Free Field Noise Level: Noise measured without any reflective surfaces (an idealized situation); sound pressure levels at 3 feet from the source unless specified otherwise.
- J. Operating Weight: The weight of unit plus weight of fluids or solids normally contained in unit during operation.

1.04 SYSTEM DESCRIPTION

- A. General:
 - 1. Provisions specified under each technical equipment specification prevail over and supersede conflicting provisions as specified in this Section.
 - 2. Provide equipment and parts that are suitable for stresses, which may occur during fabrication, transportation, erection, and operation.
 - 3. Provide equipment that has not been in service prior to delivery, except as required by tests.
 - 4. Like parts of duplicate units are to be interchangeable.
 - 5. When 2 or more units of equipment for the same purpose are required, provide products of same manufacturer.
 - 6. Equipment manufacturer's responsibility extends to selection and mounting of gear drive units, motors or other prime movers, accessories, and auxiliaries required for proper operation.
 - 7. When necessary, modify manufacturer's standard product to conform to specified requirements or requirements indicated on the Drawings and contained in Laws and Regulations.
- B. Material Requirements:
 - 1. Materials: Suitable for superior corrosion resistance and for services under conditions normally encountered in similar installations.
 - 2. Dissimilar Metals: Separate contacting surfaces with dielectric material.
- C. Power Transmission Systems:
 - 1. Power Transmission Equipment: V-belts, sheaves, shaft couplings, chains, sprockets, mechanical variable-speed drives, variable frequency drives, gear reducers, open and enclosed gearing, clutches, brakes, intermediate shafting, intermediate bearings, and U-joints are to be rated for 24 hour-a-day continuous service or frequent stops-and-starts intermittent service, whichever is most severe, and sized with a minimum service factor of 1.5:
 - a. Apply 1.5 service factor to nameplate horsepower and torque of prime source of power and not to actual equipment loading.
 - b. Apply service factors higher than 1.5 when recommended for continuous 24 hour-per-day operation and shock loadings specified in AGMA 6010-E88, other applicable AGMA standards, or other applicable referenced standards.
 - c. When manufacturer recommends service factor greater than 1.5, manufacturer's recommendation takes precedence.

- D. Vibration:
1. Resonant Frequency: Ensure there are no natural resonant torsional, radial, or axial frequencies within 25 percent above or below the operating rotational frequencies or multiples of the operating rotational frequencies that may be excited by the equipment design.
 2. Design, balance and align equipment to meet the vibration criteria specified in Section 15958.
- E. Equipment Mounting and Anchoring:
1. Mount equipment on cast iron or welded steel bases with structural steel support frames. Utilize continuous welds to seal seams and contact edges between steel members. Grind welds smooth.
 2. Provide bases and supports with machined support pads, dowels for alignment of mating of adjacent items, adequate openings to facilitate grouting, and openings for electrical conduits.
 3. Provide jacking screws in bases and supports for equipment weighing over 1,000 pounds.
 4. Anchorage of Equipment to Concrete: Perform calculations and determine number, size, type, strength, and location of anchor bolts or other connections.
 5. Provide bolt sleeves for anchor bolts for heavy equipment. Adjust bolts to final location and fill sleeve with non-shrink grout.
 6. Anchorage of Equipment to Metal Supports: Perform calculations and determine number, size, type, strength, and location of bolts used to connect equipment to metal supports.
 7. Design equipment anchorage, supports, and connections for dead load, running loads, loads during start-up, seismic load, and other loads as required for proper operation of equipment.
- F. Seismic Design:
1. Design equipment anchorage and related details for seismic design criteria as specified in Section 01612.
 2. For equipment with operating weight of 400 pounds or more, provide calculations for:
 - a. Determine operating weight and centroid of equipment.
 - b. Calculate forces and overturning moments.
 - c. Calculate shear and tension forces in equipment anchorages, supports, and connections.
 - d. Design equipment anchorage, supports, and connections based on calculated shear and tension forces.
- G. Equipment Units Weighing 50 Pounds or More: Provide with lifting lugs or eyes to allow removal with hoist or other lifting device.

1.05 SUBMITTALS

- A. Product Data:
1. For Each Item of Equipment:
 - a. Design features.
 - b. Load capacities.
 - c. Efficiency ratings.
 - d. Material designations by UNS alloy number or ASTM Specification and Grade.

- e. Data needed to verify compliance with the Specifications.
 - f. Catalog data.
 - g. Name plate data.
 - h. Clearly mark submittal information to show specific items, materials, and accessories or options being furnished.
2. Gear Reduction Units:
- a. Engineering information per applicable AGMA standards.
 - b. Gear mesh frequencies.
- B. Shop Drawings:
- 1. Drawings for Equipment:
 - a. Drawings that include outline drawings, cut-away drawings, parts lists, material specification lists, and other information required to substantiate that proposed equipment complies with specified requirements.
 - 2. Outline drawings showing equipment, driver, driven equipment, pumps, seal, motor(s) or other specified drivers, variable frequency drive, shafting, U-joints, couplings, drive arrangement, gears, baseplate or support dimensions, anchor bolt sizes and locations, bearings, and other furnished components.
 - 3. Installation and checkout instructions including leveling and alignment tolerances, grouting, lubrication requirements, and initial start-up procedures.
 - 4. Wiring, control schematics, control logic diagrams and ladder logic or similar for computer based controls.
 - 5. Recommended or normal operating parameters such as temperatures and pressures.
 - 6. Alarm and shutdown set points for all controls furnished.
- C. Calculations:
- 1. Calculations and other information to substantiate equipment base plates, supports, bolts, anchor bolts, and other connections meet minimum design strength requirements and seismic design criteria specified in Section 01612.
 - 2. Bearing L_{10} life calculations in accordance with ABMA 9 or ABMA 11 calculation methods for drivers, pumps, gears, shafts, motors, and other drive line components with bearings.
 - 3. Calculations and other information to substantiate that operating rotational frequencies meet the requirements of this Section.
 - 4. Torsional Analysis of Power Transmission Systems: When torsional analysis specified in the equipment Sections, provide:
 - a. Sketch of system components identifying physical characteristics including mass, diameter, thickness, and stiffness.
 - b. Results of analysis including first and second critical frequencies of system components and complete system.
 - 5. Calculations shall be signed and stamped by a civil or structural engineer registered to practice in the state where the Project is located.
- D. Quality Control Submittals:
- 1. Source quality control reports and certified test data as specified in Section 15958.
 - 2. Submit factory test reports before shipment.
 - 3. Certified static and dynamic balancing reports for rotating equipment.
 - 4. Field quality control reports and test data as specified in Section 15958.
 - 5. Start-Up Plan: Proposed plan for field-testing equipment as specified in Section 01756.

6. Certificate of Proper Installation: As specified in Section 01756.
 7. Submit material test reports as specified in the equipment sections.
- E. Operation and Maintenance Manuals:
1. As specified in Section 01782.
 2. Submit prior to training of OWNER's personnel.
 3. Make available at project site complete copy of manuals for use by field personnel and ENGINEER during start-up and testing of equipment.
 4. Include manufacturer and model number of every bearing; include calculated ball pass frequencies of the installed equipment for both the inner and outer raceways.
 5. Include motor rotor bar pass frequencies.
- F. Project Closeout Documents: As specified in Section 01770.

1.06 QUALITY ASSURANCE

- A. Manufacturer's Field Service:
1. Furnish services of authorized representative specially trained in installation of equipment:
 - a. Visit project site and perform tasks necessary to certify installation.
 - b. Furnish Certificate of Proper Installation as specified in Section 01756.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Packing and Shipping:
1. Equipment: Pack in boxes, crates, or otherwise protect from damage and moisture, dust, or dirt during shipment, handling, and storage.
 2. Bearings: Separately pack or otherwise suitably protect during transport.
 3. Spare Parts: Deliver in boxes labeled with contents, equipment to which spare parts belong, and name of CONTRACTOR.
- B. Storage:
1. Equipment Having Bearings: Store in enclosed facilities. Rotate units at least once per month or more often as recommended by the manufacturer to protect rotating elements and bearings.
 2. Gear Boxes: Oil filled or sprayed with rust preventive protective coating.
- C. Protection:
1. Equipment: Protect equipment from deleterious exposure.
 2. Painted Surfaces: Protect against impact, abrasion, discoloration, and other damage.

1.08 PROJECT CONDITIONS

- A. Environmental Requirements:
1. Equipment for project is to be suitable for performance in Fifth Avenue pump station environment and under following conditions:
 - a. Ambient Temperatures: 30 to 100 degrees Fahrenheit.
 - b. Relative Humidities: 10 to 100 percent.
 - c. Site Elevation: Approximately 200 feet above mean sea level.
 - d. Other: Marine environment with coastal fog and sea salt spray.

1.09 SEQUENCING AND SCHEDULING

- A. Equipment Anchoring: Obtain anchoring material and templates or setting drawings from equipment manufacturers in adequate time for anchors to be cast-in-place when concrete is placed.
- B. Coordinate details of equipment with other related parts of the Work, including verification that structures, piping, wiring, and equipment components are compatible.
- C. General Start-Up and Testing of Equipment:
 - 1. Perform general start-up and testing procedures after operation and maintenance manuals for equipment have been received.
 - 2. Conduct functional testing of mechanical or electrical systems when each system is substantially complete and after general start-up and testing procedures have been successfully completed.
 - 3. Functional testing requirements as specified in Sections 01756, 13410, 15958, and 16950 and the equipment sections.

1.10 WARRANTY

- A. Warranty: Warrant equipment free of defects in material and workmanship for 1 year from the date of acceptance or date of first beneficial use of the equipment by the OWNER; cover parts and labor.
- B. Where an extended warranty beyond 1 year is required by the detailed equipment specification Section, manufacturer's extended warranty shall be issued in the OWNER's name.

1.11 MAINTENANCE

- A. Special Tools:
 - 1. When specified, provide special tools required for operation and maintenance.
 - 2. Mark or tag and list such tools in maintenance and operations instructions. Describe use of each tool.
- B. Spare Belts:
 - 1. When spare belts are specified, furnish 1 spare belt for every different type and size of belt-driven unit:
 - a. Where 2 or more belts are involved, furnish matched sets.
 - b. Identify as to equipment, design, horsepower, speed, length, sheave size, and use.
 - c. Package in boxes labeled with identification of contents.
- C. Spare Parts:
 - 1. Assume responsibility until turned over to OWNER.
 - 2. Store in enclosed facilities.
 - 3. Furnish itemized list and match identification tag attached to every part.
 - 4. List parts by generic title and identification number.
 - 5. Furnish name, address, and telephone number of supplier and spare parts warehouse.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Ferrous Materials:
 - 1. Steel for Members used in Fabrication of Assemblies: ASTM A 36.
 - 2. Iron Castings: ASTM A 48, tough, close-grained gray iron, free from blowholes, flaws, and other imperfections.
 - 3. Ductile Iron Castings: ASTM A536, Grade 65-45-12, free from flaws and imperfections.
 - 4. Galvanized Steel Sheet: ASTM A 526, minimum 0.0635 inch (16 gauge).
 - 5. Expanded Metal: ASTM A 36, 13 gauge, 1/2-inch flat pattern expanded metal.
- B. Nonferrous Materials:
 - 1. Stainless Steel: Type 304 or 316 as specified. Provide L grade where welding required.
 - 2. Bronze in Contact with Liquid: Composition of not more than 2 percent aluminum nor more than 6 percent zinc; UNS Alloy C83600, C92200 or C92700 in accordance with ASTM B 61, B 62, B 505, or B 584, when not specified otherwise.
- C. Dielectric Materials for Separation of Dissimilar Metals:
 - 1. Neoprene, bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or other materials.
- D. Anchors Bolts: As specified in Section 05120; minimum 0.5 inch diameter.
- E. Non-Shrink Grout: As specified in Section 03600.

2.02 SHAFT COUPLINGS

- A. General:
 - 1. Type and Ratings: Provide nonlubricated type, designed for not less than 50,000 hours of operating life.
 - 2. Sizes: Provide as recommended by manufacturer for specific application, considering horsepower, speed of rotation, and type of service.
 - 3. Use: Use of couplings specified in this Section does not relieve CONTRACTOR of responsibility to provide precision alignment of driver-driven units as required by equipment manufacturer and alignment criteria specified elsewhere in this section.
- B. Shaft Couplings - Close Coupled: Shaft couplings for close coupled electric motor driven equipment 1/2 horsepower or larger and subject to sudden torque reversals or shock loading:
 - 1. Manufacturers: One of the following or equal:
 - a. T.B. Woods, Dura-Flex, L-Jaw C-Jaw or G-Jaw.
 - b. Lovejoy, S-Flex.
 - 2. Provide flexible couplings designed to accommodate angular misalignment, parallel misalignment, and end float.
 - 3. Manufacture flexible component of coupling from synthetic rubber, or urethane.
 - 4. Provide service factor of 2.5 for electric motor drives and 3.5 for engine drives.

5. Do not allow metal-to-metal contact between driver and driven equipment.
 6. Examples of loads where sudden torque reversals may be expected:
 - a. Reciprocating pumps, blowers, and compressors.
 - b. Conveyor belts.
 - c. Reversing equipment.
- C. Shaft Couplings - Direct Connected: Shaft couplings for direct connected electric motor driven equipment 1/2 horsepower or larger and subject to normal torque, non-reversing applications:
1. Manufacturers: One of the following or equal:
 - a. Rexnord-Falk.
 - b. T.B. Woods, Dura-Flex, Sure-Flex or Form-Flex.
 2. Provide flexible couplings designed to accommodate shock loading, vibration, and shaft misalignment or offset.
 3. Provide flexible connecting element of rubber and reinforcement fibers.
 4. Connect stub shafts through collars or round flanges, firmly keyed to their shafts with neoprene cylinders held to individual flanges by through pins.
- D. Spacer Couplings: Where cartridge type mechanical seals or non-split seals are specified, provide a spacer type coupling of sufficient length to remove the seal without disturbing the driver or driven equipment unless noted otherwise in the individual equipment specifications.
- E. Specialized Couplings: Where requirements of equipment dictate specialized features, supply coupling recommended for service by manufacturer.

2.03 STUFFING BOX, SEAL CHAMBER, AND SHAFT SEALS

- A. General:
1. Unless otherwise noted in the equipment section, provide cartridge type, double mechanical shaft seals for pumps.
 2. Provide a stuffing box large enough for a double mechanical seal.
 3. Where packing is specified, provide stuffing box large enough to receive a double mechanical seal.
 4. Provide seal or packing flush connections, (3/4 inch size unless another size is indicated on the Drawings). Provide and route leakage drain line to nearest equipment floor drain indicated on the Drawings.
 5. For pumps with packing, design packing gland to allow adjustment and repacking without dismantling pump except to open up packing box.
 6. Seal or packing flush requirements shall comply with API Standard 682 requirements. Unless otherwise indicated, specified or required by the equipment and seal manufacturers, the following API flushing Plan arrangements shall be utilized as appropriate for the application:
 - a. Single seal, clean water applications: Plan 11 (Discharge bypass to seal).
 - b. Single seal, vertical pump applications: Plan 13 (Seal bypass to suction).
 - c. Single seal, clean hot water (>180 degrees F) applications: Plan 23 (Seal cooler and pumping ring).
 - d. Single seal, solids, or contaminants containing water applications: Plan 32 (External seal water- see Carollo typical detail # M262).
 - e. Double seal applications: Plan 54 (External seal water- see Carollo typical detail # M262).

- B. Packing: When specified in the equipment section of the specifications, provide the following type of packing:
1. Wastewater, Water, and Sludge Applications:
 - a. Asbestos free.
 - b. PTFE (Teflon) free.
 - c. Braided graphite.
 - d. Manufacturers: One of the following or equal:
 - 1) Chesterton, 1400.
 - 2) John Crane Inc., equivalent product.
- C. Mechanical Seals: Provide seal types specified in the equipment sections and as specified herein:
1. Provide seal types meeting the following requirements:
 - a. Balanced hydraulically.
 - b. Spring: Stationary, out of pumping fluid, Hastelloy C; Type Elgiloy or 17-7 PH stainless steel for split seals.
 - c. O-Ring: Viton 747.
 - d. Gland: Type 316L stainless steel.
 - e. Set Screws: Type 316L stainless steel.
 - f. Faces: Reaction bonded, Silicon Carbide.
 - g. Seal designed to withstand 300 pounds per square inch gauge minimum differential pressures in either direction; no requirement for seal buffer pressure to be maintained when pump is not operational even though process suction head may be present in pump.
 2. Cartridge Type Single Mechanical: Manufacturers: One of the following or equal:
 - a. Chesterton, S10.
 - b. John Crane, 5610 Series.
 3. Cartridge Type Double Mechanical: Manufacturers: One of the following or equal:
 - a. Chesterton, S20.
 - b. John Crane, 5620 Series.
 4. Split Face Single Mechanical: Manufacturers: One of the following or equal:
 - a. Chesterton, 442.
 - b. John Crane, 3710.

2.04 GEAR REDUCTION UNITS

- A. Type: Helical or herringbone, unless otherwise specified.
- B. Design:
1. Made of alloys treated for hardness and for severe service.
 2. AGMA Class II Service:
 - a. Use more severe service condition when such is recommended by unit's manufacturer.
 3. Cast iron housing with gears running in oil.
 4. Anti-friction bearings.
 5. Thermal horsepower rating based on maximum horsepower rating of prime mover not actual load.
 6. Manufactured in accordance with applicable AGMA standards.
- C. Planetary gear units are not to be used.

2.05 BELT DRIVES

- A. Sheaves:
 - 1. Separately mounted on bushings by means of at least 3 pull-up bolts or cap tightening screws.
 - 2. When 2 sheave sizes are specified, provide separate belts sized for each set of sheaves.
 - 3. Statically balanced for all; dynamically balanced for sheaves that operates at peripheral speed of more than 5,500 feet per minute.
 - 4. Key bushings to drive shaft.
- B. Belts: Anti-static type when explosion-proof equipment or environment is specified.
- C. Manufacturers: One of the following or equal:
 - 1. Dodge, Dyna-V belts with matching Dyna-V sheaves and Taper-Lock bushings.
 - 2. Wood's, Ultra-V belts with matching Sure-Grip sheaves and Sure-Grip bushings.

2.06 BEARINGS

- A. Type: Oil or grease lubricated, ball or roller antifriction type, of standard manufacture.
- B. Oil Lubricated Bearings: Provide either pressure lubricating system or separate oil reservoir splash type system:
 - 1. Size oil lubrication systems to safely absorb heat energy generated in bearings when equipment is operating under normal conditions and with the ambient temperature 15 degree Fahrenheit above the maximum ambient temperature specified elsewhere in this Section.
 - 2. Provide an external oil cooler when required to satisfy the specified operating conditions. Provide air cooled system if a water cooling source is not indicated on the Drawings. Equip oil cooler with a filler pipe and external level gauge.
- C. Grease Lubricated Bearings, Except Those Specified to Be Factory Sealed: Fit with easily accessible grease supply, flush, drain, and relief fittings:
 - 1. Lubrication Lines and Fittings:
 - a. Lines: Minimum 1/4-inch diameter stainless steel tubing.
 - b. Multiple Fitting Assemblies: Mount fittings together in easily accessible location.
 - c. Use standard hydraulic type grease supply fittings:
 - 1) Manufacturers: One of the following or equal:
 - a) Alenite.
 - b) Zurk.
- D. Ratings: Rated in accordance with ABMA 9 or ABMA 11 for L₁₀ rating life of not less than 50,000 hours:
 - 1. Higher ratings, when specified in other Sections, supersede preceding requirement.

2.07 SAFETY GUARDS

- A. Drive Assemblies: Enclose sprockets, belts, drive chains, gearings, couplings, and other moving parts on drive assemblies in safety enclosures that are in compliance with applicable Laws and Regulations.
- B. Shafts: Provide guards that protect personnel from rotating shafts or components within 7.5 feet of floors or operating platforms.
- C. Hot Surfaces: Insulate all surfaces with normal operating temperatures above 120 degrees Fahrenheit when surface is within 7.5 feet height from any operating floor or level; insulation thickness such that temperature is below 120 degrees; cover insulation with moisture-proof protective jacket; insulation Type 3 and cover Type 5 as specified in Section 15082.
- D. Guard Requirements:
 - 1. Allow visual inspection of moving parts without removal.
 - 2. Allow access to lubrication fittings.
 - 3. Prevent entrance of rain or dripping water for outdoor locations.
 - 4. Size belt and sheave guards to allow for installation of sheaves 15 percent larger and addition of one belt.
- E. Materials:
 - 1. Sheet Metal: Carbon steel, 12 gauge minimum thickness, hot-dip galvanized after fabrication.
 - 2. Fasteners: Type 304 stainless steel.

2.08 WARNING SIGNS

- A. Provide for equipment that starts automatically or remotely.
- B. Material and Size: Metal as specified in Section 10400.
- C. Colors: Black lettering on yellow background.
- D. Text: As specified in Section 10400.

2.09 FABRICATION

- A. Structural Steel Members: As specified in Section 05120.
- B. Nameplates:
 - 1. Engraved or stamped on Type 304 stainless steel and fastened to equipment at factory in an accessible and visible location.
 - 2. Indicate Following Information as Applicable:
 - a. Manufacturer's name.
 - b. Equipment model number and serial number.
 - c. Maximum and Normal rotating speed.
 - d. Horsepower.
 - e. Rated capacity.
 - f. Service class per applicable standards.

3. Nameplates for Pumps: Include:
 - a. Rated total dynamic head in feet of fluid.
 - b. Rated flow in gallons per minute.
 - c. Impeller, gear, screw, diaphragm, or piston size.
 4. Gear Reduction Units: Include:
 - a. AGMA Class of service.
 - b. Service factor.
 - c. Input and output speeds.
- C. Bolt Holes in Equipment Support Frames: Do not exceed bolt diameter by more than 25 percent, up to limiting maximum diameter oversize of 1/4 inch.
- D. Shop Finishing:
1. Provide factory and field coating as specified in Section 09960. If not specified in Section 09960, provide coating as follows:
 - a. Bases and Support Frames in Contact with Concrete or Other Material: Coat contacting surfaces with minimum of 2 coats of zinc chromate primer before installation or grouting.
 - b. Shop Primer for Steel and Iron Surfaces, Unless Specified Otherwise:
 - 1) Manufacturers: One of the following or equal:
 - a) Ameron, Amercoat 185 Universal Primer.
 - b) Cook, 391-N-167 Barrier Coat.
 - c) Kop-Coat, Pug Primer.
 - d) Tnemec, 37-77 Chem-Prime.
 - e) Valspar, 13-R-28 Chromox Primer.
 - c. Coat machined, polished, and nonferrous surfaces which are not to be painted with rust-preventive compounds:
 - 1) Manufacturers: One of the following or equal:
 - a) Houghton, Rust Veto 344.
 - b) Rust-Oleum, R-9.
 - d. Coating for Ferrous Metal Surfaces, Except Stainless Steel: High solids polyamine epoxy.
 - e. Finish Painting of Motors: Shop finish paint with manufacturer's standard coating, unless otherwise specified in Section 09960.

2.10 SOURCE QUALITY CONTROL

- A. As specified in Section 15958 for testing requirements and the individual equipment sections of the Specifications.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Inspect all components for shipping damage, conformance to specifications, and proper torques and tightness of fasteners.

3.02 PREPARATION

- A. Metal Work Embedded in Concrete:
1. Accurately place and hold in correct position while concrete is being placed.

2. Clean surface of metal in contact with concrete immediately before concrete is placed.
- B. Concrete Surfaces Designated to Receive Grout:
1. Heavy sandblast concrete surface in contact with grout.
 2. Clean surfaces of sandblasting sand, grease, oil, dirt, and other foreign material that may reduce bonding of grout.
 3. Concrete Saturation: Saturate concrete with water. Concrete shall be saturated surface damp at time grout is placed.
- C. Field Measurements:
1. Prior to fabrication of equipment, take measurements for installation of equipment and verify dimensions indicated on the Drawings. Ensure equipment and ancillary appurtenances fit within available space.

3.03 INSTALLATION

- A. Install equipment in accordance with manufacturer's installation instructions and recommendations.
- B. Lubrication Lines and Fittings:
1. Lines from Fittings to Point of Use: Support and protect.
 2. Fittings:
 - a. Bring fittings to outside of equipment in manner such that they are readily accessible from outside without necessity of removing covers, plates, housings, or guards.
 - b. Mount fittings together wherever possible using factory-mounted multiple fitting assemblies securely mounted, parallel with equipment lines, and protected from damage.
 - c. Fittings for Underwater Bearings: Bring fittings above water surface and mount on edge of structure above.
- C. Alignment of Drivers and Equipment:
1. Where drive motors or other drivers are connected to driven equipment by flexible coupling, disconnect coupling halves and align driver and equipment after complete unit has been leveled on its foundation.
 2. Comply with procedures of appropriate Hydraulic Institute Standards, AGMA Standards, alignment tolerances of equipment manufacturers and the following requirements to bring components into angular and parallel alignment:
 - a. Maximum Total Coupling Offset (not the per plane offset): Not to exceed 0.5 mils per inch of coupling length for spacer couplings based on coupling length (not dial separation).
 - b. Utilize jacking screws, wedges, or shims as recommended by the equipment manufacturer and as specified in the equipment sections.
 3. Use reverse-indicator arrangement dial type or laser type alignment indicators: Mount indicators on the driver/coupling flange and equipment/coupling flange. Alignment instrumentation accuracy shall be sufficient to read angular and radial misalignment at 10 percent or less of the manufacturer's recommended acceptable misalignment.
 4. Alignment and calculations shall include measurement and allowance for thermal growth, spacer coupling length, indicator separation and axial spacing tolerances of the coupling.

5. When alignment satisfies most stringent tolerance of system components, grout between base and foundation. Allow minimum 48 hours for grout to harden. After grout hardens, remove jacking screws, tighten anchor bolts and other connections, and recheck alignment. Correct alignment as required.
 6. After operational testing is complete, dowel motor or drivers and driven equipment. Comply with manufacturer's instructions.
- D. Grouting Equipment Bases:
1. Grout equipment with non-shrink grout as specified in Section 03600.
 2. Comply with manufacturer's installation instructions for grouting spaces, and tolerances for level and alignments, both vertical and horizontal.
 3. Grout equipment bases after piping connections are complete and in alignment with no strain transmitted to equipment.
 4. Grout base when equipment is leveled and in alignment.
 5. Place grout, filling voids under equipment bases and other supports including recesses between anchor bolts and sleeves:
 - a. Extend grout to edge of bases or bedplates and bevel at 45 degrees around units.
 - b. Finish surfaces with slope that prevents ponding water within grouted areas.
- E. Special Techniques: Use applicable special tools and equipment, including precision machinist levels, dial indicators, and gauges as required in equipment installations.
- F. Tolerances:
1. Completed Equipment Installations: Comply with requirements for intended use and specified vibration and noise tolerances.
- G. Warning Signs: Mount securely with stainless fasteners at equipment that can be started automatically or from remote locations.

3.04 FIELD QUALITY CONTROL

- A. Test equipment as specified in Section 15958 and the individual equipment Section of the Specifications.
- B. Perform operational testing as required by Section 01756.

3.05 MANUFACTURER'S REPRESENTATIVE

- A. Field Checkout: Before field-testing and start-up, provide services of factory-trained field service representative to certify the equipment has been installed, aligned, and checked in accordance with the manufacturer's instructions and the Specifications.
- B. Testing: Provide services of factory trained representative to observe and advise the CONTRACTOR during field quality control testing.
- C. Training: When training is specified, provide services of factory-trained representative to perform training as specified in Section 01756.

END OF SECTION

SECTION 15052

BASIC PIPING MATERIALS AND METHODS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Basic piping materials and methods.
- B. Related Sections:
 - 1. Section 01140 - Work Restrictions.
 - 2. Section 15061 - Pipe Supports.
 - 3. Section 15142 - Disinfection of Potable Water Lines.
 - 4. Section 15211 - Ductile Iron Pipe: AWWA C151.
 - 5. Section 15956 - Piping Systems Testing.

1.02 REFERENCES

- A. American Society of Testing and Materials (ASTM):
 - 1. F 37 - Standard Test Methods for Sealability of Gasket Materials.

1.03 DEFINITIONS

- A. Buried Pipe: Pipe that is buried in the soil, or cast in a concrete pipe encasement that is buried in the soil.
- B. Exposed Pipe: Pipe that is located above ground, or pipe that is located inside a structure, supported by a structure, or case into a concrete structure.
- C. Underground Piping: Piping actually buried in soil or cast in concrete.
- D. Underwater Piping: Piping below tops of walls in basins or tanks containing water.
- E. Wet Wall: Wall with water on at least 1 side.

1.04 SUBMITTALS

- A. Product Data:
 - 1. Escutcheons.
 - 2. Link -type seals.
 - 3. Gaskets.

PART 2 PRODUCTS

2.01 ESCUTCHEONS

- A. Material: Chrome-plated steel plate.

- B. Manufacturers: One of the following or equal:
 - 1. Dearborn Brass Company, Model Number 5358.
 - 2. Keeney Manufacturing Company, Model Number 102 or Number 105.
 - 3. Beaton and Corbin, Model Number 1 or Number 13.

2.02 LINK TYPE SEALS

- A. Characteristics:
 - 1. Modular mechanical type, consisting of interlocking neoprene or synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening.
 - 2. Assemble links solely with stainless steel bolts and nuts to form a continuous rubber belt around the pipe.
 - 3. Provide a nylon polymer pressure plate with 316 Stainless Steel hardware. Isolate pressure plate from contact with wall sleeve.
- B. Manufacturers: One of the following or equal:
 - 1. Calpico, Incorporated.
 - 2. Pipeline Seal and Insulator, Inc., Link-Seal.

2.03 GASKETS

- A. Gaskets for fluids with pressure or temperature conditions shall be suitable for the specific fluids and pressure and temperature conditions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Existing Conditions:
 - 1. Locate and expose existing structures, piping, conduits, and other facilities and obstructions that may affect construction of underground piping before starting excavation for new underground piping and appurtenances.
 - 2. Verify sizes, elevations, locations, and other relevant features of existing facilities and obstructions. Determine conflicts for the construction of the new underground piping and appurtenances.
 - 3. Make piping location and grade adjustments to resolve conflicts between new piping and existing facilities and obstructions.

3.02 INSTALLATION

- A. General:
 - 1. Piping Drawings:
 - a. Except in details, piping is indicated diagrammatically. Not every offset and fitting, or structural difficulty that may be encountered has been indicated on the Drawings. Sizes and locations are indicated on the Drawings.

- b. Perform minor modifications to piping alignment where necessary to avoid structural, mechanical, or other type of obstructions that cannot be removed or changed:
 - 1) Modifications are intended to be of minor scope, not involving a change to the design concept or a change to the Contract Price or Contract Times.
 - 2. Piping Alternatives:
 - a. Provide piping as specified in this Section, unless indicated on the Drawings or specified otherwise.
 - b. Alternative Pipe Ratings: Piping with greater pressure rating than specified may be substituted in lieu of specified piping without changes to the Contract Price. Piping of different material may not be substituted in lieu of specified piping.
 - c. Valves in Piping Sections: Capable of withstanding specified test pressures for piping sections and fabricated with ends to fit piping.
 - d. For flanged joints, where one of the joining flanges is raised face type, provide a matching raised face type flange for the other joining flange.
- B. Wall and Slab Penetrations:
 - 1. Provide sleeves for piping penetrations through aboveground masonry and concrete walls, floors, ceilings, roofs, unless specified or otherwise indicated on the Drawings.
 - 2. For piping 1 inch in nominal diameter and larger, provide sleeves with minimum inside diameters of 1 inch plus outside diameter of piping. For piping smaller than 1 inch in nominal diameter, provide sleeve of minimum twice the outside diameter of piping:
 - a. Arrange sleeves and adjacent joints so piping can be pulled out of sleeves and replaced without disturbing the structure.
 - b. Cut ends of sleeves flush with surfaces of concrete, masonry, or plaster.
 - c. Conceal ends of sleeves with escutcheons where piping runs through floors, walls, or ceilings of finished spaces within buildings.
 - d. Seal spaces between pipes and sleeves with link-type seals when not otherwise specified or indicated on the Drawings.
 - 3. Provide flexibility in piping connecting to structures to accommodate movement due to soil settlement and earthquakes. Provide flexibility using details indicated on the Drawings.
- C. Exposed Piping:
 - 1. Install exposed piping in straight runs parallel to the axes of structures, unless otherwise indicated on the Drawings:
 - a. Install piping runs plumb and level, unless otherwise indicated on the Drawings. Slope plumbing drain piping with a minimum of 1/4 inch per foot downward in the direction of flow. Slope digester gas piping to drip traps or low-point drains at a minimum of 1/2 inch per foot where condensate flows against the gas, or at a minimum of 1/4 inch per foot where condensate flows with gas.
 - 2. Install exposed piping after installing equipment and after piping and fitting locations have been determined.
 - 3. Support Piping: As specified in Section 15061:
 - a. Do not transfer pipe loads and strain to equipment.
 - 4. In addition to the joints indicated on the Drawings, provide unions, flexible couplings, flanged joints, flanged coupling adapters, and other types of joints

- or means which are compatible with and suitable for the piping system, and necessary to allow ready assembly and disassembly of the piping.
5. Assemble piping without distortion or stresses caused by misalignment:
 - a. Match and properly orient flanges, unions, flexible couplings, and other connections.
 - b. Do not subject piping to bending or other undue stresses when fitting piping. Do not correct defective orientation or alignment by distorting flanged joints or subjecting flange bolts to bending or other undue stresses.
 - c. Flange bolts, union halves, flexible connectors, and other connection elements shall slip freely into place.
 - d. Alter piping assembly to fit, when proper fit is not obtained.
 - e. Install eccentric reducers or increasers with the top horizontal for pump suction piping.
- D. Buried Piping:
1. Reclaimed water piping to be buried with minimum 4-foot cover without air traps, unless otherwise indicated on the Drawings.
 2. Where 2 similar services run parallel to each other, piping for such services may be laid in the same trench. Lay piping with sufficient room for assembly and disassembly of joints, for thrust blocks, for other structures, and to meet separation requirements of public health authorities having jurisdiction.
 3. Laying Piping:
 - a. Lay piping in finished trenches free from water or debris. Begin at the lowest point with bell ends up slope.
 - b. Place piping with top or bottom markings with markings in proper position.
 - c. Lay piping on an unyielding foundation with uniform bearing under the full length of barrels.
 - d. Where joints require external grouting, banding, or pointing, provide space under and immediately in front of the bell end of each section laid with sufficient shape and size for grouting, banding, or pointing of joints.
 - e. At the end of each day's construction, plug open ends of piping temporarily to prevent entrance of debris or animals.
 4. Concrete encase all buried pipe installed under concrete slabs or structures.
- E. Venting Piping Under Pressure:
1. Lay piping under pressure flat or at a continuous slope without air traps, unless otherwise indicated on the Drawings.
 2. Install plug valves as air bleeder cocks at high points in piping. Provide 1-inch plug valves for water lines, and 2-inch plug valves for sewage and sludge lines, unless otherwise indicated on the Drawings.
 3. Provide additional pipe taps with plug cocks and riser pipes along piping as required for venting during initial filling, disinfecting, and sampling.
 4. Before piping is placed into service, close plug valves and install plugs. Protect plugs and plug valves from corrosion in accordance with Section 09960.
- F. Restraining Piping:
1. Restrain piping at all locations.
 2. Provide restraints with ample size to withstand thrust forces resulting from test pressures:
 - a. During testing, provide suitable temporary restraints where piping does not require permanent restraints.

3. Provide underground mechanical restraints where specified.
- G. Connections to Existing Piping:
1. Expose existing piping to which connections are to be made with sufficient time to permit, where necessary, field adjustments in line, grade, or fittings:
 - a. Protect domestic water/potable water supplies from contamination:
 - 1) Make connections between domestic water supply and other water systems in accordance with requirements of public health authorities.
 - 2) Provide devices approved by OWNER of domestic water supply system to prevent flow from other sources into the domestic supply system.
 2. Make connections to existing piping and valves after sections of new piping to be connected have been tested and found satisfactory.
 3. Provide sleeves, flanges, nipples, couplings, adapters, and other fittings needed to install or attach new fittings to existing piping and to make connections to existing piping.
 4. For flanged connections, provide stainless steel bolts with isolation bushings and washers, and full-face flange gaskets.
- H. Connections to In-Service Piping:
1. Shutdown in-service piping as specified in Section 01140:
 - a. Establish procedures and timing in a conference attended by CONTRACTOR, ENGINEER, and OWNER of the in-service piping.
 2. Where operation and maintenance of existing facilities require that a shutdown be made during hours other than normal working hours, perform the related work in coordination with the hours of actual shutdown.
 3. Additional provisions regarding shutdown of existing facilities are specified in Section 01140.
- I. Connections Between Ferrous and Nonferrous Metals:
1. Connect ferrous and nonferrous metal piping, tubing, and fittings with dielectric couplings especially designed for the prevention of chemical reactions between dissimilar metals.
 2. Nonferrous metals include aluminum, copper, and copper alloys.
- J. Flanged Connections Between Dissimilar Metals Such as Ductile Iron Pipe and Steel Pipe:
1. Provide stainless steel bolts with isolation bushings and washers, and full-face flange gaskets.

3.03 CLEANING

- A. Piping Cleaning:
1. Upon completion of installation, clean piping interior of foreign matter and debris. Perform special cleaning when required by the Contract Documents.
- B. Cleaning Potable Water Piping:
1. Flush and disinfect potable water piping as specified in Section 15142.

3.04 PIPING SCHEDULE

PIPING SCHEDULE											
Process Abbrev.	Service	Nominal Diameter (inches)	Material	Pressure Class Special Thickness Class Schedule Wall Thickness	Pipe Spec. Section	Joints/ Fittings	Test Pressure/ Method	Lining	Coating	Service Conditions	Comments
DR	Drain	16	PVC	CL 150	15244	B&SP	15 feet/GR				
IN/OUT	Reservoir Inlet/Outlet										
	Underground	24	DIP	CL 350	15211	Integrally REST B&SP	250 psig/HH	CM w/ asphaltic seal coat	Factory Applied Zinc and Bituminous Coating		Do not factory coat DIP with asphaltic seal coat
	Aboveground	24	DIP	CL 350	15211	Integrally REST B&SP	250 psig/HH	CM w/ asphaltic seal coat	EPP		Do not factory coat DIP with asphaltic seal coat
OF	Overflow	16	DIP	CL 53	15211	FL	15 feet/GR	CM with asphaltic seal coat	EPP		Do not factory coat DIP with asphaltic seal coat
OUTLET	Outlet	8x15	STL	3/8"	13206Q	FL	45 feet/GR	None	Paint to match Reservoir Coating per Section 09974		
PW	Potable Water										
	Underground	0.5-3	GSP	CL 150	15270	SCRD	150 psig/HH	None	PTW		

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PIPING SCHEDULE											
Process Abbrev.	Service	Nominal Diameter (inches)	Material	Pressure Class Special Thickness Class Schedule Wall Thickness	Pipe Spec. Section	Joints/ Fittings	Test Pressure/ Method	Lining	Coating	Service Conditions	Comments
		4-24	DIP	CL 350	15211	Integrally REST B&SP	150 psig/HH	CM	Factory Applied Zinc and Bituminous Coating		Do not apply asphaltic seal coat to CM lining or pipe exterior
	Aboveground	0.5-3	GSP	CL 150	15270	SCRD	150 psig /HH	None	Paint to match Reservoir Coating per Section 09974		
		4-24	DIP	CL 350	15211	FL	150 psig /HH	CM	EPP		Do not apply asphaltic seal coat to CM lining or pipe exterior
RW	Recycled Water										
	Underground	0.5-3	GSP	CL 300	15270	SCRD	412 psig/HH	None	PTW		
		4-24	DIP	CL 350	15211	Integrally REST B&SP	412 psig/HH	CM w/ asphaltic seal coat	Factory Applied Zinc and Bituminous Coating		Do not factory coat DIP with asphaltic seal coat
	Aboveground	0.5-3	GSP	CL 300	15270	SCRD	412 psig /HH	None	Paint to match Reservoir Coating per Section 09974		

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PIPING SCHEDULE											
Process Abbrev.	Service	Nominal Diameter (inches)	Material	Pressure Class Special Thickness Class Schedule Wall Thickness	Pipe Spec. Section	Joints/ Fittings	Test Pressure/ Method	Lining	Coating	Service Conditions	Comments
		4-24	DIP	CL 350	15211	FL	412 psig /HH	CM w/ asphaltic seal coat	EPP		Do not factory coat DIP with asphaltic seal coat
RW	Aboveground and Belowground	1	CU	CL 300	15281	Solder	412 psig /HH	None	None		
Abbreviations: 1. The following abbreviations used in the column of test method refer to the respective methods as specified in Section 15956. GR Gravity method HH High head method 2. Abbreviations to designate piping include the following: B&SP Bell and spigot CL Class, followed by the designation CM Cement mortar CU Copper pipe DIP Ductile iron piping EPP Epoxy polyurethane coating FL Flange						GSP Galvanized steel pipe MJ Mechanical joint NPS Nominal pipe size, followed by the number in inches psig pounds per square inch gauge PTW Polyethylene tape wrap PVC Polyvinyl Chloride REST Restrained SCR D Screwed-On WLD Weld					

END OF SECTION

SECTION 15061

PIPE SUPPORTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Supports for pipe, fittings, valves, and appurtenances.
- B. Related Sections:
 - 1. Section 01612 - Seismic Design Requirements.
 - 2. Section 05120 - Structural Steel.

1.02 REFERENCES

- A. American National Standard Institute or Manufacturer's Standardization Society (ANSI/MSS):
 - 1. SP-58 - Pipe Hangers and Supports - Materials, Design, and Manufacture.
 - 2. SP-69 - Pipe Hangers and Supports - Selection and Application.

1.03 SUBMITTALS

- A. Submit in accordance with Section 01330.
- B. Shop Drawings: Include schedule, indicating where supports will be installed, and drawings of pipe support system components.
- C. Calculations and other information to substantiate supports meet minimum design strength requirements and can withstand seismic loads as specified in Section 01612.

PART 2 PRODUCTS

2.01 PIPE SUPPORTS

- A. Concrete Inserts for Pipes Under 30-Inch Diameter: ANSI/MSS SP-69, Type 18. Minimum 1,140 pounds capacity with 5/8 inch diameter rod.: Manufacturers: One of the following or equal:
 - a. Anvil International, Figure 282.
 - b. Carpenter & Paterson, Figure 108 or 650.
 - c. Cooper B-Line Systems, Inc., Figure B3014.
- B. Hanger Rods: Sized to match suspended pipe hanger, or as indicated on the Drawings:
 - 1. Manufacturers: One of following or equal:
 - a. Anvil International, Figure 140.
 - b. Bergen-Power, Figure 133.
 - c. Cooper B-Line Systems, Inc., Figure B3205.

- C. Hanger Rods, Continuously Threaded: Sized to match suspended pipe hanger, or as indicated on the Drawings:
 - 1. Manufacturers: One of the following or equal:
 - a. Anvil International, Figure 146.
 - b. Bergen-Power, Figure 94.

- D. Eye Bolts: Welded and rated equal to full load capacity of rod.

- E. Welded Eyebolt Rod:
 - 1. Manufacturers: One of the following or equal:
 - a. Anvil International, Figure 278.
 - b. Bergen-Power, Figure 93.
 - c. Cooper B-Line Systems, Inc., Figure B3210.

- F. Adjustable Ring Hangers: ANSI/MSS SP-69 Type 7 or Type 9 (system dependent):
 - 1. Manufacturers: One of the following or equal:
 - a. Anvil International, Figure 97.
 - b. Cooper B-Line Systems, Inc., Figure B3172.

- G. Adjustable Clevis Hangers: ANSI/MSS SP-69, Type 1:
 - 1. Manufacturers: One of the following or equal:
 - a. Anvil International, Figure 260 or Figure 590.
 - b. Bergen-Power, Figure 100.
 - c. Cooper B-Line Systems, Inc., Figure B3100 or B3102.

- H. Adjustable Clevis Hangers for Insulated Pipe: Oversize:
 - 1. Manufacturers: One of the following or equal:
 - a. Anvil International, Figure 300.
 - b. Bergen-Power, Figure 100EL.
 - c. Cooper B-Line Systems, Inc. Figure B3108.

- I. Brackets: ANSI/MSS SP-69, Type 32 with back plate; rated for 1,500 pounds:
 - 1. Manufacturers: One of the following or equal:
 - a. Anvil International, Figure 195.
 - b. Cooper B-Line Systems, Inc., Figure B3066.

- J. Standard U-Bolt: ANSI/MSS SP-69, Type 24:
 - 1. Manufacturers: One of the following or equal:
 - a. Anvil International, Figure 137.
 - b. Bergen-Power, Figure 283.
 - c. Cooper B-Line Systems, Inc., Figure B3188.

- K. Riser Clamps: ANSI/MSS SP-69, Type 8:
 - 1. Manufacturers: One of the following or equal:
 - a. Anvil International, Figure 261.
 - b. Bergen-Power, Figure 126.
 - c. Cooper B-Line Systems, Inc., Figure B3373.

- L. Pipe Clamps: ANSI/MSS SP-69, Type 4:
 - 1. Manufacturers: One of the following or equal:
 - a. Anvil International, Figure 212.
 - b. Bergen-Power, Figure 175.
 - c. Cooper B-Line Systems, Inc., Figure B3140.

- M. Adjustable Offset Pipe Clamp:
 - 1. Manufacturers: One of the following or equal:
 - a. Anvil International, Figure 100.
 - b. Cooper B-Line Systems, Inc., Figure B3149.
- N. Offset Pipe Clamp:
 - 1. Manufacturers: One of the following or equal:
 - a. Anvil International, Figure 103.
 - b. Cooper B-Line Systems, Inc., Figure B3148.
- O. Floor Stand or Stanchion Saddles: ANSI/MSS SP-69 Type 37. Provided with U-bolt hold down yokes:
 - 1. Manufacturers: One of the following or equal:
 - a. Anvil International, Figure 259.
 - b. Bergen-Power, Figure 125.
 - c. Cooper B-Line Systems, Inc., Figure B3090.
- P. Spring Hangers:
 - 1. Manufacturers: One of the following or equal:
 - a. Anvil International, Figure B-268.
 - b. Bergen-Power, Figure 920.
- Q. One Hole Pipe Clamps:
 - 1. Manufacturers: One of the following or equal:
 - a. Anvil International, Figure 126.
 - b. Carpenter & Paterson, Figure 237S.
- R. Welded Beam Attachment: ANSI/MSS SP-69, Type 22:
 - 1. Manufacturers: One of the following or equal:
 - a. Anvil International, Figure 66.
 - b. Bergen-Power, Figure 113A or 113B.
 - c. Cooper B-Line Systems, Inc., Figure B3083.
- S. Heavy Pipe Clamp: ANSI/MSS SP-69, Type 4:
 - 1. Manufacturers: One of the following or equal:
 - a. Anvil International, Figure 216.
 - b. Bergen-Power, Figure 298.
- T. PTFE Pipe Slide Assembly: ANSI/MSS SP-58, Type 35 with lateral and vertical restraint:
 - 1. Manufacturers: One of the following or equal:
 - a. Anvil International, Figure 257, type 3.
 - b. Cooper B-Line Systems, Inc., Figure B3893.
- U. Anchor bolts, flush shells, powder actuated fasteners, and concrete anchors: As specified in Section 05120.

2.02 MATERIALS

- A. Pipe Supports:
 - 1. Stainless Steel (Type 304 or 316): Use in all submerged locations, above water level but below top of wall inside water bearing structures and where specifically indicated on the Drawings.

2. Hot-Dip Galvanized Steel: Use in areas other than above and where specifically indicated on the Drawings. Hot-dip galvanize pipe support after fabrication.
3. Plastic, aluminum, FRP, and other miscellaneous materials: Use where specifically indicated on the Drawings.

B. Fasteners:

1. As specified in Section 05120.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Properly support, suspend, or anchor exposed pipe, fittings, valves, and appurtenances to prevent sagging, overstressing, or movement of piping; and to prevent thrusts or loads on or against connected pumps, blowers, and other equipment.
- B. Carefully determine locations of inserts. Anchor to formwork prior to placing concrete.
- C. Use flush shells only where indicated on the Drawings.
- D. Do not use anchors relying on deformation of lead alloy.
- E. Do not use stud type powder actuated fasteners for securing metallic conduit or steel pipe larger than 1 inch to concrete, masonry, or wood.
- F. Suspend pipe hangers from hanger rods. Secured with double nuts.
- G. Install continuously threaded hanger rods only where indicated on the Drawings.
- H. Use adjustable ring hangers; or adjustable clevis hangers, for 4 inch and smaller diameter pipe.
- I. Use adjustable clevis hangers for pipe larger than 4 inches in diameter.
- J. Secure pipes with galvanized double nutted U-bolts or suspend pipes from hanger rods and hangers.
- K. Support Spacing:
 1. Support 2 inch and smaller piping on horizontal and vertical runs at maximum 5 feet on center, unless otherwise specified.
 2. Support larger than 2 inch piping on horizontal and vertical runs at maximum 10 feet on center, unless otherwise specified.
 3. Support exposed polyvinyl chloride and other plastic pipes at maximum 5 feet on center, regardless of size.
 4. Support tubing, copper pipe and tubing, fiber-reinforced plastic pipe or duct, and rubber hose and tubing at intervals close enough to prevent sagging greater than 1/4 inch between supports.

- L. Install Supports at:
 - 1. Horizontal bends.
 - 2. Both sides of flexible pipe connections.
 - 3. Base of risers.
 - 4. Floor penetrations.
 - 5. Connections to pumps, blowers, and other equipment.
 - 6. Valves and appurtenances.
- M. Securely anchor plastic pipe, valves, and headers to prevent movement during operation of valves.
- N. Anchor plastic pipe between expansion loops and direction changes to prevent axial movement through anchors.
- O. Provide ductile iron elbows or tees supported from floors with base fittings where indicated on the Drawings.
- P. Support base fittings with metal supports or when indicated on the Drawings, concrete piers.
- Q. Size hanger rods, supports, clamps, anchors, brackets, and guides in accordance with ANSI/MSS SP-58 and SP-69.
- R. Do not use chains, plumbers' straps, wire, or similar devices for permanently suspending, supporting, or restraining pipes.
- S. Support plumbing drainage and vents in accordance with Uniform Plumbing Code.
- T. Supports, clamps, brackets, and portions of support system bearing against copper pipe: Copper plated, copper throughout, or isolated with neoprene or polyvinyl chloride tape.
- U. Where pipe is insulated, install over-sized supports and hangers.
- V. Install insulation shield in accordance with ANSI/MSS SP-69, Type 40. Shield shall be galvanized steel unless specified elsewhere.
- W. Install riser clamps at floor penetrations and where indicated on the Drawings.

END OF SECTION

SECTION 15075

MECHANICAL IDENTIFICATION

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Mechanical Identification including the following:
 - 1. Equipment nameplates.
 - 2. Pipe identification by color and legend.
 - 3. Special Items.
 - 4. Underground Warning Tape.
 - 5. Identification of equipment and components of systems with paint, brands, tags, and signboards.
- B. Related Sections:
 - 1. Section 01600 - Product Requirements.
 - 2. Section 01770 - Closeout Procedures.

1.02 REFERENCES

- A. Marina Coast Water District, Section 600, Design Criteria Recycled Water Facilities.
- B. American National Standards Institute (ANSI):
 - 1. A13.1 - Scheme for the Identification of Piping Systems.

1.03 SUBMITTALS

- A. Submit in accordance with Section 01330.
- B. Submit Following:
 - 1. Product data.
 - 2. Samples.
 - 3. Manufacturer's installation instructions.
 - 4. Submit following as specified in Section 01770:
 - a. Operation and Maintenance Data.
 - b. Warranty.

1.04 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with OSHA.

PART 2 PRODUCTS

2.01 RECYCLED WATER FACILITIES IDENTIFICATION

- A. Manufacturers:
 - 1. Warning Tape and Pipe Sleeves:
 - a. Terra Tape, Division of Reef Industries.

- b. T. Christy Enterprises, Inc.
 - c. Seaton Name Plate Co.
 2. Warning Labels and Signs: In all cases the warning labels or signs must be approved prior to installation. Failure to receive prior approval may result in the owner, applicant, or customer removing such sign(s) and providing approved replacement(s). All costs will be at the applicant's, owner's or customer's expense. Failure to comply with these requirements, as set forth herein will result in termination of service as provided for in the District's Rules and Regulations, Section 600.
 3. Witness Markers:
 - a. Carsonite Water line Markers - Carsonite International.
- B. Identification:
 1. The use of stenciled pipe will be accepted as an alternative to the use of warning tape.
 2. Buried DIP carrying recycled water shall be encased within a purple 8-mil polyethylene sleeve, per the requirements of Section 15251, with the words "RECYCLED WATER" stenciled with 2-inch black letters.
 3. Exposed DIP carrying recycled water shall have purple coatings with the words "RECYCLED WATER" stenciled with 2-inch black letters. Lettering shall be on both sides of the pipe each section of pipe.
 4. PVC or DIP carrying domestic water, and located in the vicinity of recycled water piping, shall have the words "DOMESTIC WATER" stenciled with 2-inch blue letters. Lettering shall be on both sides of the pipe in at least three places in an 18-foot section of pipe (total six places per section of pipe).
 5. PVC pipe carrying recycled water shall be purple in color with black letters. The stenciling shall appear on both sides of the pipe with the marking "RECYCLED WATER" in 5/8-inch letters repeated every 12 inches.
 6. All service lines shall be encased within a color-coded 8-mil polyethylene sleeve. Sleeve shall be blue in color for all domestic water services and purple in color for all recycled water services.
- C. Valve Boxes:
 1. All valve boxes for recycled water facilities shall have circular valve box covers with the inscription "RECYCLED " cast thereon, and shall be painted purple. Valve boxes for domestic water systems shall meet MCWD standards.
 2. All valve boxes installed in unpaved areas (open space areas) shall be marked with a witness pole; in addition to the above referenced markings.
- D. Color and Painting Schedule:
 1. Recycled water facilities shall be painted safety purple.
 2. Domestic water facilities shall be blue.
 3. Witness poles for recycled water lines, valves and appurtenances shall be purple.
 4. Witness poles for domestic water lines, valves and appurtenances shall be blue.

- E. Restriction of Public Access:
 - 1. All off-site recycled water facilities shall be restricted from public access so that the general public cannot draw water from the system. Facilities such as air release assemblies, blowoff hydrants, blow offs on strainers, and other such facilities, shall be restricted from public access.
 - 2. Recycled water facilities, both above and below grade, shall be housed in an approved lockable container colored purple. A sign reading "CAUTION: RECYCLED WATER" shall be installed, its size approved by the District representative. Other means of restricting public access may be approved by the District representative.

- F. Warning Signs and Labels:
 - 1. The District requires warning labels to be installed on all appurtenances in vaults, such as, but not limited to, air release valves, blow offs, and meters, and on designated facilities, such as, but not limited to, controller panels and wash down or blow off hydrants on water trucks and temporary construction services.
 - 2. Each pump and every pipe shall be identified with a painted label. In the fenced pump station area, at least one sign shall be posted on the fence that can be readily seen by all operations personnel utilizing the facilities.
 - 3. Painted labels may, at the District representative's discretion be acceptable in lieu of plastic labels.

- G. Materials:
 - 1. Buried Piping Warning Tape:
 - a. The plastic warning tape shall be an inert plastic film specifically formulated for prolonged underground use and shall be prepared with black printing on a purple field having the words, "CAUTION: RECYCLED WATER-LINE." Warning tape for domestic water pipeline shall be blue with black printing having the words, "CAUTION: DOMESTIC WATERLINE BURIED BELOW." The minimum thickness shall be 4 mils and the overall width of the tape shall be 6 inches for 8-inch pipe and larger, and 3 inches for 6-inch and smaller pipe.
 - 2. Warning Labels:
 - a. Labels shall be inert plastic film specifically formulated for prolonged exposure and shall be prepared with black printing on a purple field having the words: "CAUTION: RECYCLED WATER FACILITY." The minimum thickness shall be 4 mils for adhesive backed labels and 10 mils for tag type labels. Tag type labels shall have reinforced tie holes and shall be attached with heavy-duty nylon fasteners. The size, type of label, and location will be dictated by each individual application, and subject to acceptance by the District's representative. The minimum size shall be 1/2-inch letters.

2.02 EQUIPMENT NAMEPLATES

- A. Material and Fabrication:
 - 1. Stainless steel sheet engraved or stamped with text, holes drilled, or punch for fasteners.

- B. Fasteners:
 - 1. Number 4 or larger oval head stainless steel screws or drive pins.

- C. Text:
 - 1. Manufacturers name, equipment model number and serial number, identification tag number, and when appropriate, drive speed, motor horsepower with rated capacity, pump rated total dynamic head and impeller size.

2.03 SPECIAL ITEMS

- A. In addition, special coating of following items will be required:

Item	Color
Valve handwheels and levers	Red
Hoist hooks and blocks	Yellow and black stripes
Steel guard posts	In accordance with standard details.

- B. Paint minimum 2 inches high numbers on or adjacent to accessible valves, pumps, flowmeters, and other items of equipment which are identified on Drawings or in Specifications by number.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify satisfactory conditions of substrate for applying identification.
- B. Verify that conditions are satisfactory for installation and application of products as specified in Section 01600.

3.02 PREPARATION

- A. Prepare and coat surfaces as specified in Section 09960.
- B. Prepare surface in accordance with product manufacturer's instructions.

3.03 PIPING IDENTIFICATION

- A. Installation of Pipe Warning Tape:
 - 1. Warning tapes shall be installed 12 inches above the pipe longitudinally and shall be centered. The warning tape shall be installed continuously for the length of the pipe and per Standard Detail P-002.
- B. Installation of Warning Labels:
 - 1. Warning labels shall be firmly attached to all appurtenances using heavy-duty nylon fasteners.
- C. Installation of Witness Markers:
 - 1. Witness markers shall be installed over pipe in unpaved areas, open space areas, at appurtenances, including but not limited to valves, air release/vacuum breaks, dead ends, inflection points, tees, and at intervals not greater than 200 feet.

2. Witness markers shall be embedded into the soil at least 18-inches and shall be equipped with a barb or other such device to secure it in the surrounding soil.

3.04 APPLICATION

- A. Identify piping with legend markers, directional arrow markers, and number markers; use self adhesive arrow roll tape to secure ends of piping markers and indicate flow direction.
- B. Provide legend markers, directional arrow markers and number markers where piping passes through walls or floors, at piping intersections and at maximum 15 foot spacing on piping runs.
- C. Provide piping marker letters and colors as scheduled.
- D. Place markers on piping so they are visible from operator's position in walkway or working platform near piping. Locate markers along horizontal centerline of pipe, unless better visibility is achieved elsewhere.

END OF SECTION

SECTION 15110

VALVES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Basic requirements for valves.
- B. Related Sections:
 - 1. Section 15052 - Basic Piping Materials and Methods.
 - 2. Section 15211 - Ductile Iron Pipe, AWWA C151.

1.02 REFERENCES

- A. American National Standards Institute/American Society of Mechanical Engineers (ANSI/ ASME):
 - 1. B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges.
 - 2. B16.34 - Valves - Flanged, Threaded, and Welding End.
- B. American Society for Testing and Materials (ASTM):
 - 1. A 126 - Specification for Gray Iron Casting for Valves, Flanges, and Pipe Fittings.
 - 2. A 167 - Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - 3. A 536 - Specification for Ductile Iron Castings.
 - 4. E 527 - Practice for Numbering Metals and Alloys (UNS).
- C. American National Standards Institute/American Water Works Association (ANSI/AWWA):
 - 1. C 111/A21.11 - Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe Fittings.
- D. American Water Works Association (AWWA):
 - 1. C 504 - Standard for Rubber-Seated Butterfly Valves.
- E. SSPC – Society for Protective Coatings:
 - 1. SSPC SP 2 - Surface Preparation Specification for Hand Tool Cleaning.
 - 2. SSPC SP7 - Brush-Off Blast Cleaning.
 - 3. SSPC SP10 - Surface Preparation Specification for Near-White Blast Cleaning.

1.03 DESIGN REQUIREMENTS

- A. Pressure Rating:
 - 1. Suitable for service under minimum working pressures of 275 pounds per square inch gauge.

2. When a piping system is specified in the Piping Schedule to be tested at a pressure greater than 150 pounds per square inch gauge, provide valves for that piping system with design working pressure which is sufficient to withstand the test pressure.

B. Valve to Piping Connections:

1. Valves 3 inch nominal size and larger: Flanged ends.
2. Valves less than 3 inch nominal size: Screwed ends.
3. Plastic Valves in Plastic Piping:
 - a. Up to 2.5 Inches: Provide solvent or heat welded unions.
 - b. 3 inches and above: Provide solvent or heat welded flanges.

1.04 SUBMITTALS

A. Submit in accordance with Section 01330.

B. Submittals Prior to Installation:

1. Product Data: Submit detailed technical information relating to the valve including description of component parts, materials of construction, performance, dimensions, and weights.

C. Operation and Maintenance Data:

1. Furnish bound sets of installation, operation, and maintenance instructions for each type of manual valve 4 inch in nominal size and larger, and all non-manual valves. Include information on valve operators in operation and maintenance instruction manual.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Valves: Manufactured by manufacturers whose valves have had successful operational experience in comparable service.

1.06 DELIVERY STORAGE AND HANDLING

- A. Protect valves and protective coatings from damage during handling and installation; repair coating where damaged.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Stainless Steel: ASTM A 167, Type 316, or Type 304, UNS Alloy S31600 or S30400.
- B. Valve and Operator Bolts and Nuts:
1. Fabricated of stainless steel for the following installation conditions:
 - a. Submerged in sewage or water.
 - b. In an enclosed space above sewage or water.
 - c. In structures containing sewage or water, below top of walls.
 - d. At openings in concrete or metal decks.

2. Where dissimilar metals are being bolted, use stainless steel bolts with isolation bushings and washers.
 3. Underground Bolts: Low-alloy steel in accordance with AWWA C 111/A21.11.
- C. Bronze and Brass Alloys: Use bronze and brass alloys with not more than 6 percent zinc and not more than 2 percent aluminum in the manufacture of valve parts; UNS Alloy C83600 or C92200 unless specified otherwise.
- D. Valve Bodies: Cast iron in accordance with ASTM A 126, Class 30 minimum or ductile iron in accordance with ASTM A 536, Grade 65-45-12 minimum unless specified otherwise.

2.02 INTERIOR PROTECTIVE LINING

- A. When specified in the particular valve specification, provide valves with type of protective lining specified in the particular valve Specification.
- B. Apply protective lining to interior, non-working surfaces, except stainless steel surfaces.
- C. Lining Types:
1. Fusion Bonded Epoxy:
 - a. Manufacturers: One of the following or equal:
 - 1) 3-M Company, ScotchKote 134; certified to NSF 61 for drinking water use.
 - b. Clean surfaces to meet SSPC SP-7 or SP-10, as recommended by epoxy manufacturer.
 - c. Apply in accordance with manufacturer's published instructions.
 - d. Lining Thickness: 0.010 to 0.012 inches except that:
 - 1) Lining thickness in grooves for gaskets: 0.005 inches.
 - 2) Do not coat seat grooves in valves with bonded seat.
 - e. Quality Control:
 - 1) Lining thickness: Measured with a non-destructive magnetic type thickness gauge.
 - 2) Verify lining integrity with a wet sponge-testing unit operating at approximately 60 volts, or as recommended by the lining manufacturer.
 - 3) Consider tests successful when lining thickness meets specified requirements and when no pinholes are found.
 - 4) Correct defective lining disclosed by unsuccessful tests, and repeat test.
 - 5) Repair pinholes with liquid epoxy recommended by manufacturer of the epoxy used for lining.
 2. High Solids Epoxy:
 - a. Product: As specified in Section 09960:
 - 1) Certified to NSF 61 for drinking water use.
 - b. Clean surfaces to meet SP-7 or SP-10, or as recommended by coating manufacturer.
 - c. Apply coating in accordance with Section 09960 and coating manufacturer's recommendations.

- d. Quality Control: After coating is cured, check coated surface for porosity with a holiday detector set at 1,800 volts, or as recommended by coating manufacturer:
 - 1) Repair holidays and other irregularities and retest coating.
 - 2) Repeat procedure until holidays and other irregularities are corrected.

2.03 UNDERGROUND VALVES

- A. Provide underground valves with flanged, mechanical, or other type of joint required for the type of pipe to which the valve is to be connected.
- B. Coating and Wrapping:
 - 1. After installation, encase valves in 2 layers of polyethylene wrap as specified for ductile iron piping in Section 15251:
 - a. Ascertain that polyethylene wrapping does not affect operation of valve.

2.04 VALVE BOXES

- A. Provide cast-iron valve boxes at each buried valve to access valve and valve operators.
- B. Do not support boxes on valve, valve operator, or pipe.
- C. Boxes:
 - 1. 2-piece, fabricated of cast-iron; provide cover, with asphalt varnish or enamel protective coating.
 - 2. Adjustable to grade, install centered around the upper portions of the valve and valve operator.
- D. Manufacturers: One of the following or equal:
 - 1. Tyler Pipe Industries, Inc.
 - 2. Neenah Foundry Company.

2.05 VALVE OPERATORS

- A. Valve operator "Open" direction: Open counterclockwise.
- B. Provide valves located below operating level or deck with extensions for key operation or floor stands and handwheels.
- C. Provide manually operated valves located not more than 6 feet above the operating level with tee handles, wrenches, or handwheels:
 - 1. Make the valve operator more conveniently accessible by rolling valves, located more than 5 feet but less than 6 feet above the operating level, toward the operating side.
 - 2. Secure tee handles and wrenches to the valve head or stem, except where a handle or wrench so secured constitutes a hazard to personnel; in which case, stow handle or wrench immediately adjacent to the valve on or in a suitable hanger, bracket, or receptacle.

- D. Provide an operator shaft extension from valve or valve operator to finished grade or deck level when buried valves, and other valves located below the operating deck or level, are specified or indicated on the Drawings to be key operated; provide 2 inch square AWWA operating nut, and box and cover as specified, or a cover where a box is not required.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Preparation: Required information prior to installation:
 - 1. Install valves after the required submittal on installation has been accepted.
 - 2. Determine, after flanged valves and flanged check valves are selected, the face-to-face dimensions of flanged valves and flanged check valves.
- B. Fabricate piping to lengths taking into account the dimensions of flanged valves and flanged check valves.

3.02 INSTALLATION

- A. Provide incidental work and materials necessary for installation of valves including flange gaskets, flange bolts and nuts, valve boxes and covers, concrete bases, blocking, and protective coating.
- B. Where needed, furnish and install additional valves for proper operation and maintenance of equipment and plant facilities under the following circumstances:
 - 1. Where such additional valves are required for operation and maintenance of the particular equipment furnished by CONTRACTOR.
 - 2. Where such additional valves are required as a result of a substitution or change initiated by CONTRACTOR.
- C. Install valves with their stems in vertical position above the pipe, except as follows:
 - 1. Butterfly valves, gate valves aboveground, globe valves, ball valves, and angle valves may be installed with their stems in the horizontal position.
- D. Install valves so that handles clear obstructions when the valves are operated from fully open to fully closed.
- E. Place top of valve boxes flush with finished grade or as otherwise indicated on the Drawings.
- F. Valves with Threaded Connections:
 - 1. Install valves by applying wrench on end of valve nearest the joint to prevent distortion of the valve body.
 - 2. Apply pipe joint compound or Teflon tape on external (male) threads to prevent forcing compound into valve seat area.
- G. Valves with Flanged Connections:
 - 1. Align flanges and gasket carefully before tightening flange bolts.
 - 2. When flanges are aligned, install bolts and hand tighten.
 - 3. Tighten nuts opposite each other with equal tension before moving to next pair of nuts.

H. Valves with Soldered Connections:

1. Do not overheat connection to prevent damage to resilient seats and metal seat rings.
2. Position valves in full open position before starting soldering procedure.
3. Apply heat to piping rather than to valve body.

END OF SECTION

SECTION 15111

BALL VALVES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Metal body ball valves.
- B. Related Sections:
 - 1. Section 09960 - High-Performance Coatings.

1.02 REFERENCES

- A. American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME):
 - 1. B16.5 - Pipe Flanges and Flanged Fittings.
- B. American Petroleum Institute (API):
 - 1. 6D - Specification for Pipeline Valves (Gate, Ball, and Check Valves).
- C. American Society for Testing and Materials (ASTM):
 - 1. A 351 - Specification for Castings, Austenitic, Austenitic-Ferritic (Duplex), for Pressure-Containing Parts.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's catalog data describing Design and technical features for products specified.

PART 2 PRODUCTS

2.01 METAL BODY BALL VALVES, LESS THAN 6 INCH SIZE

- A. Manufacturers: One of the following, or approved equal:
 - 1. NIBCO, Inc.
- B. General:
 - 1. Type: Non-lubricated and capable of sealing in either direction.
 - 2. End Connections:
 - a. Threaded or solder ends for sizes 3-inch and smaller.
 - b. Class 150 flanged for sizes larger than 3 inch. Flanges shall conform to ANSI/ASME B16.1 standards.
 - 3. Stem Packing: Manually adjustable while valve is under pressure.
 - 4. Shafts: Rigidly connected to the ball by a positive means. The connection shall be designed to transmit torque equivalent to at least 75 percent of the torsional strength of the shaft.

5. Handles: Stainless steel latch lock handle with vinyl grip and stainless steel nut designed to open and close the valve under operating conditions.
6. Temperature Limits: Suitable for operation between minus 20 and 350 degrees Fahrenheit.

C. Materials:

1. Valves in Copper Lines: Bronze body.
2. Valves in Steel and Ductile Iron Piping: Ductile iron or cast steel body.
3. Valves in Stainless Steel Piping: Stainless Steel body, material type to match piping material specified in Section 15052.
4. Ball: Type 304 or 316 stainless steel.
5. Seats: TFE.
6. Stem Seals: TFE or Viton.
7. Bearings: Self-lubricated, corrosion resistant material that will not contaminate potable water.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General: Install each type of valve in accordance with manufacturers' printed instructions.

3.02 FIELD APPLIED COATING OF VALVE EXTERIOR

- A. Match color and be compatible with manufacturer's coating system and as specified in Section 09960.
 1. When shop applied finish coating matches field applied coating on adjacent piping, touch up shop coating in damaged areas in accordance with instructions recommended by the paint manufacturer.
 2. When shop applied coating does not match field coating on adjacent piping, or when damage has occurred to the shop applied coating that requires more than touchup, blast clean valve surfaces or utilize other surface preparation recommended by the manufacturer of the coating material and apply the coating system used for coating adjacent piping.

END OF SECTION

SECTION 15112
BUTTERFLY VALVES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Metal body butterfly valves.
- B. Related Sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 13446 - Valve and Gate Operators.
 - 3. Section 15050 - Basic Mechanical Materials and Methods.
 - 4. Section 15052 - Basic Piping Materials and Methods.
 - 5. Section 15110 - Valves.
 - 6. Section 15211 - Ductile Iron Pipe: AWWA C151.

1.02 REFERENCES

- A. American Society of Mechanical Engineers/American National Standards Institute/ (ASME/ANSI):
 - 1. ASME/ANSI B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Classes 25, 125 and 250.
 - 2. ASME/ANSI B16.5 - Pipe Flanges and Flanged Fittings, NPS 1/2 through NPS 24.
- B. American Society for Testing and Materials (ASTM):
 - 1. A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - 2. A216 - Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for Higher-Temperature Service.
 - 3. A276 - Standard Specification for Stainless Steel Bars and Shapes.
 - 4. A351 - Standard Specification for Castings, Austenitic, Austenitic-Ferritic (Duplex), for Pressure-Containing Parts.
 - 5. A395 - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
 - 6. A479 - Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels.
 - 7. A515 - Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate - and Higher-Temperature Service.
 - 8. A516 - Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower-Temperature Service.
 - 9. A536 - Standard Specification for Ductile Iron Castings.
 - 10. A564 - Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes.
 - 11. A743 - Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.

12. B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
 13. D429 - Standard Test Methods for Rubber Property-Adhesion to Rigid Substrate.
- C. American Water Works Association (AWWA):
1. C110 - Standard for Ductile-Iron and Gray-Iron Fittings 3 Inches through 48 Inches for Water and Other Liquids.
 2. C504 - Standard for Rubber-Seated Butterfly Valves.
 3. C540 - Standard for Power-Actuating Devices for Valves and Sluice Gates.
 4. C550 - Standard for Protective Interior Coatings for Valves and Hydrants.
 5. C606 - Standard for Grooved and Shouldered Joints.
- D. Compressed Gas Association (CGA):
1. Standard G-4.1 - Cleaning Equipment for Oxygen Service.
- E. National Sanitation Foundation (NSF/ANSI):
1. Standard 61 - Drinking Water System Components - Health Effects.

1.03 SYSTEM DESCRIPTION

- A. Design Requirements:
1. General Purpose AWWA Butterfly Valves:
 - a. Design Standard: Provide valves designed and manufactured in accordance with AWWA C504.
 - b. Class:
 - 1) Provide butterfly valves conforming to AWWA Class 250B in piping systems with test pressure greater than 150 pounds per square inch and less than 250 pounds per square inch, unless otherwise specified.
 2. High pressure butterfly valves:
 - a. Piping systems designed for operating pressures greater than 250 pounds per square inch and less than 450 pounds per square inch: Provide ASME B16.5, Class 300 high pressure valves.
- B. Usage:
1. Provide and install butterfly valve types as outlined in the Butterfly Valve Application Schedule at the end of this Section.
- C. Design Requirements for All Butterfly Valves:
1. Design valves and actuators for maximum operating torque, in accordance with and using safety factors required in AWWA C540, using the following values:
 - a. Maximum water velocity: 16 feet per second with valve fully open.
 - b. Maximum pressure differential across the closed valve: Equal to the pressure class designation.
 - c. Coefficient for seating and unseating torque, dynamic torque, and bearing friction in accordance with valve manufacturer's published recommendations.
 2. Valve Disc: Seat in an angular position of 90 degrees to the pipe axis and rotate an angle of 90 degrees between fully open and fully closed positions:
 - a. Do not supply valves with stops or lugs cast with or mechanically secured to the body of the valve for limiting the disc travel.

3. Unacceptable Thrust Bearings: Do not provide valves with thrust bearings exposed to the fluid in the line and consisting of a metal bearing surface in rubbing contact with an opposing metal bearing surface.
- D. Performance Requirements:
1. Tight shutoff at the pressure rating of the valve with pressure applied in either direction.
 2. Suitable for the following service conditions:
 - a. Throttling.
 - b. Frequent operation.
 - c. Operation after long periods of inactivity.
 - d. Installation in any position and flow in either direction.

1.04 SUBMITTALS

- A. Shop Drawings: Submit information specified in Section 01330 and Section 15050 and the following:
1. Certified drawings and material specifications.
 2. For General Purpose AWWA Butterfly Valves, include description of the method of attachment of the disc edge to the valve disc.
- B. Product Data: Include manufacturer's published recommendations for seating and unseating torque coefficient, dynamic torque, and bearing friction for calculation of maximum operating torque.
- C. Certificates:
1. General Purpose AWWA Butterfly Valves:
 - a. Proof-of-Design Tests: Certified statement that proof-of-design tests were performed and all requirements were successfully met.
 - b. Affidavit of compliance attesting valves provided comply with all provisions of AWWA C504.
 2. Interior Epoxy Coatings: Affidavit of compliance attesting that epoxy coatings applied to interior surfaces of butterfly valves comply with all provisions of AWWA C550.
 3. Certification, for all valves and coatings in contact with potable water, that the products used are suitable for contact with drinking water in accordance with NSF/ANSI Standard 61.

PART 2 PRODUCTS

2.01 GENERAL PURPOSE AWWA BUTTERFLY VALVES

- A. Manufacturers: One of the following or equal:
1. DeZurik.
 2. Henry Pratt Company.
- B. Valve Body:
1. Material: Cast iron, ASTM A126, Grade B, or ductile iron, ASTM A536, Grade 65-45-12.
 2. Body Design:
 - a. Flanged Body Valves:

- 1) Usage: Comply with limitations specified in the Butterfly Valve Application Schedule.
- 2) Flanges: ASME/ANSI B16.1 Class 125 flanges for Class 150B valves, ASME/ANSI B16.1 Class 250 flanges for Class 250B valves.

C. Disc:

1. Material: Cast iron or ductile iron with Type 316 stainless steel edge that matches seat in valve body.
2. Secure valve disc to shaft by means of smooth-sided, taper or dowel pins, Type 316 stainless steel or Monel.
3. Extend pins through full diameter of shaft and mechanically secure in place.

D. Shaft and Bearings:

1. Shaft Design:
 - a. Valves 20-inch and less: One piece, through disc design.
2. Shaft Seal: Vee type, chevron design.
3. Shaft Material for Class 150B Valves: Type 316 stainless steel, ASTM A276.
4. Shaft Material for Class 250B Valves: Type 17-4 pH stainless steel, ASTM A564.
5. Shaft Bearings: Self-lubricating sleeve type; Teflon with stainless steel or fiberglass backing.

E. Seats:

1. Seat Materials: EPDM.
2. For valves 20 inches in nominal size and smaller, bond or vulcanize seat into the valve body.
3. Resilient Seat: Withstand 75 pound per inch pull when tested in accordance with ASTM D429, Method B.

F. Valve Packing:

1. Valves 4 inch to 48 inch nominal size: Self-adjusting V-type packing or chevron-type packing. EPDM.

2.02 HIGH PRESSURE BUTTERFLY VALVES

A. Manufacturers: One of the following or equal:

1. Crane Flowseal.
2. Neles-Jamesbury.

B. Valve body:

1. Material: Carbon steel ASTM A515 or A516, Grade 70, or ASTM A216, WCB.
2. Body design: Flanged, in accordance with ASME B16.5, Class 300 dimensions. Wafer and lugged style valves may not be used for high-pressure service.

C. Disc:

1. Offset disc.
2. Material: Type 316 stainless steel, ASTM A351, Grade CF-8M.

D. Shaft and bearings:

1. Shaft: Type 316 stainless steel, ASTM A479 or Type 17-4 PH stainless steel, ASTM A564.

2. Shaft bearings: Self-lubricating sleeve type; Teflon with stainless steel or fiberglass backing.
- E. Disc pins: Secure valve disc to shaft by means of solid, smooth-sided, taper or dowel pins, Type 316 stainless steel or Monel:
1. Extend pins through shaft and mechanically secure in place.
- F. Seats:
1. Material: Teflon, or Teflon with titanium back-up ring.
 2. Seat retainer ring:
 - a. If used on sizes above 20-inch: Type 316 stainless steel with stainless steel fasteners.
 - b. Type 316 stainless steel for digester gas applications.
 - c. For all such valves, bond the seat to the retention ring.
- G. Valve shaft packing: Teflon, chevron type design. Field adjustable and field replaceable.

2.03 BUTTERFLY VALVE ACTUATORS

- A. Additional requirements for manual actuators are in Section 13446.
- B. Manual actuators for aboveground valves in nominal sizes and in service applications other than specified above, except for valves 30 inches and larger:
1. For valves operating at pressures up to and including 250 pounds per square inch, provide either a totally enclosed worm gear actuator or a totally enclosed traveling nut actuator mounted on the valve.
 2. For valves operating at pressures above 250 pounds per square inch, provide totally enclosed worm gear actuator mounted on the valve.
- C. Manual actuators for buried or submerged valves, all sizes and pressures:
1. Provide totally enclosed worm gear actuator mounted on the valve.
 2. Actuators for buried or submerged valves shall be hermetically sealed and grease packed.
 3. For buried valves, provide 2-inch square AWWA nut on enclosed actuator.
 4. For buried valves, provide extension stem, valve box and valve box cover in accordance with Section 15110.
- D. Position Indication:
1. For all aboveground worm gear or traveling nut manual actuators, provide position indication on the actuator enclosure.

2.04 COATING

- A. Shop coat interior and exterior metal surfaces of valves per manufacture recommendations, except as follows:
1. Interior machined surfaces.
 2. Surfaces of gaskets and elastomeric seats and stem seals.
 3. Bearing surfaces.
 4. Stainless steel surfaces and components.
- B. Coating material for potable water applications:

1. Formulate interior coating material from materials in accordance with CFR 21, AWWA C550, and NSF 61.
- C. Submit affidavit of compliance attesting that epoxy coatings applied to interior surfaces of butterfly valves in accordance with CFR 21, AWWA C550, and NSF 61.
- Field Applied Coatings:
1. Additional coating of the valve exterior will be required to match the epoxy or epoxy/polyurethane paint system:
 - 1) When shop applied finish coating matches field applied coating on adjacent piping, touch up shop coating in damaged areas in accordance with instructions recommended by the paint manufacturer.
 - 2) When shop applied coating does not match field coating on adjacent piping, or when damage has occurred to the shop applied coating that requires more than touchup, blast clean valve surfaces or utilize other surface preparation recommended by the manufacturer of the coating material and apply the coating system used for coating adjacent piping.
- D. Surface Coatings:
1. Interior surfaces: Fusion Bonded Epoxy.
 2. Exterior Surfaces of Valves, Actuators, and Accessories:
 - a. Submerged Valves: High solids epoxy.
 - b. Buried Valves: Coal tar epoxy.
 - c. Other Valves: High solids epoxy.
 3. Polished and machined surfaces: Apply rust-preventive compound.
- E. Coating Materials:
1. High Solids Epoxy and Coal Tar Epoxy:
 - a. Products: Coating product in contact with potable water must be acceptable under AWWA C550 and NSF-61.
 2. Rust-preventive compound: One of the following or equal:
 - a. Houghton, Rust Veto 344.
 - b. Rust-Oleum, R-9.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install valves with valve shafts horizontal, unless a vertical shaft is required to suit a particular installation, and unless a vertical shaft is indicated on the Drawings.
- B. Install pipe spools or valve spacers in locations where butterfly valve disc travel may be impaired by adjacent pipe lining, pipe fittings, valves, or other equipment.
- C. Wrap buried valves with 2 layers of linear low density polyethylene film having a minimum thickness of 8 mils, in accordance with AWWA C105.
- D. Valve shall be anchored in concrete per MCWD Standard plan W-7.

BUTTERFLY VALVE APPLICATION SCHEDULE	
Valve Type and Style	Acceptable Applications
General Purpose AWWA Butterfly Valves – Flanged Body Design	Aboveground or submerged in the following service applications only: <ul style="list-style-type: none"> - Acceptable in all service applications except oxygen and ozone service and high-pressure service. - May be used in buried applications when required by the specified piping system.
General Purpose AWWA Butterfly Valves – Mechanical Joint Body Design	Buried in the following service applications only: <ul style="list-style-type: none"> - Acceptable in all service applications except oxygen and ozone service and high-pressure service.
General Purpose AWWA Butterfly Valves – Lugged Body Design	Aboveground in the following service applications only: <ul style="list-style-type: none"> - Aeration Air Systems
General Purpose AWWA Butterfly Valves – Wafer (not lugged) Body Design	Not allowed.
General Purpose AWWA Butterfly Valves – Grooved End Body Design	Aboveground, in sizes 20-inch and less, with piping system test pressure less than 100 psi, and in the following service applications only: <ul style="list-style-type: none"> - Acceptable in all service applications, except oxygen and ozone service, where piping for that service is specified in the Piping Schedule to have grooved end joints.
High Pressure Butterfly Valves – Flanged Body Design	Service applications with piping system test pressure greater than 250 psi. Acceptable in aboveground and buried installations.
High Pressure Butterfly Valves – Wafer or Lugged Wafer Body Design	Not allowed.
Industrial Class Butterfly Valves – Lugged Body Design	Aboveground in the following service applications only: <ul style="list-style-type: none"> - Aeration Air Systems - Natural Gas Systems - Digester Gas Systems - Chilled and Hot Water Systems
Industrial Class Butterfly Valves – Wafer (not lugged) Body Design	Not allowed.
Stainless Steel Butterfly Valves - Lugged Body Design	Aboveground in the following service applications only: <ul style="list-style-type: none"> - Oxygen Systems - Ozone Systems
Stainless Steel Butterfly Valves – Wafer (not lugged) Body Design	Not allowed.

END OF SECTION

SECTION 15114

CHECK VALVES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Cushioned swing.
 - 2. Duckbill Style Check

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. A 48 - Specification for Gray Iron Castings.
 - 2. A 126 - Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - 3. A 276 - Specification for Stainless Steel Bars and Shapes.
 - 4. B 582 - Specification for Nickel-Chromium-Iron-Molybdenum-Copper Alloy Plate, Sheet, and Strip.
 - 5. B 584 - Specification for Copper Alloy Sand Castings for General Applications.
- B. American Water Works Association (AWWA):
 - 1. C 508 - Standard for Swing-Check Valves for Waterworks Service 2 Inch Through 24 Inch NPS.

1.03 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Check Valves: When not otherwise specified as indicated on the Drawings, provide check valves suitable for service as follows:
 - a. In either horizontal or vertical position.
 - b. Under pressures equal and less than 200 pounds per square inch gauge.

PART 2 PRODUCTS

2.01 CUSHIONED SWING CHECK VALVES

- A. Manufacturers: One of the following or equal:
 - 1. Crispin, Series SWC-AC.
 - 2. APCO, Air Cushioned Swing-Check, Series 6000.
- B. Valve Design:
 - 1. Counter-weighted.
 - 2. Rubber seated and drip tight.
 - 3. Totally enclosed pneumatic dampening chambers with adjustment for closing speed.

- C. Materials:
 - 1. Valve Body, Cover, and Disc: Cast-iron, ASTM A 126, Class B.
 - 2. Disc Seat: Buna N.
 - 3. Shaft: Stainless steel.
 - 4. Cushion Cylinder: Corrosion resistant metal.
 - 5. Disc Ring Seat: Bronze.
 - 6. Seat Pins and Lock Screws: Stainless steel.

2.02 DUCKBILL CHECK VALVES

- A. Manufacturers: One of the following or equal:
 - 1. Tide Flex, Series 35-1.
 - 2. Or equal.
- B. Design:
 - 1. Maximum downstream head: 0 feet.
 - 2. With internal pressure 1 to 2 inches w.c. above backpressure, bill of valve opens, allowing flow.
- C. End connection:
 - 1. Flanged.
- D. Materials of construction:
 - 1. Single piece elastomer construction with internal polyester fabric reinforcing all vulcanized into a composite material:
 - a. Internal reinforcing sufficient to maintain structural integrity under the specified operating conditions.
 - b. Exterior applications require coating for UV protection and to resist pest gnawing.
 - c. Elastomeric material: EPDM.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install valves in accordance with Section 15110 and the manufacturer's instructions.
- B. Flapper Type Check Valves:
 - 1. Install with proper orientation of flow direction arrow on valve body.
 - 2. When installed in horizontal pipelines, mount with shaft on vertical locations.
 - 3. When mounted in a vertical pipeline, directly downstream of an elbow, mount with the shaft perpendicular to the outermost portion of the elbow.
 - 4. Mount on downstream side of discharge silencer when used on positive displacement and centrifugal blowers.

3.02 ADJUSTING

- A. Adjust cushioned swing check valves in the field by means of external adjustment devices to minimize pressure surges.
- B. Adjust weight on swing check valves to affect proper closing action on equipment shutdown.

END OF SECTION

SECTION 15115

GATE VALVES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Gate valves.
- B. Related Sections:
 - 1. Section 15110 - Valves.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. B 98 - Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.
- B. American Water Works Association (AWWA):
 - 1. C 509 - Standard for Resilient-Seated Gate Valves for Water-Supply Service (includes addendum C509a-95).
 - 2. C 550 - Standard for Protective Interior Coatings for Valves and Hydrants.

PART 2 PRODUCTS

2.01 GATE VALVES

- A. Gate Valves Aboveground:
 - 1. Valves less than 3 inches in size for clean water and air service: Manufacturer's standard bronze, solid wedge disc, rising stem, screwed end, Class 250 pounds:
 - a. Manufacturers: One of the following or equal:
 - 1) Crane, Figure 431.
 - 2) Jenkins, Figure 47.
 - 3) Lunkenheimer Company, Figure 2151.
 - 2. Valves 3 inches in size and larger:
 - a. Resilient wedge type in compliance with AWWA C509.
 - b. Flange, iron body, and bonnet rated for 200 pound working pressure. Provide O-ring seal between valve body and bonnet.
 - c. Ductile or cast iron wedge encapsulated in nitrile rubber and capable of sealing in either flow direction.
 - d. Bronze stem with double or triple O-ring or braided packing stem seals.
 - e. Rising stem configuration with handwheel diameter sized to allow opening of valve with no more than a 40 pound pull.
 - f. Coat interior and exterior surfaces of valve body and bonnet with fusion bonded epoxy in accordance with AWWA C550.
 - g. Manufacturers: One of the following or equal:
 - 1) M&H/Kennedy Valve Company.
 - 2) Mueller.
 - 3) American Flow Control, Series 2500.

- B. Gate Valves Underground:
1. Resilient wedge type in compliance with AWWA C509.
 2. Iron body, resilient seat, non-rising stem, double O-ring stem seal.
 3. Ductile or cast iron wedge encapsulated in nitrile rubber and capable of sealing in either flow direction.
 4. Bronze stem with double or triple O-ring or braided packing stem seals.
 5. Coat interior and exterior surfaces of valve body and bonnet with fusion bonded epoxy in accordance with AWWA C550.
 6. Valve Operator: Provide standard AWWA 2-inch operating nut, matching valve key, and valve box for operating stem.
 7. Manufacturers: One of the following or equal:
 - a. Mueller Company A-2361.
 - b. American Flow Control, Series 3500.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install valves in accordance with Section 15110 and manufacturer's instructions.

END OF SECTION

SECTION 15119

AIR AND VACUUM RELIEF VALVES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Air release valves, air and vacuum valves, and air vents.
- B. Related Sections:
 - 1. Section 15110 - Valves.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. A 126 - Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - 2. A 240 - Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.
 - 3. A 270 - Specification for Seamless and Welded Austenitic Stainless Steel Sanitary Tubing.
 - 4. B 584 - Specification for Copper Alloy Sand Castings for General Applications.

1.03 SUBMITTALS

- A. Submit in accordance with Section 15110.
- B. Product Data: Detailed technical information relating to each type of valve including description of component parts, materials of construction, performance information, dimensions, and weights.
- C. Operations and Maintenance Data: Furnish bound sets of installation, operation, and maintenance instructions for each type of valve.

PART 2 PRODUCTS

2.01 COMBINATION AIR VALVES, WATER SERVICE

- A. Pipeline Valves (1-Inch) :Manufacturers: One of the following or equal:
 - 1. Valve and Primer Corporation, DeZurik/APCO, Series 140C.
 - 2. Multiplex Manufacturing Company, Crispin UL Series.
- B. Surge Protection Valve (3-Inch) :Manufacturers: One of the following or equal:
 - 1. Valve and Primer Corporation, DeZurik/APCO 1500C with 200A air release valve (as indicated on drawings).
 - 2. Crispin UL Series.
 - 3. Vent-o-Max, RBX.

- C. Design:
1. Operation: Automatic exhaust of large quantities of air from pipelines during filling and draining and release of accumulated air while pipeline is under pressure.
 2. Utilize compound lever system in conjunction with large and small orifices.
 3. Internal parts removable through top cover without removing valve from pipeline.
 4. Pressure Rating: 300 pounds per square inch.
 5. Inlet:
 - a. Screwed, 2-inch size and smaller.
 - b. Flanged 3-inch size and larger.
- D. Materials:
1. Body: Cast iron.
 2. Float: Stainless steel, type 316.
 3. Needle: Buna-N.
 4. Lever Frame: Cast iron or Delrin.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with Section 15110 and manufacturer's instructions.

END OF SECTION

SECTION 15120
PIPING SPECIALTIES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Piping specialties including:
 - 1. Pipe saddles for ductile iron pipe.
- B. Related Sections:
 - 1. Section 15052 - Basic Piping Materials and Methods.

1.02 REFERENCES

- A. American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME).
- B. American National Standards Institute/American Water Works Association (ANSI/AWWA):
 - 1. ANSI/AWWA C153/A21.53 - Ductile Iron Compact Fittings.
 - 2. ANSI/AWWA C111/A21.11 - Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.
 - 3. ANSI/AWWA C110/A21.10 - Ductile Iron and Gray Iron Fittings.
 - 4. ANSI/AWWA C213 - Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipelines.
 - 5. ANSI/AWWA C151/A21.51 - Ductile Iron Pipe, Centrifugally Cast.
- C. American Society for Testing and Materials (ASTM):
 - 1. ASTM A148 - Specification for Steel Castings, High-Strength, for Structural Purposes.
 - 2. ASTM A536 - Specification for Ductile Iron Castings.
- D. Society of Automotive Engineers (SAE).

1.03 SUBMITTALS

- A. Submit in accordance with Section 01330.
- B. Product Data:
 - 1. Manufacturer's certificate attesting successful performance of specified tests.
 - 2. Shop drawings detailing dimensions and materials. Provide weights for each size of ball type flexible expansion joint used on the project.
 - 3. Manufacturer's published installation instructions.
 - 4. Operation and maintenance manuals.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Per manufactures requirements.

PART 2 PRODUCTS

2.01 PIPE SADDLES FOR DUCTILE IRON PIPE

- A. Manufacturers: One of the following or equal:
 - 1. BTR Inc./Smith-Blair, Inc., Style 317.
 - 2. Romac Industries, Inc., Style 202S.

- B. Materials:
 - 1. Pipe Saddles: Ductile iron.
 - 2. Straps, Bolts, and Nuts: Type 304 stainless steel with Teflon coating on nuts.
 - 3. Gaskets: Rubber.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Pipe Saddles:
 - 1. Coat threads on bolts with anti-gall coating prior to installation.

END OF SECTION

SECTION 15121

PIPE COUPLINGS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Bolted, split-sleeve coupling.
 - 2. Bolted, split-sleeve flange adapter coupling.
 - 3. Dismantling joints.
 - 4. Flanged coupling adapters.
 - 5. Flexible couplings.
 - 6. Restrained flange coupling adapters.

- B. Related Sections:
 - 1. Section 15052 - Basic Piping Materials and Methods.
 - 2. Section 15956 - Piping System Testing.

1.02 REFERENCES

- A. American National Standards Institute/National Science Foundation (ANSI/NSF):
 - 1. ANSI/NSF 61 - Drinking Water System Components - Health Effects.

- B. American Society for Testing and Materials (ASTM):
 - 1. A 36 - Standard Specification for Carbon Structural Steel.
 - 2. A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dip, Zinc-Coated, Welded and Seamless.
 - 3. A 193 - Standard Specification for Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service.
 - 4. A 536 - Standard Specification for Ductile Iron Castings.
 - 5. A 563 - Standard Specification for Carbon and Alloy Steel Nuts.
 - 6. A 576 - Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
 - 7. F 593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

- C. American Water Works Association (AWWA):
 - 1. C111 - AWWA Standard for Rubber Gasket Joints for Ductile Iron Pipe and Fittings.
 - 2. C207 - AWWA Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In. (100mm through 3,600mm).

1.03 SUBMITTALS

- A. Shop drawings, detailing dimensions, and materials.
- B. Piping Layout Drawings: Coordinate preparation of required piping layout drawings such that coupling center sleeve sizes are clearly identified on drawings.
- C. Manufacturer's published installation instructions.

PART 2 PRODUCTS

2.01 PIPE COUPLINGS FOR DUCTILE IRON PIPING

- A. Dismantling Joints:
 - 1. Manufacturers: One of the following or equal:
 - a. Romac Industries, Inc., Style DJ400.
 - b. Smith-Blair, Inc., Series 975.
 - 2. Materials:
 - a. Flanged Spool:
 - 1) C207 Schedule 40 steel pipe in accordance with ASTM A 53 for sizes 3 inches to 12 inches.
 - 2) Steel for pipe in accordance with ASTM A 36 for sizes 14 inches to 72 inches.
 - b. End Ring and Body:
 - 1) For sizes 3 inches to 12 inches, ductile iron in accordance with ASTM A 536.
 - 2) For sizes 14 inches to 72 inches, steel in accordance with ASTM A 36 or A 53.
 - c. Follower Ring: Ductile iron in accordance with ASTM A 536 or steel in accordance with ASTM A 36 or A 576.
 - d. Bolts and Hex Nuts:
 - 1) Aboveground: High strength, low alloy steel in accordance with AWWA C111.
 - 2) Buried and Underwater: Type 316 stainless steel bolts in accordance with ASTM F 593.
 - e. Tie Rods: High tensile steel in accordance with ASTM A 193 Grade B7.
 - 3. Flange Design: Class E steel ring flange in accordance with AWWA C207, compatible with ANSI Class 125 and 150 bolt circles.
 - 4. Coating and Lining: Manufacturer's standard fusion bonded epoxy, ANSI/NSF 61 certified.
- B. Flanged Coupling Adapters: 12 inch size and smaller:
 - 1. Manufacturers: One of the following or equal:
 - a. Smith-Blair, Inc., Series 912.
 - b. Dresser, Inc., Style 227.
 - c. Baker Series 601.
 - 2. Materials:
 - a. Flanged Body: Ductile iron in accordance with ASTM A 536.
 - b. Follower Ring: Ductile iron in accordance with ASTM A 536.

- c. Bolts and Hex Nuts:
 - 1) Aboveground: High strength, low alloy steel in accordance with AWWA C111.
 - 2) Buried and Underwater: Type 316 stainless steel bolts in accordance with ASTM A 193 (Grade B 8M) for bolts and ASTM A194 (Grade 8M) for nuts.
 - 3. Flange Design: Class E steel ring flange in accordance with AWWA C207 compatible with ANSI Class 125 and 150 bolt circles.
 - 4. Coating and Lining: Manufacturer's standard fusion bonded epoxy, ANSI/NSF 61 certified.
- C. Flanged Coupling Adapters: Greater than 12 inch size:
- 1. Manufacturers: One of the following or equal:
 - a. Smith-Blair, Inc., Series 913.
 - b. Dresser, Inc., Style 128-W.
 - c. Baker Series 601.
 - 2. Materials:
 - a. Flange and Flanged Body: Ductile iron or low carbon steel having a minimum yield strength of 30,000 pounds per square inch.
 - b. Follower Ring: Low carbon steel having a minimum yield strength of 30,000 pounds per square inch.
 - c. Bolts and Hex Nuts:
 - 1) Aboveground: High strength, low alloy steel in accordance with AWWA C111.
 - 2) Buried and Underwater: Type 316 stainless steel bolts in accordance with ASTM A 193 (Grade B 8M) for bolts and ASTM A194 (Grade 8M) for nuts.
 - 3. Flange Design: Class E steel ring flange in accordance with AWWA C207 compatible with ANSI Class 125 and 150 bolt circles.
 - 4. Coating and Lining: Manufacturer's standard fusion bonded epoxy, ANSI/NSF 61 certified.
- D. Flexible Couplings:
- 1. Manufacturers: One of the following or equal:
 - a. Dresser, Inc., Style 253.
 - b. Smith-Blair, Inc., Series 441.
 - c. Baker Series 200.
 - 2. Materials:
 - a. Center Rings: Ductile iron in accordance with ASTM A 536.
 - b. Follower Rings: Ductile iron in accordance with ASTM A 536.
 - c. Bolts and Hex Nuts:
 - 1) Aboveground: High strength, low alloy steel in accordance with AWWA C111.
 - 2) Buried and Underwater: Type 316 stainless steel in accordance with ASTM F 593.
 - 3. Coating and Lining: Manufacturer's standard fusion bonded epoxy, ANSI/NSF 61 certified.

4. Center Sleeve Dimensions: Provide center sleeves with lengths in accordance with following table:

Nominal Pipe Size	Sleeve Length
3 inch and smaller	Manufacturer's standard
4 inch through 8 inch	7 inches
10 inch through 14 inch	12 inches
Greater than 16 inch	Use steel flexible coupling per Paragraph 2.02

- E. Restrained Flange Coupling Adapter:
1. Manufacturers: One of the following or equal:
 - a. Romac Industries, Inc., Style RFCA.
 - b. EBAA Iron Inc., Series 2100.
 2. Materials:
 - a. Flange and Flanged Body: Ductile iron in accordance with ASTM A 536.
 - b. Follower Ring: Lug type restraint system:
 - 1) Follower Ring: Ductile iron in accordance with ASTM A 536.
 - 2) Restraining Lugs: Ductile iron in accordance with ASTM A 536:
 - a) Designed to contact the pipe and apply forces evenly.
 - 3) Restraining Bolts: Ductile iron in accordance with ASTM A 536. Bolt heads shall be designed to twist off when the proper torque has been applied.
 - c. Bolts and Hex Nuts:
 - 1) Aboveground: High strength, low alloy steel in accordance with AWWA C111.
 - 2) Buried and Underwater: Type 316 stainless steel bolts in accordance with ASTM F 593.
 3. Flange Design: Class E steel ring flange in accordance with AWWA C207 compatible with ANSI Class 125 and 150 bolt circles.
 4. Coating and Lining: Manufacturer's standard fusion bonded epoxy, ANSI/NSF 61 certified.
 5. Angular Deflection: Restrained flange coupling adapter must allow angular deflection after assembly.

PART 3 EXECUTION

3.01 INSTALLATION

- A. In underground and underwater installations, coat the exterior of coupling with a protective coating after installation.
- B. Flexible Couplings and Flange Coupling Adapters: Install with gap between pipe ends in accordance with the following table unless a greater gap is indicated on the Drawings. Maximum gap tolerance shall be within 1/8 inch:
 1. Install flexible coupling with pipe gap located in middle of center sleeve.

2. Install flanged coupling adapter with end of plain end pipe in middle of flanged coupling body:

Center Ring Length	Gap Dimension and Tolerance
4 inch through 6 inch	3/8 inch
7 inch	5/8 inch
10 inch and greater	7/8 inch

- C. Provide harnesses (tie-downs) for flexible couplings unless otherwise indicated on the Drawings with a written note:
 1. Design harnesses (tie-downs) for the test pressures as specified in the Piping Schedule in Section 15052.

- D. Bolted, Split-Sleeve Couplings:
 1. Inspect each coupling to insure that there are no damaged portions of the coupling. Particular attention should be paid to the sealing pad/sealing plate area. Before installation, thoroughly clean each coupling of any foreign substance which may have collected thereon and shall be kept clean at all time thereafter.
 2. Wrenches used shall be of a size and type recommended by the manufacturer. Bolts and studs shall be tightened so as to secure a uniform gasket compression between the coupling and the body of the pipe with all bolts or studs tightened approximately the same amount. Final tightening shall be done by hand (no air impact wrenches) and is complete when the coupling is in uniform contact around the circumference of the pipe.
 3. The deflection in the joint between the pipe ends shall not exceed the maximum deflection recommended by the manufacturer. No joint shall be misfit any amount that would be detrimental to the strength and water tightness of the finished joint.
 4. On the fixed ends of bolted, split-sleeve couplings, the shoulders shall bear on the restraint rings all around with no gap.

- E. Install Dismantling Joints and Flange Coupling Adapters per manufactures installation instructions.

END OF SECTION

SECTION 15128

FORCE BALANCED DUCTILE IRON BALL-TYPE FLEXIBLE EXPANSION JOINTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Force balanced ductile iron ball-type flexible expansion joints.
- B. Related sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 15052 - Common Work Results for General Piping.
 - 3. Section 15211 - Ductile Iron Pipe: AWWA C151.

1.02 REFERENCES

- A. American Water Works Association (AWWA):
 - 1. C110 - Ductile-Iron and Gray-Iron Fittings.
 - 2. C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - 3. C153 - Ductile-Iron Compact Fittings for Water Service.
 - 4. C210 - Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
 - 5. C213 - Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
- B. ASTM International (ASTM):
 - 1. A536 - Standard Specification for Ductile Iron Castings.

1.03 SYSTEM DESCRIPTION

- A. Design requirement:
 - 1. Performance requirements:
 - a. Joints capable of angular deflecting and expanding or contracting simultaneously without leakage.
 - b. Angular deflection: Capable of providing a minimum angular deflection from centerline at each ball joint as follows:
 - 1) 14 to 24-inch pipe: 15 degrees.
 - c. Axial movement capacity: Unless otherwise indicated on the Drawings, factory pre-set axial movement to reserve 50 percent of the total axial movement capacity for expansion and 50 percent of the total axial movement capacity for compression. Provide one or more expansion sleeves to provide a total axial movement:
 - 1) 24 inch: 10 inch minimum expansion or compression.
 - d. Working pressure rating:
 - 1) Sizes 4 inch through 24 inch: 250 pounds per square inch.

1.04 SUBMITTALS

- A. Submit as specified in Section 01330.

- B. Product data: As specified in Section 15052.
- C. Source quality control test reports:
 - 1. Holiday test of lining.
 - 2. Pressure test.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. One of the following or equal:
 - 1. EBAA Iron, Inc., Force Balanced Flex-Tend.

2.02 MATERIALS

- A. Ductile iron: Material properties in accordance with ASTM A536 with wall thickness meeting requirements of AWWA C153.
- B. Gaskets:
 - 1. At ball joints and sleeves: EPDM.
 - 2. At flanged end connections: As specified in Section 15052.
 - 3. At mechanical joint end connections: As specified in Section 15211.
- C. Bolts and nuts:
 - 1. At flanged end connections: As specified in Section 15052.

2.03 MANUFACTURED UNITS

- A. Consist of 2 ball and socket type joints with an expansion unit located between the 2 ball joints. The ball and socket ends shall be integrally cast with the expansion unit.
- B. End connections: Provide end connections indicated on the Drawings:
 - 1. Mechanical joint end connections in accordance with the dimensional requirements of either AWWA C111 or AWWA C153.
 - 2. Flange end connections in accordance with the dimensional requirements of AWWA C110 with the addition of an O-ring groove.

2.04 FINISHES

- A. Coat external surfaces as follows:
 - 1. Aboveground installations: Field apply coating system as specified in Section 15052 for the piping system.
- B. Line all internal wetted surfaces and seal contact surfaces with a minimum of 15 mils of fusion-bonded epoxy in accordance with AWWA C213.
 - 1. Holiday test epoxy lining with a 1,500-volt spark test in accordance with AWWA C213.

2.05 SOURCE QUALITY CONTROL

- A. Pressure test to rated working water pressure before shipment.

2.06 PACKING AND SHIPPING

- A. Protect sliding and rotating surfaces against damage during packing and shipping and installation.

PART 3 EXECUTION

3.01 HANDLING

- A. Protect sliding and rotating surfaces against damage during handling and installation.

3.02 INSTALLATION

- A. Install force balance ductile iron ball-type flexible expansion joints in accordance with manufacturer's published instructions to meet minimum expansion and contraction values as specified.

END OF SECTION

SECTION 15142

DISINFECTION OF POTABLE WATER LINES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Disinfection of recycled water facilities, bacteriological testing, and flushing of recycled lines at completion of treatment.

1.02 REFERENCES

- A. American Water Works Association(AWWA):
 - 1. AWWA C 651 - Standard for Disinfecting Water Mains.
- B. APHA/AWWA/WEF - Standard Methods for Examination of Water and Wastewater.

1.03 SUBMITTALS

- A. Submit Disinfection Test Plan Which Details Procedure to be Utilized to Disinfect Water Lines Including:
 - 1. Method and locations of disinfectant application.
 - 2. Locations of sampling points.
 - 3. Method of flushing and location of flushing ports.
 - 4. Method of dechlorination.
 - 5. Disposal location for dechlorinated water.
- B. Submit Disinfection Reports and Include the Following:
 - 1. Date issued.
 - 2. Project name and location.
 - 3. Treatment subcontractor's name, address, and phone number.
 - 4. Type and form of disinfectant used.
 - 5. Time and date of disinfectant injection start.
 - 6. Time and date of disinfectant injection completion.
 - 7. Test locations.
 - 8. Initial and 24 hour disinfectant residuals in parts per million for each outlet tested.
 - 9. Time and date of flushing start.
 - 10. Time and date of flushing completion.
 - 11. Disinfectant residual after flushing in parts per million for each outlet tested.
- C. Submit Bacteriological Reports and Include the Following:
 - 1. Date issued.
 - 2. Project name and location.
 - 3. Laboratory's name, certification number, address, and phone number.
 - 4. Time and date of water sample collection.
 - 5. Name of person collecting samples.
 - 6. Test locations.
 - 7. Time and date of laboratory test start.
 - 8. Coliform bacteria test results for each outlet tested.

9. Certification that water conforms or fails to conform to bacterial standards of Federal Safe Drinking Water Act.
10. Bacteriologist's signature and bacteriological laboratory's evidence of certification.

1.04 QUALITY ASSURANCE

- A. Bacteriological Laboratory: Certified by state in which Project is located.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Protect against damage and contamination.
- B. Maintain caution labels on hazardous materials.
- C. Maintain storage room dry and with temperatures as uniform as possible between 60 degrees Fahrenheit and 80 degrees Fahrenheit.

1.06 PROTECTION

- A. Provide necessary signs, barricades, and notices to prevent persons from accidentally consuming water or disturbing system being treated.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Disinfectant: Free chlorine in gas, tablet, or liquid, form:
 1. Chlorine Gas: Shall be supplied and converted from its liquid form to a gas as detailed in AWWA C651 Sections 2.1 and 5.2.
 2. Calcium Hypochlorite Tablets: Shall have an average weight of 0.009 pound each, and shall contain not less than 70 percent of available chlorine.
 3. Liquid Chlorine: Shall conform to AWWA C651 4.1.1 or AWWA C651 4.1.2.

PART 3 EXECUTION

3.01 CLEANING RECYCLED WATER LINES

- A. Prior to chlorination, remove by flushing or other means, soil, and debris from the water lines.

3.02 INSPECTION

- A. Verify that water line system is completed and cleaned.
- B. Start disinfection of water lines when conditions are satisfactory.

3.03 RECYCLED WATER LINES TREATMENT

- A. Contractor shall notify the District two (2) working days prior to chlorination of facilities.
- B. Perform disinfection of recycled water lines in accordance with AWWA C 651 and as specified in this Section.
- C. All required corporation stops and other plumbing materials necessary for chlorination or flushing of the main shall be installed by and at the expense of the Contractor.
- D. Starting at outlet closest to water source, bleed water from each outlet until water produces odor of disinfectant. Repeat process at each outlet throughout system.
- E. Care shall be taken to expel all air from the pipeline during the filling operation.
- F. Test for disinfectant residual at each of following locations and other locations in accordance with submitted disinfection test plan:
 - 1. Ends of piping runs.
- G. Maintain disinfectant in system for 24 hours.
- H. When disinfectant residual is less than 25 parts per million after 24 hours, repeat system treatment.

3.04 FLUSHING

- A. Remove disinfectant from water lines.
- B. Flush water lines with potable water containing no more disinfectant residual than the active distribution system or 1.0 parts per million, whichever is greater.
- C. Continue flushing until water at designated flushing ports contains disinfectant residual equal to concentration specified above.

3.05 DISPOSAL OF CHLORINATED WATER

- A. Dispose of chlorinated water in accordance with the submitted disinfection test plan and applicable requirements of federal, state, county, and city having jurisdiction over disposal of hazardous wastes in location of the Project and disposal site.

END OF SECTION

SECTION 15211

DUCTILE IRON PIPE: AWWA C151

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Ductile iron pipe, joints, fittings, gaskets, and pipe linings and coatings.
- B. Related sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 02318 - Trenching.
 - 3. Section 15052 - Common Work Results for General Piping.
 - 4. Section 15956 - Piping Systems Testing.
 - 5. Section 01756 - Testing, Training, and Facility Start-Up

1.02 REFERENCES

- A. American Society of Mechanical Engineers (ASME):
 - 1. B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
- B. American Water Works Association (AWWA):
 - 1. C104 - Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
 - 2. C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - 3. C110 - Standard for Ductile-Iron and Gray-Iron Fittings.
 - 4. C111 - Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - 5. C115 - Flanged Ductile Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
 - 6. C150 - Standard for Thickness Design of Ductile-Iron Pipe.
 - 7. C151 - Standard for Ductile-Iron Pipe, Centrifugally Cast.
 - 8. C600 - Installation of Ductile Iron Water Mains and Their Appurtenances.
 - 9. C606 - Standard for Grooved and Shouldered Joints.
- C. American Welding Society (AWS):
 - 1. D11.2 - Guide for Welding Iron Castings.
- D. ASTM International (ASTM):
 - 1. A47 - Standard Specifications for Ferritic Malleable Iron Castings.
 - 2. A183 - Standard Specifications for Carbon Steel Track Bolts and Nuts.
 - 3. A536 - Standard Specifications for Ductile Iron Castings.
 - 4. C283 - Standard Test Methods for Resistance of Porcelain Enameled Utensils to Boiling Acid.
 - 5. D792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
- E. Ductile Iron Pipe Research Association (DIPRA):
 - 1. Thrust Restraint Design Manual.

- F. International Organization for Standardization (ISO):
 - 1. ISO8179 - Ductile Iron Pipes - External Zinc Based Coating.
- G. NACE International (NACE):
 - 1. SP0188 - Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
- H. National Association of Pipe Fabricators, Inc. (NAPF):
 - 1. 500-03 - Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings.
- I. Society for Protective Coatings (SSPC):
 - 1. PA-2 - Measurement of Dry Coating Thickness With Magnetic Gages.

1.03 SYSTEM DESCRIPTION

- A. Thrust restraint system design:
 - 1. The pipe shall be restrained at all locations.

1.04 SUBMITTALS

- A. Submit as specified in Section 01330.
- B. Product data: As specified in Section 15052.
- C. Shop drawings:
 - 1. Detailed layout drawings showing alignment of pipes, location of valves, fittings, and appurtenances, types of joints, and connections to pipelines or structures.
 - 2. Photographs, drawings, and descriptions of fittings, gaskets, couplings, grooving of pipe and fittings, pipe linings, and coatings.
- D. Manufacturer's statement:
 - 1. Manufacturer shall provide a sworn statement that the materials provided complies with the requirements and standards of these specifications. The statement shall also confirm that the inspection and specified tests and inspection and specified tests have been made and that the results thereof comply with the requirements and standards of this specification.
- E. Manufacturer's test reports:
 - 1. On regular measurements of zinc coating masses that are required by ISO 8179 Part 4.4.
 - 2. Include Coating Manufacturer's Technical Representative's reports.

1.05 QUALITY ASSURANCE

- A. Arrange for Manufacturer's Technical Representative to make periodic visits to factory or shop to inspect surface preparation of pipe, fittings, and accessories; and to inspect application of linings to interior and coatings to exterior of pipe, fittings, and accessories.

- B. Owner witnessed pipeline production and factory testing: Contractor is responsible for all travel, meal, and lodging costs associated with up to two Owner's representatives and the Engineer or Engineer's representative witnessing ductile iron pipe production and factory testing as indicated in the Source Testing in Section 01756. Witness of the source testings shall occur during the first week of pipeline production for this project.
- C. Arrange for Manufacturer's representative train pipeline installers, as needed, prior to pipeline installation and to make a site visit during the first 1,000 linear feet of pipeline installation to inspect the pipeline and installation method.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Block piping and associated fittings for shipment to prevent damage to coatings and linings.
- B. Carefully handle piping and associated fittings during loading, unloading, and installation:
 - 1. Do not drop piping material from cars or trucks.
 - 2. Lower piping by mechanical means.
 - 3. Do not drop or pound pipe to fit grade.
- C. Protect gaskets from long-term exposure to sunlight.
- D. Store piping, fittings, and other accessories such that they do not accumulate and hold rainwater, dirt, and debris.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

- A. Ductile iron piping:
 - 1. Manufacturers meeting qualifications as specified in this Section.
 - 2. Typical type:
 - a. In accordance with AWWA C150 and AWWA C151.
 - b. Pressure class 350 pounds per square inch.
 - c. Manufactured from greater than 90 percent recycled material.
 - 3. Type with screw-on flanges:
 - a. In accordance with AWWA C115 with minimum special thickness Class 53 wall thickness as required for screw-on flanges.
- B. Joints:
 - 1. Flanged joints:
 - a. Screw-on flanges: Comply with the diameter, thickness, drilling, and other characteristics in accordance with ASME B16.1. In addition, comply with the following requirements:
 - 1) Ductile iron.
 - 2) Long hub, threaded, and specially designed for ductile iron pipe.
 - 3) After attaching to pipe, machine flange face to make pipe end and flange even and perpendicular to the axis of the pipe.
 - b. Bolt holes on flanges: 2-holed and aligned at both ends of pipe.
 - c. Cap screw or stud bolt holes: Tapped.

- d. Bolts and nuts: As specified in Section 15052.
- e. Gaskets: Styrene Butadiene (SBR) rated to 350 pounds per square inch. Gaskets shall be supplied by pipe manufacturer.
- 2. Mechanical joints: In accordance with AWWA C111.
- 3. Mechanical wedge action joint restraints:
 - a. Manufacturers: One of the following, no equal:
 - 1) EBAA Iron, Inc., Megalug Series 1100.
 - 2) Star Pipe Products, Split Stargrip Series 3000.
 - 3) Sigma Corporation, One-Lok Model SLDE.
 - b. Materials:
 - 1) Gland body: Ductile iron in accordance with ASTM A536.
 - 2) Wedges and wedge actuating components: Ductile iron in accordance with ASTM A536:
 - a) Wedges shall be heat treated to a minimum of 370 BHN.
 - 3) Actuating bolts and nuts: Ductile iron in accordance with ASTM A536:
 - a) Provide torque-limiting twist off components to ensure proper installation.
 - c. Coatings:
 - 1) Provide manufacturer applied coating system.
 - 2) Manufacturers: One of the following or equal:
 - a) EBAA Iron Inc., Mega-Bond.
 - b) Star Pipe Products, Star-Bond.
 - c) Sigma Corporation, Corrsafe™ Electro-deposition coating.
 - d. Working pressure:
 - 1) Shall include a minimum safety factor of 2:1.
 - 2) 250 pounds per square inch.
 - e. Restraint shall consist of multiple gripping wedges incorporated into a follower gland meeting the requirements of AWWA C111.
 - f. Restraint shall allow post assembly angular deflection that is a minimum of 50 percent of the angular deflection allowed by the mechanical joint.
 - g. Restraint must be in accordance with applicable requirements of AWWA C110 and AWWA C111 for mechanical joints.
- 4. Integrally restrained push-on joints:
 - a. Application:
 - 1) Where designation restrained push-on is specified in the Piping Schedule provided in Section 15052, supply a restrained push-on joint piping system, which includes restrained push-on joints.
 - b. Gaskets: Styrene Butadiene (SBR) rated to 350 pounds per square inch. Gaskets shall be supplied by pipe manufacturer.
 - c. Design:
 - 1) Restrained push-on joints of the configuration which utilizes a gripping or friction force for restraint will not be acceptable.
 - 2) Suitable for the following working pressures:
 - a) 350 pounds per square inch gauge.
 - d. Manufacturers: One of the following, no equal:
 - 1) U.S. Pipe, TR Flex.
 - a) Local Representative: Collin Bryant (530) 521-8081
 - 2) McWane Ductile, TR Flex.
 - a) Local Representative: John Johnson (951) 813-9589
 - 3) American Cast Iron Pipe Company, Flex Ring or Lok-Ring.
 - a) Local Representative: Rosemary Smud (678) 770-6575

- e. Limit buried joints to half the manufacturer's published allowable angular joint deflection for purposes of pipeline alignment and elimination of fittings.
- C. Fittings:
- 1. Ductile iron in accordance with AWWA C110.
 - 2. Joint type: Mechanical joint below ground and flanged above ground.
 - 3. Plain end-to-flanged joint connectors using setscrews are not acceptable.
- D. Pipe and Fitting linings:
- 1. Cement-mortar lining:
 - a. In accordance with AWWA C104, apply cement-mortar on clean bare metal surfaces. Extend to faces of flanges, ends of spigots, and shoulders of hubs.
 - b. Minimum lining thickness: Standard in accordance with AWWA C104.
 - c. Type of cement: Type II.
 - 2. Asphaltic seal coat:
 - a. Apply over cement mortar linings and to outside surface of pipes that will not receive another coating. Apply in accordance with AWWA C151.
- E. Pipe coatings:
- 1. Zinc coating:
 - a. The exterior shall be coated with a layer of arc-sprayed zinc per ISO 8179.
 - b. The mean mass of zinc based coating measured in accordance with ISO 8179 shall not be less than 200g/m² of pipe surface area with a local minimum of 180 g/m².
 - c. Manufacturer shall carry out regular measurements of zinc coating masses in accordance with ISO 8179.
 - d. Pipe markings shall include the word "zinc" or a similar designation clearly identifying the pipe has a zinc coating.
 - 2. Topcoat:
 - a. The finishing layer shall be bituminous paint compatible with the zinc based layer. The mean dry film thickness shall be per AWWA C151.
- F. Fitting coatings:
- 1. Zinc coating:
 - a. The exterior shall be coated with a zinc rich paint conforming to 8179- 2. Dry film thickness shall be as recommended by the paint manufacturer, but not less than 2.0 mils.
 - b. Fitting markings shall include the word "zinc".
 - 2. Topcoat: Same as Pipe coatings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General:
- 1. Install ductile iron piping in accordance with AWWA C600, modified as specified in Section 15052.
 - 2. For underground piping, the trenching, backfill, and compaction: As specified in Section 02318.

- B. Joints:
 - 1. Install types of joints as specified in the piping schedule provided in Section 15052.
 - 2. Mechanical joints are not acceptable in above ground applications.

3.02 FIELD QUALITY CONTROL

- A. Testing ductile iron piping:
 - 1. Test as specified in Section 15052 and Section 15956.
 - 2. Do not test sections longer than 1/2 mile in total pipe length.
- B. Repair damaged pipe and fitting coating in accordance with ISO 8179:
 - 1. Zinc rich paint shall conform to ISO 8179 - 2, or per Manufacturer's recommended zinc rich paint if the Contractor can demonstrate a field applied coating that conform to ISO 8179 - 2 is not available.
- C. Repair damaged cement mortar lining to match quality, thickness, and bonding of original lining in accordance with AWWA C104:
 - 1. When lining cannot be repaired or repairs are defective, replace defective piping with undamaged piping.

3.03 SPARE PARTS

- A. Spare Pipe:
 - 1. Supply and deliver two (2) standard length pieces of ductile iron pipe with associated gasket materials to the Owner's corporation yard. Coordinate delivery time and location with Owner.

END OF SECTION

SECTION 15244

POLYVINYL CHLORIDE (PVC) AWWA C900/C905 PIPE

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Polyvinyl chloride pipe.
 - 2. Fittings.

- B. Related Sections:
 - 1. Section 15052 - Basic Piping Materials and Methods.
 - 2. Section 15211 - Ductile Iron Pipe: AWWA C151.
 - 3. Section 15956 - Piping Systems Testing.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. D1238 - Flow Rates of Thermoplastics by Extrusion Plastomer.
 - 2. D1505 - Standard Test Method for the Density of Plastics by the Density-Gradient Technique.
 - 3. D17840-02 - Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - 4. D2122 - Determining Dimensions of Thermoplastic Pipe and Fittings.
 - 5. D2152 - Poly Vinyl Chloride (PVC) Pipe and Molded Fittings by Acetone Immersion.
 - 6. F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 - 7. F 645 - Standard Guide for Selection, Design, and Installation of Thermoplastic Water Pressure Piping Systems.
 - 8. F1057 - Standard Practice for Estimating the Quality of Extruded Poly Vinyl Chloride (PVC) Pipe by the Heat Reversion Technique.

- B. American Water Works Association (AWWA):
 - 1. C900 - AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 Inches Through 12 Inches (100 mm Through 300 mm), for Water Distribution.
 - 2. C905 - AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 Inches Through 48 Inches (350 mm Through 1,200 mm) for Water Transmission and Distribution.
 - 3. C111/A21.11 - ANSI/AWWA Standard for Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - 4. M23 - AWWA Manual of Supply Practices PVC Pipe—Design and Installation, Second Edition.

1.03 SUBMITTALS

- A. Product Data: Describe materials, pipe, fittings, and gaskets.
- B. Manufacturer's Published Installation Instructions.
- C. Certificates:
 - 1. Submit manufacturer's certificate attesting that pipe, and fitting types meet specified requirements.
 - 2. Manufacturer's certification of date of manufacture of pipe for each lot delivered.

1.04 QUALITY ASSURANCE

- A. The CONTRACTOR shall require the manufacturer to mark the date of extrusion on the pipe. This dating shall be done in conjunction with records to be held by the manufacturer for two (2) years, covering quality control tests, raw material batch number, and other information deemed necessary by the manufacturer.
- B. Mark plastic pipe with nominal size, type, class, or pressure rating, manufacturer and all markings required by applicable ASTM and AWWA standards.

1.05 WARRANTY

- A. A one-year warranty for the pipe shall be included, and shall cover the cost of replacement pipe and freight to project site, should the pipe have any defects in material or workmanship.
- B. Warranty periods shall begin on the date of installation and product acceptance after all applicable testing.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect piping materials from sunlight, scoring, and distortion.
- B. Do not allow surface temperatures on pipe and fittings to exceed 120 degrees Fahrenheit.

PART 2 PRODUCTS

2.01 GENERAL

- A. Extruding and Molding Material: 100 percent virgin material containing no scrap, regrind, or rework material except when permitted in the referenced standards.
- B. PVC compound meets or exceeds ASTM D1784, cell class 12454.

2.02 PIPE

- A. C900:
 - 1. Meets or exceeds AWWA C900.
 - 2. Pressure Class 150 or 200 and dimension ratio not more than 18 and 14 respectively as scheduled in Section 15052.

- B. C905:
 - 1. Meets or exceeds AWWA C905.
 - 2. Pressure Class 165 or 235 and dimension ratio not more than 25 and 18 respectively as scheduled in Section 15052.

2.03 JOINTS AND FITTINGS

- A. Fittings:
 - 1. Cast or ductile iron fittings as specified in Section 15251, sized for the dimensions of the pipe being used.
 - 2. Must be of equal or greater pressure rating than the pipe.
- B. Joint Design: Push-on or mechanical joint type as specified in Piping Schedule in Section 15052.
- C. Gaskets: In accordance with ASTM F 477.
- D. Mechanical Thrust Restraint:
 - 1. The restraint system shall be rated in accordance with the performance requirements of ANSI/AWWA C111/A21.11.
 - 2. The restraining system for PVC shall be rated at a 2:1 safety factor for the pipe on which it is installed (300 psi PVC pressure class).
 - 3. As manufactured by one of the following or equal:
 - a. EBAA Iron: Megalug Mechanical Joint Restraint.

2.04 TRACER WIRE

- A. All piping shall be installed with a continuous, insulated TW, THW, THWN, or HMWPE insulated copper, 10 gauge or thicker wire for pipeline location purposes by means of an electronic line tracer:
 - 1. The wires must be installed along the entire length of the pipe.
 - 2. The insulation color shall match the color of the pipe being installed.
 - 3. Sections of wire shall be spliced together using approved splice caps and waterproof seals. Twisting the wires together is not acceptable.

2.05 SOURCE QUALITY CONTROL

- A. Piping:
 - 1. Hydrostatic Proof Testing for C900: Test pipe and integral bell to withstand, without failure, 4 times the pressure class of the pipe for a minimum of 5 seconds.
 - 2. Hydrostatic Proof Testing for C905: Test pipe and integral bell to withstand, without failure, a minimum of 2 times the pressure class of the pipe for a minimum of 5 seconds.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General:
 - 1. Pipe should be loaded, off-loaded, and otherwise handled in accordance with AWWA M23.

2. Where not otherwise specified, install piping in accordance with ASTM F 645, or manufacturer's published instructions for installation of piping.
3. Provide molded transition fittings for transitions from plastic to metal or IPS pipe. Do not thread plastic pipe.

B. Piping:

1. Install piping in accordance with referenced installation and construction in Standards in Appendix A of AWWA C900 and C905 and manufacturer's published installation instructions.

3.02 FIELD QUALITY CONTROL

A. Leakage Test for Piping:

1. Subject to visible leak test and to pressure test with maximum leakage allowance, as specified in Section 15956.
2. Pressure Test with Maximum Leakage Allowance: Perform test after backfilling:
 - a. Test Pressure: As specified in piping schedule in Section 15052.
 - b. Maximum leakage allowances are as follows, wherein the value for leakage is in gallons per 50 joints per hour:

Test Pressure	Nominal Pipe Size (inches)									
	4	6	8	10	12	14	16	18	20	24
150 psi	0.33	0.50	0.66	0.83	0.99	1.16	1.32	1.49	1.66	1.99
200 psi	0.38	0.57	0.76	0.96	1.15	1.34	1.53	1.72	1.91	2.29
250 psi	0.43	0.64	0.85	1.07	1.28	1.50	1.71	1.92	2.14	2.56

END OF SECTION

SECTION 15252A

STEEL PIPING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Steel piping, joints, fittings, pipe lining and coating, and fabricated steel piping fittings and specials test.
- B. Related Sections:
 - 1. Section 09960 - Coatings.
 - 2. Section 15052 - Basic Piping Materials and Methods.

1.02 REFERENCES

- A. American Association of State Highway and Transportation Officials (AASHTO):
 - 1. Standard H-20.
- B. American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME):
 - 1. B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
 - 2. B16.3 - Malleable-Iron Threaded Fittings, Classes 150 and 300.
 - 3. B16.5 - Pipe Flanges and Flanged Fittings.
 - 4. B16.9 - Factory-Made Wrought Steel Buttwelding Fittings.
 - 5. B16.12 - Cast Iron Threaded Drainage Fittings.
- C. American Society for Testing and Materials (ASTM):
 - 1. A 47 - Ferritic Malleable Iron Casting.
 - 2. A 53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - 3. A 105 - Forgings, Carbon Steel, for Piping Components.
 - 4. A 106 - Seamless Carbon Steel Pipe for High-Temperature Service.
 - 5. A 153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 6. A 183 - Carbon Steel Track Bolts and Nuts.
 - 7. A 536 - Ductile Iron Castings.
 - 8. C 150 - Portland Cement.
 - 9. D 297 - Steel Casting, Iron-Chromium and Iron-Chromium-Nickel, Heat-Resistant, for General Application.
 - 10. D 395 - Rubber Property-Compression Set.
 - 11. D 977 - Emulsified Asphalt.
 - 12. D 471 - Rubber Property-Effect of Liquids.
 - 13. D 573 - Rubber Property-Deterioration in an Air Oven.
 - 14. D 412 - Rubber Properties in Tension.
 - 15. D 429 - Rubber Property-Adhesion to Rigid Substrates.
 - 16. D 2000 - Classification System for Rubber Products in Automotive Applications.
 - 17. D 2240 - Rubber Property-Durometer Hardness.

- D. American Water Works Association (AWWA):
 - 1. C200 - Steel Water Pipe 6 Inches and Larger.
 - 2. C203 - Coal-Tar Protective Coatings and Linings for Steel Water Pipelines-Enamel and Tape-Hot Applied.
 - 3. C205 - Cement-Mortar Protective Lining and Coating for Steel Water Pipe-4 Inches and Larger-Shop Applied.
 - 4. C206 - Field Welding of Steel Water Pipe.
 - 5. C207 - Steel Pipe Flanges for Waterworks Service-Sizes 4 inches Through 144 inches.
 - 6. C208 - Dimensions for Fabricated Steel Water Pipe Fittings.
 - 7. C606 - Grooved and Shouldered Joints.
 - 8. M 11 - Design Manual.

- E. National Association of Corrosion Engineers (NACE):
 - 1. RP0274-74 - Standard Recommended Practice.

1.03 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Design Criteria for Pipe and Pipe Fittings: In accordance with AWWA Manual M11 with the following modifications:
 - a. Wall Thickness: As designed or minimum 1/4 inch for pipe from 12 inches in diameter to, and including, 72 inches in diameter or minimum 5/16 inch for pipe larger than 72 inches in diameter, whichever is thicker.
 - b. Inside Diameter of Unlined Pipe: Nominal.
 - c. Inside Diameter of Lined Pipe: As measured from face to face of liner, but not less than nominal.
 - d. Deflection of Underground Pipe Inside Diameter: Maximum 2 percent under trench load of H-20 live load in accordance with AASHTO specifications.
 - e. Working Stress of Steel: Maximum 50 percent of yield stress.

1.04 SUBMITTALS

- A. Shop Drawings: Details of fittings and specials showing thickness and dimensions of plates, detail of welds, and materials; listing of proposed services and locations for use of grooved joint type piping; tabulated layout schedules for cement-mortar lined and coated steel pipe.

- B. Product Data: Details of fittings and specials showing thickness and dimensions of plates, detail of welds, and materials; grooved joint piping fittings, gaskets, couplings, grooving of pipe and fittings, and pipe lining and coating.

- C. Certificates of Compliance: Cement-mortar lined and coated steel pipe.

- D. Design Calculations: Wall thicknesses for external loading, special loading and internal pressure.

- E. Mill certificates.

- F. Test Reports: Rubber gaskets.

1.05 QUALITY ASSURANCE

- A. Applicable Standards:
 - 1. Cement-mortar lined and coated steel pipe shall conform to the following standards, as complemented and modified herein:
 - a. Steel Pipe: AWWA C200.
 - b. Cement-Mortar Lining and Coating: AWWA C205.
 - c. Fittings and Specials: AWWA C208.
 - d. Reinforcement of Fittings and Specials: AWWA M 11.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Steel Pipe:
 - 1. Type, Pipe 6 inches and Smaller: ASTM A 53, black or galvanized, seamless or straight seam electric resistance welded. Minimum Schedule 40.
 - 2. Type, from 6 to 12 inches: ASTM A 53, black or galvanized pipe, seamless or straight seam electric resistance welded. Minimum Schedule 20.
 - 3. Type, Larger than 12 inches: AWWA C200, without butt strap, riveted, or swaged joints; wall thickness as indicated on the Drawings.
- B. Steel Pipe Fittings:
 - 1. Screwed Fittings:
 - a. Malleable Iron: ANSI/ASTM B16.3, Class 150 ; galvanized in accordance with ASTM A 153 where used with galvanized pipe.
 - b. Cast Iron Drainage: ANSI/ASTM B16.12, galvanized in accordance with ASTM A 153 where used with galvanized pipe.
 - 2. Flanged Fittings:
 - a. Type for 12-inch and Smaller Pipe: ANSI/ASTM B16.1, cast iron or ductile iron, Class 125 ; or ANSI/ASTM B16.5, steel, Class 150 , galvanized in accordance with ASTM A 153 where used with galvanized pipe.
 - b. Type for Larger than 12-inch Pipe: ANSI/ASTM B16.5, steel, Class 150 ; galvanized in accordance with ASTM A 153 where used with galvanized pipe; or AWWA C207 and AWWA C208, fabricated from flanges and steel pipe, respectively.
 - c. Companion Flanges for 4 inches and Smaller Pipe: ANSI/ASTM B16.1, cast iron or ductile iron, Class 125 ; ANSI/ASTM B16.5, steel, Class 150 , slip-on or welding neck; or ammonia type for use on chlorine liquid or gas piping.
 - d. Companion Flanges for Larger than 4 inch to and Including 12-inch Pipe: ANSI/ASTM B16.5, slip-on or welding neck type.
 - e. Companion Flanges for Larger than 12-inch Pipe: ANSI/ASTM B16.5, steel, Class 150 ; galvanized in accordance with ASTM A 153 where used with galvanized pipe; or AWWA C207, steel plate or raised hub type.
 - f. Weld flanges to pipe or fittings before applying lining.
 - g. Machine flanges or provide tapered filler for changes in grade or to slope lines for drainage.

- h. Flange Bolts: ANSI/ASTM B16.1 for typical applications; or Type 304 or 316 stainless steel, or Everdur for underground or underwater applications:
 - 1) Cut and finish flange bolts to project a maximum of 1/4 inch beyond outside face or nut after assembly.
 - 2) Tap holes for cap screws or stub bolts when used.
 - i. Gaskets: In accordance with Section 15052.
3. Welding Fittings:
- a. Welding Fittings for Piping 8 inches and less in Nominal Diameter: Butt-welding fittings in accordance with ANSI/ASTM B16.9, standard wall or standard weight.
 - b. Welding Fittings for Piping Larger than 8 inches in Nominal Diameter: Butt-welding fittings in accordance with ANSI/ASTM B16.9, or, at the option of the CONTRACTOR, made up out of sections of pipe welded together, except where smooth bends are indicated for air lines.
 - c. Fittings made up of sections of pipe welded together shall be made of pipe of at least the same wall thickness as the pipe with which used, and bends shall be miter bends, fabricated in accordance with AWWAC208 and as supplemented by AWWA Manual M 11. Welding of these made-up fittings shall be in accordance with AWWA C206:
 - 1) Design and fabricate outlets and 4 branch fittings in accordance with AWWA Manual M 11.
 - 2) Bends may be welded to adjacent pipe sections:
 - a) Bends shall be manufactured of the following number of pieces:
 - (1) Bends from 0 to 30 degrees angle, 2 pieces.
 - (2) Bends from 30 to 45 degrees angle, 3 pieces.
 - (3) Bends from 45 to 67-1/2 degrees angle, 4 pieces.
 - (4) Bends from 67-1/2 to 90 degrees angle, 5 pieces.
4. Grooved Joint Fittings:
- a. Fittings for Grooved Joint Steel Piping: Rigid-grooved type, and as follows:
 - 1) Grooves: Cut; rolled grooves are not acceptable.
 - 2) Couplings: Cast in 2 or more segments of ductile iron conforming to ASTM A 536, Grade 65-45-12 or malleable iron conforming to ASTM A 47, Grade 32510.
 - 3) Bolts and Nuts: ASTM A 183, Grade 2.
 - 4) Gaskets: Composition water sealing designed so that the internal piping pressure serves to increase the seal's watertightness:
 - a) Gaskets for water service and oil-free air systems at temperatures less than 230 degrees Fahrenheit shall be made of ethylene propylene diene monomers (EPDM) in accordance with ASTM D 2000 Line Call Out 2CA615A25B24.
 - b) Gaskets for use with cement-mortar lined steel piping shall be captured between the ends of the pipe to protect exposed metal from corrosion, and shall be made of nitrile in accordance with ASTM D 2000, Line Call Out 2CA615A25B24.
 - 5) Perform grooving of the pipe wall only on standard or heavier schedule weight pipe:
 - a) For pipe with wall thickness less than standard weight, weld a shouldered end on the pipe in accordance with AWWA C606.

- b) Fabricated pipe, pipe conforming to AWWA C200, shall have shouldered ends welded onto the pipe.
 - c) Shoulder: Type B or D in accordance with AWWA C606.
 - 6) Couplings and Grooving: As manufactured by Gustin-Bacon Piping Products, Victaulic Company of America, or equal.
- b. Fittings for Grooved Joint Piping: Ductile iron conforming to ASTM A 536, Grade 65-45-12, or malleable iron conforming to ASTM A 47, Grade 32510, and as follows:
 - 1) Where cast fittings are not made, standard fittings including large diameter elbows shall be made of forged steel conforming with ASTM A 105, Grade B with 0.375 inch wall thickness, or shall be standard segmentally welded fittings fabricated of Schedule 40 carbon steel pipe:
 - a) Grooves: As manufactured by Gustin-Bacon Piping Products, Victaulic Company of America, or equal.
 - 2) Fittings for grooved joint piping shall be furnished by the manufacturer of the grooved joint material.
 - 3) Fittings for grooved joint piping shall be for rigid-grooved type joints.
 - 4) Connection to flanged units shall be by means of flange to grooved joint adapters:
 - a) Where the flanged to grooved joint adapters interfere with the operation of adjacent valves, pumps, or other items, the connection shall be by means of a spool with one end flanged and the other grooved, long enough to prevent interference with adjacent valves, pumps, or other items.

C. Steel Pipe Lining and Coating:

- 1. General:
 - a. Except where otherwise specified in the Specifications and indicated on the Drawings, lining and coating for steel pipe shall be as specified hereinafter.
 - b. Pipe Coating:
 - 1) Except as otherwise specified or indicated on the Drawings, provide underground steel piping with one of the coatings specified hereinafter.
 - 2) Extend pipe coating for underground piping 6 inches above finish grade or finish floor, and neatly terminate.
 - 3) Field paint aboveground steel pipe as specified in Part 3 of this Section.
- 2. Cement-mortar Lining and Coating:
 - a. Lining:
 - 1) Shop apply cement-mortar lining for steel pipe, interior, in accordance with AWWA C205; or, at the option of CONTRACTOR, field apply with a pipe lining machine.
 - b. Coating:
 - 1) Cement-mortar Coating for Steel Pipe Exterior: In accordance with AWWA C205, modified as follows:
 - a) Portland Cement: ASTM C 150, Type II, low alkali.
 - b) Sand: AWWA C205 except that the total percentage of deleterious material shall not exceed 3 percent.

- D. Fabricated Steel Piping Fittings and Specials:
1. General: Specified herein are the design and fabrication of fabricated steel piping fittings and specials, which include elbows, branches, nozzles, manifolds, headers, heads, collars, stiffeners, reinforcements, and other steel fabrications relating to steel piping, but shall not include steel pipe.
 2. Design:
 - a. CONTRACTOR shall design and detail fittings and specials:
 - 1) Design: In accordance with the recommended procedures in AWWA Manual M 11, as complemented and modified herein.
 - 2) Nozzles: Reinforced in conformance with recommended practice in AWWA M 11, Steel Pipe Manual.
 - 3) Design reinforcing for fittings and specials for the specified test pressure.
 - 4) Fittings shall conform in dimension to AWWA C208, complemented with the provisions specified herein.
 - 5) The working stress for steel used for fabrication of pipe shall not exceed 50 percent of the yield stress.
 - b. The thickness of pipe, large elbows, and headers, except header nozzles, shall be the thicker of:
 - 1) The thickness designed in accordance with the design methods specified in the preceding paragraph "Fabricated Steel Piping Fittings and Specials."
 - 2) The thickness indicated on the Drawings.
 - 3) The following thicknesses:
 - a) For Pipes Smaller than 72 inches in Diameter: Minimum 1/4 inch.
 - c. Elbows shall be of the number of pieces specified under paragraph Steel Pipe Fittings, "Welding and Fittings", and thickness of material shall conform to thickness of pipe or manifold shells specified.
 - d. Ends of fittings to be welded to pipe shall be beveled for welding.
 3. Fabrication:
 - a. Shop fabricate steel piping fittings and specials in units as long as practicable for safe hauling and installation. Minimize number of field welds.
 - b. Fabricate fittings and specials to uniform lengths with proper end clearance for the specified types of joint or attachment.
 - c. Fabricate fittings and specials to allow field assembly without cutting or special work.
 - d. Where specified in the Piping Schedule in Section 15052 - Pipes and Pipe Fittings, or indicated on the Drawings, the inside of fabricated steel manifolds and other fittings and specials shall receive a cement-mortar lining in accordance with AWWA C205:
 - 1) Reinforce lining for piping 24 inches in diameter and larger with wire fabric.
 - e. Do not weld flanges to nozzles until the nozzles and reinforcements are completely welded to the header:
 - 1) Accurately space and align flanges so that when connections have been made there will be no stress on the header, piping, or equipment. Properly locate and align equipment.
 4. Testing: No shop testing will be required for manifolds or piping connected thereto.

E. Steel Pipe, Cement-mortar Lined and Coated:

1. General:

- a. Applicable Standards: Cement-mortar lined and coated steel pipe shall conform to the standards specified in Part 1 of this Section.
- b. Identification Marks: Provide identification marks in compliance with AWWA C200. These marks shall be stenciled or otherwise shown at the top of the piping items exterior, including the following information:
 - 1) Name or trademark of the manufacturer.
 - 2) Date of manufacture of the item.
 - 3) Internal diameter in inches.
 - 4) Number of the item, sequential from initial to end station.
- c. Diameter Designation: The pipe diameter specified in the Specifications and indicated on the Drawings shall be the clear inside diameter after application of the cement-mortar lining with a tolerance of plus 0 inch and minus 1/4 inch.

2. Design:

- a. Pipe and fittings shall be designed by CONTRACTOR.
- b. Design: In accordance with the recommended procedures in AWWA Manual M 11, as complemented and modified herein.
- c. Thicknesses of Pipe, Fittings and Specials Shall Be the Thicker Of:
 - 1) The thickness designed in accordance with the design methods specified in the preceding Subparagraph 2.
 - 2) The thickness indicated on the Drawings.
 - 3) The following thicknesses:
 - a) For pipes 26 inches and less in nominal diameter, not less than 1/4 inch.
 - b) For pipes more than 26 inches and less than 38 inches in nominal diameter, not less than 5/16 inch.
 - c) For pipes 38 inches to and including 54 inches in nominal diameter, not less than 3/8 inch.
- d. The working stress for steel used for fabrication of pipe shall not exceed 50 percent of the yield stress.
- e. Break longitudinal and girth seams for straight seam pipe shall be no greater in number than would be required for the fabrication of pipe with 96-inch by 120-inch steel plates:
 - 1) Break longitudinal seams at the girth seams.

3. Materials:

- a. Cement: ASTM C 150, Type II, low alkali.
- b. Gaskets shall be as specified in Section 15052 and meet the following requirements:
 - 1) Minimum tensile strength, tested in accordance with ASTM D 412, between 2,000 and 2,700 pounds per square inch.
 - 2) Minimum elongation, tested in accordance with ASTM D 412, between 350 and 400 percent.
 - 3) Shore A durometer hardness, tested in accordance with ASTM D 2240, between 50 and 65.
 - 4) Specific gravity, tested in accordance with ASTM D 297, between 0.90 and 1.50.
 - 5) Maximum compression set, tested in accordance with Method B of ASTM D 395, 20 percent.
 - 6) Maximum tension strength loss, tested in accordance with ASTM D 573 at 96 hours, 70 degrees Centigrade, in air, 20 percent.

- 7) Maximum elongation loss, tested in accordance with ASTM D 573 at 96 hours, 70 degrees Centigrade, in air, 20 percent.
 - 8) Maximum absorption, tested in accordance with ASTM D 471 at 48 hours, 70 degrees Centigrade, in air, 5 percent.
4. Fabrication:
- a. Joints: Except as otherwise specified or indicated on the Drawings, provide bell and spigot type joints with rubber gaskets:
 - 1) Bell and Spigot Rings: Rolled Carnegie shape M-3516.
 - b. Flanges: AWWA C207, Class D, steel ring, and as follows:
 - 1) Match pipe flanges to the valve flanges:
 - a) At flanged joints connecting to valves, provide a steel pipe section without rod reinforcing and not less than 24 inches in length.
 - b) Apply cement-mortar lining and coating to the steel pipe section.
 - c. Shop Coat of Primer: Flanges and portions of pipe not covered with cement-mortar shall be given a shop coating of primer.
 - d. Bend Radii of Fittings: Not less than 2.5 times the nominal diameter.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Joints:
1. Steel pipe joints shall be screwed, welded, flanged, grooved, or made with flexible joints. The type of joint for piping is specified in the Piping Schedule in Section 15052.
 2. In addition to the joints indicated on the Drawings, provide unions, flexible couplings, flanged joints, and other types of joints or means necessary to allow ready assembly and disassembly of the piping.
 3. Unless otherwise indicated on the Drawings or specified in the Piping Schedule in Section 15052, pipe joints shall be as follows:
 - a. Pipe smaller than 2 inches in nominal diameter shall have screwed joints or flexible couplings.
 - b. Pipe 2 inches to 4 inches in nominal diameter shall have screwed joints, flanged joints, welded joints, or joints made with flexible couplings.
 - c. Pipe larger than 4 inches in nominal diameter shall have flanged joints, welded joints, or joints made with flexible couplings.
- B. Screwed Joints:
1. Perform threading with clean, sharp dies:
 - a. Wavy, rough, or otherwise defective pipe threads are not acceptable.
 2. Make screwed joints tight and clean with an application of Teflon tape or approved paste compound applied to the male threads only, except as follows:
 - a. Make up liquid and dry chlorine lines, and liquefied petroleum gas lines, with litharge and glycerin.
 3. Provide railroad type unions with bronze-to-iron seat, galvanized where used with galvanized pipe:
 - a. Flanged joints may be used instead of unions.

- C. Flanged Joints:
 - 1. In flanged joints, flanges shall come together at the proper orientation with no air gaps between the flanges after the gaskets are in place.
 - 2. Attach slip-on flanges to pipe by two fillet welds, in accordance with AWWA C207.
 - 3. Secure welding neck flanges with full penetration butt welds without backing rings:
 - a. After welding in place, the faces of flanges shall be perpendicular to the axis of the pipe, or, in the case of fittings, at the proper angle to each other, and bolt holes shall be in proper alignment.

- D. Welded Joints:
 - 1. Welded joints shall be electric welded in accordance with AWWA C206.
 - 2. Welders shall be qualified pursuant to the provisions of AWWA C206:
 - a. Welders' testing shall be at the CONTRACTOR's expense, including cost of test nipples, welding rods, and equipment.
 - 3. Do not weld galvanized pipe.

- E. Grooved Joints:
 - 1. Piping with grooved joints shall be installed where indicated on the Drawings and may be installed in place of flanged piping and screwed piping, except that grooved joint piping shall not be used in the following installations:
 - a. In underground and underwater installations.
 - b. In piping subject to test pressures of 150 pounds per square inch gauge, or more.
 - c. In steam and gas piping.
 - d. In sludge and scum piping designed to be steam cleaned.
 - 2. Assemble in accordance with manufacturer's published instructions.
 - 3. Support grooved-end pipe in accordance with manufacturer's recommendations. In addition, provide at least 1 support between consecutive couplings.

- F. Lining and Coating:
 - 1. Field paint aboveground steel pipe as specified in Section 09960, Coatings.
 - 2. Field applied cement-mortar lining shall be of the same density, smoothness, and thickness as shop applied lining, and shall conform to applicable portions of AWWA C602.
 - 3. Plastic tape wrap application procedures shall be in accordance with manufacturer's published instructions:
 - a. Apply primer with brush, without runs and drips.
 - b. Lap wrapping not less than 1/2 inch. A single wrap lapped 50 percent or more will not be acceptable.
 - c. Application on Welded Joints:
 - 1) Remove sharp edges of weld spatter and slag with a file or ball peen hammer before wrapping welded joints.
 - 2) Apply a single thickness of tape base wrap over the primer, around the weld.
 - 3) Start first wrapping 4 inches back on the pipe wrap, spiral wrap tape over the joint holding the proper tension and overlap, and finish 4 inches back on the pipe wrap on the other side of the joint.
 - 4) Apply final wrapping in same manner.

- d. Wrap fittings, valves, and other odd shaped components in the pipeline with first and finish wrapping over the prime coat.
- e. Wrap joints, fittings, valves, and other irregular shapes of piping with extruded coatings with tape as specified in this Subparagraph.
- 4. Protect lining of fabricated steel piping fittings and specials during hauling, installation, and operation.
- 5. Finish joints of fabricated steel piping fittings and specials as specified for pipe lining after field welding is done.
- 6. After final field welding of fabricated steel piping fittings and specials, complete the lining and exterior painting at and near the welded connections:
 - a. Repair or replace lining damaged as a result of welding heat, handling, or other causes.

3.02 FIELD QUALITY CONTROL

- A. Testing: Fabricated steel manifolds shall be field tested with the pipe to which they connect.
- B. Holiday Detection Testing of Plastic Tape Wrap Coatings:
 - 1. Perform a complete high voltage electrical inspection (holiday detection testing) of all steel piping systems and fittings coated with plastic tape wrap prior to burying:
 - a. Perform high voltage electrical inspection in strict accordance with NACE RP0274-74.
 - b. Test voltage used for the electrical inspection of the piping and fittings shall be in accordance with the recommendations given by the tape coating manufacturer in their published literature.
 - c. Repair all holidays and defects found in the coating system through the high voltage electrical inspection in strict accordance with the tape coating manufacturer's recommendations.
 - d. Retest repaired areas in the coating prior to burial of the piping to ensure that all holidays and defects in the coating have been properly repaired.
 - 2. Before conducting holiday detection testing on any piping systems, submit to the ENGINEER for review and approval technical literature and data describing the testing instrumentation, equipment, electrodes, and other accessories that will be used:
 - a. The literature and data shall include complete information covering the operation and use of the testing equipment, including operational voltage ranges.
 - 3. All holiday detection testing and coating repair work shall be witnessed, inspected and approved by the ENGINEER.
- C. Holiday Detection Testing of Extruded Coatings:
 - 1. Perform a complete high voltage electrical inspection (holiday detection testing) of all steel piping systems and fittings coated with extruded high-density polyethylene prior to burial of the pipe.
 - 2. Perform the high voltage electrical testing as specified under the preceding paragraph "Holiday Detection Testing of Plastic Tape Wrap Coatings."

END OF SECTION

SECTION 15270

STEEL PIPE: GALVANIZED AND BLACK, ASTM A53

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Steel pipe: Galvanized and black, ASTM A 53.
- B. Related sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 09960 - High-Performance Coatings.
 - 3. Section 15052 - Common Work Results for General Piping.

1.02 REFERENCES

- A. American Society of Mechanical Engineers (ASME):
 - 1. B16.3 - Malleable-Iron Threaded Fittings: Classes 150 and 300.
 - 2. B16.5 - Pipe Flanges and Flanged Fittings.
 - 3. B16.9 - Factory-Made Wrought Buttwelding Fittings.
- B. American Water Works Association (AWWA):
 - 1. C110 - Ductile-Iron and Gray-Iron Fittings.
 - 2. C203 - Coal-Tar Protective Coatings and Linings for Steel Water Pipelines-Enamel and Tape-Hot Applied.
 - 3. C205 - Standard for Cement-Mortar Protective Lining and Coating for Steel Water Pipe-4 Inches and Larger-Shop Applied.
 - 4. C206 - Field Welding of Steel Water Pipe.
 - 5. C602 - Standard for Cement-Mortar Lining of Water Pipelines in Place-4 inches and Larger.
 - 6. C606 - Standard for Grooved and Shouldered Joints.
- C. ASTM International (ASTM):
 - 1. A47 - Standard Specification for Ferritic Malleable Iron Casting.
 - 2. A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 3. A105 - Standard Specification for Carbon Steel Forgings for Piping Applications.
 - 4. A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 5. A183 - Standard Specification for Carbon Steel Track Bolts and Nuts.
 - 6. A536 - Standard Specification for Ductile Iron Castings.
 - 7. C150 - Standard Specification for Portland Cement.
 - 8. D2000 - Standard Classification System for Rubber Products in Automotive Applications.

1.03 SUBMITTALS

- A. Submit as specified in Section 01330.

- B. Product data: As specified in Section 15052.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Portland cement: In accordance with ASTM C150, Type II, low alkali.

2.02 MANUFACTURED UNITS

- A. Steel pipe:
 - 1. General:
 - a. In accordance with ASTM A53.
 - 1) Type: Type E - electric-resistance welded or Type S - seamless.
 - 2) Grade: Grade A or B.
 - b. Schedule:
 - 1) As indicated on the Drawings or as specified in Section 15052 pipe schedule.
 - 2) Minimum Schedule unless otherwise indicated on the Drawings or as specified in Section 15052 pipe schedule.
 - a) Pipe 6 inches and smaller: Schedule 40.
- B. Pipe fittings:
 - 1. Flanged and welding fittings:
 - a. Butt-welding fittings in accordance with ASME B16.9. Schedule of fittings: same class or thickness as the pipe to which it connects.
 - 2. Screwed fittings:
 - a. Malleable iron:
 - 1) Class 150 or Class 300 in accordance with ASME B16.3, as specified in Section 15052 pipe schedule.
 - 2) Galvanized in accordance with ASTM A153 where used with galvanized pipe.
 - 3. Grooved joint fittings:
 - a. Fittings for grooved joint steel piping: Rigid-grooved type.
 - b. Fittings for grooved joint piping:
 - 1) Manufacturers: One of the following or equal:
 - a) Victaulic Company of America.
 - 2) Ductile iron fittings:
 - a) Larger than 4 inches in diameter: In accordance with ASTM A536, Grade 65-45-12, long radius, per AWWA C110.
 - b) Less than 4 inches in diameter: Malleable iron conforming to ASTM A47, Grade 32510.
 - 3) Where cast fittings are not made, forged steel in accordance with ASME B 16.9, ASTM A105, Grade B with 0.375 inch minimum wall thickness.
 - a) Bends: Long radius.
 - 4) Fittings for grooved joint piping shall be furnished by the manufacturer of the grooved joint coupling.
 - 5) Fittings for grooved joint piping shall be for rigid-grooved type joints. Connection to flanged units shall be by means of a spool with one end flanged and the other grooved, long enough to prevent

interference with adjacent valves, pumps, or other items, minimum length, 4 inches.

C. Pipe joints:

1. General:

- a. Use type of pipe joints as indicated on the Drawings or as specified in Section 15052 pipe schedule.
- b. In addition to the type of pipe joints indicated on the Drawings or as specified in Section 15052 pipe schedule, use flexible couplings, unions or flanged joints to allow ready assembly and disassembly of the piping.

2. Flanged joints:

- a. In accordance with ASME B16.5, steel, 300 pounds, slip-on or weld neck, galvanized in accordance with ASTM A153 where used with galvanized pipe.
- b. Companion flanges:
 - 1) In accordance with ASME B16.5, steel.
 - 2) Class 300 pounds, slip-on or welding neck.
- c. Weld flanges to pipe or fittings before applying lining.
- d. Machine flanges or provide tapered filler for changes in grade or to slope lines for drainage.
- e. Match pipe flanges to the valve flanges.
- f. Flange bolts: As specified in Section 15052.
- g. Gaskets: As specified in Section 15052.

3. Grooved joints:

- a. Grooves: Cut grooves. Rolled grooves are not acceptable.
- b. Couplings housing: Cast in 2 or more segments of ductile iron in accordance with ASTM A536, Grade 65-45-12 or malleable iron in accordance with ASTM A47, Grade 32510.
- c. Bolts and nuts: In accordance with ASTM A183, Grade 2.
- d. Gaskets: Composition water sealing designed so that the internal piping pressure serves to increase the seal's watertightness.
 - 1) Gaskets for water service and oil-free air systems at temperatures less than 230 degrees Fahrenheit shall be made of ethylene propylene diene monomers (EPDM) in accordance with ASTM D2000 Line Call Out 2CA615A25B24.
 - 2) Gaskets for use with cement-mortar lined steel piping shall be captured between the ends of the pipe to protect exposed metal from corrosion, and shall be made of EPDM in accordance with ASTM D2000, Line Call Out EPDM.
- e. Perform grooving of the pipe wall only on standard or heavier schedule weight pipe.
 - 1) For pipe with wall thickness less than standard weight, weld a shouldered end on the pipe in accordance with AWWA C606.
 - 2) Shoulder: Type B or D in accordance with AWWA C606.
- f. Couplings and grooving: Manufacturers: One of the following or equal:
 - 1) Victaulic Company of America.
- g. Grooved joint piping shall not be used in the following installations:
 - 1) In underground and underwater installations.
 - 2) In piping subject to test pressures of 150 pounds per square inch gauge, or more.
 - 3) In steam and gas piping.
 - 4) In sludge and scum piping designed to be steam cleaned.

4. Welded joints: Butt welds, 2 pass, full depth with beveled ends and no backing rings.
- D. Pipe lining and coating:
1. General:
 - a. Lining and coating shall be as indicated on the Drawings or as specified in Section 15052 pipe schedule.
 2. Pipe coating:
 - a. Extend pipe coating for underground piping 6 inches above finish grade or finish floor, and neatly terminate.
 - b. Field paint aboveground steel pipe as specified in Execution of this Section.
 - c. Coat exposed piping as specified in Section 09960.
 - d. Coat submerged piping as specified in Section 15052 pipe schedule and Section 09960.
 - e. Cement-mortar coating:
 - 1) Cement-mortar coating: In accordance with AWWA C205, modified as follows:
 - a) Sand: In accordance with AWWA C205 except that the total percentage of deleterious material shall not exceed 3 percent.
 - f. Plastic tape wrap:
 - 1) For buried pipe, wrap fittings, valves, and other odd shaped components in the pipeline with first and finish wrapping over the prime coat, total thickness of tape 80 mils.
 3. Pipe lining:
 - a. Cement-mortar lining:
 - 1) Shop apply cement-mortar lining in accordance with AWWA C205. At the option of Contractor, field apply with a pipe lining machine.
 - b. Coal-tar enamel lining:
 - 1) Coal-tar enamel lining for interior of steel pipe: In accordance with AWWA C203.
 - c. Coal-tar epoxy lining:
 - 1) Coal-tar epoxy lining: Epoxy bituminous coating as specified for submerged metal in Section 09960.
 - d. Fusion epoxy:
 - 1) Fusion bonded epoxy as specified for submerged metal or exposed metal in Section 15057.
 - e. High solids epoxy:
 - 1) High solids epoxy as specified for submerged metal or exposed metal in Section 09960.
 - f. Polyurethane lining:
 - 1) Polyurethane as specified for submerged metal in Section 09960.

2.03 FABRICATION

- A. Shop coat of primer:
1. Flanges and portions of pipe not covered with cement-mortar shall be given a shop coating of primer.
 2. Primer compatible with finish coating system.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Pipe joints:
1. General:
 - a. Steel pipe joints shall be screwed, welded, flanged, grooved, or made with flexible joints. The type of joint for piping is as specified in Section 15052 pipe schedule or as indicated on the Drawings.
 - b. In addition to the joints indicated on the Drawings, provide unions, flexible couplings, flanged joints, and other types of joints or means necessary to allow ready assembly and disassembly of the piping.
 - c. Unless otherwise indicated on the Drawings or as specified in Section 15052 pipe schedule, pipe joints shall be as follows:
 - 1) Pipe smaller than 2 inches in nominal diameter shall have screwed joints, welded joints, unions, or flexible couplings.
 - 2) Pipe 2 inches to 4 inches in nominal diameter shall have screwed joints, flanged joints, welded joints, or joints made with flexible couplings.
 - 3) Pipe larger than 4 inches in nominal diameter shall have flanged joints, welded joints, or joints made with flexible couplings.
 2. Flanged joints:
 - a. Flanges shall come together at the proper orientation with no air gaps between the flanges after the gaskets are in place.
 - b. Secure welding neck flanges with full penetration butt welds without backing rings.
 - c. Secure slip-on flanges with both internal and external welds.
 - d. After welding in place, the faces of flanges shall be perpendicular to the axis of the pipe, or, in the case of fittings, at the proper angle to each other, and bolt holes shall be in proper alignment.
 3. Grooved joints:
 - a. Assemble in accordance with manufacturer's published instructions.
 - b. Support grooved joint pipe in accordance with manufacturer's recommendations. In addition, provide at least 1 support between consecutive couplings.
 4. Screwed joints:
 - a. Perform threading with clean, sharp dies.
 - 1) Wavy, rough, or otherwise defective pipe threads are not acceptable.
 - b. Make screwed joints tight and clean with an application of Teflon tape or paste compound applied to the male threads only, except as follows:
 - 1) Make up liquid and liquefied petroleum gas lines, with litharge and glycerin.
 - c. Provide railroad type unions with bronze-to-iron seat. Galvanized where used with galvanized pipe.
 - 1) Flanged joints may be used instead of unions.
 5. Welded joints:
 - a. Field welded joints: Electric arc welded in accordance with AWWA C206.
 - b. Welder's qualification: Qualified in accordance with AWWA C206.
 - 1) Welders' testing shall be at the Contractor's expense, including cost of test nipples, welding rods, and equipment.
 - c. Do not weld galvanized pipe.

- B. Pipe lining and coating:
 - 1. Pipe lining:
 - a. Field applied cement-mortar lining shall be of the same density, smoothness, and thickness as shop applied lining, and in accordance with AWWA C602.
 - 2. Pipe Coating:
 - a. Plastic tape wrap application:
 - 1) Wrap fittings, valves, and other odd shaped components in the pipeline with first and finish wrapping over the prime coat.
 - 2) Wrap joints, fittings, valves, and other irregular shapes of piping with extruded coatings with tape as specified in this subparagraph.
 - b. Field coat aboveground steel pipe as specified in Section 09960.

3.02 FIELD QUALITY CONTROL

- A. Field test fabricated steel manifolds with the pipe to which they connect.

END OF SECTION

SECTION 15281

COPPER WATER TUBE: SEAMLESS, ASTM B88

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Copper water tube-seamless, ASTM B88.
- B. Related sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 15052 - Common Work Results for General Piping.
 - 3. Section 15061 - Pipe Supports.

1.02 REFERENCES

- A. ASTM International (ASTM):
 - 1. B32 - Standard Specification for Solder Metal.
 - 2. B88 - Standard Specification for Seamless Copper Water Tube.
 - 3. B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube.
 - 4. B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fitting.
- B. International Association of Plumbing and Mechanical Officials (IAPMO):
 - 1. IS 3 - Installation Standard for Copper Plumbing Tube, Pipe and Fittings.

1.03 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Class: Provide copper piping system designed for a minimum 300 psi operating pressure.

1.04 SUBMITTALS

- A. Submit as specified in Section 01330.
- B. Product data: As specified in Section 15052.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Seamless copper water tube:
 - 1. Type: ASTM B88:
 - a. Exposed copper piping or tubing: Type L hard-drawn, rigid.
 - b. Copper tubing buried in the ground or in plastic conduit: Type K soft-annealed.

2. Fittings: Manufacturers: Solder type forged, or wrought copper. One of the following or equal:
 - a. Hoke, Gyrolok.
 - b. Crawford Fitting Company, Swagelok.
 - c. Parker.
3. Solder: ASTM B32, Alloy Grade Sb5.
4. Flux: ASTM B813.
5. Dielectric insulating unions or fittings: Manufacturers: One of the following or equal:
 - a. Mueller Company.
 - b. Watts Series 3001A.
6. Special thread to tube adapters: Manufacturers: One of the following or equal:
 - a. Crawford Fitting Company, Swagelok.
 - b. Hoke, Gyrolok.
 - c. Parker.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General:
 1. Support copper piping and tubing as specified in Sections 15061.
 2. Clean copper lines with high-pressure air after first disconnecting piping at instruments, filters, pressure reducers, valve operators, and other special devices.
 3. Install copper pipe in accordance with IAPMO IS 3.
- B. Installation of copper piping:
 1. Connect copper pipe connected to ferrous pipe or valves, or other non-copper items, by means of dielectric insulating unions or fittings.
 2. Where connections are made to meters or other devices having iron pipe size threaded fittings, provide special thread to tube adapters.
- C. Installation of copper tubing:
 1. Install copper tubing in accordance with ASTM B828 and IAPMO IS 3.
 2. Install copper tubing in straight runs, supported at intervals close enough to avoid sagging.
 3. Make cuts square with a tubing cutter or with a 32-tooth hacksaw.
 - a. Provide a sizing tool to correct distortions.
 4. Ream the inside of the tubing and remove burrs from the outside, holding the end of the tubing downward and preventing chips and fillings from entering the tubing.
 5. Perform flaring with a flare block and yoke type screw feed flaring tool:
 - a. After removing the tubing from the flare block, inspect both surfaces of the flare for splits, cracks, or other imperfections.
 - b. Where there are imperfections, cut off the imperfect flare, and prepare a new flare.

3.02 FIELD QUALITY CONTROL

- A. Testing: Test copper lines in the same manner as the piping system to which they connect.

END OF SECTION

SECTION 15956

PIPING SYSTEMS TESTING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Test requirements for piping systems.
- B. Related Sections:
 - 1. Section 15052 - Basic Piping Materials and Methods.

1.02 REFERENCES

- A. Uniform Plumbing Code (UPC).
- B. National Fuel Gas Code: ANSI Z 223.1 or NFPA 54.
- C. American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME):
 - 1. B31.8 - Gas Transmission and Distribution Piping Systems.
 - 2. B31.1 - Power Piping.
 - 3. B31.3 - Process Piping.
- D. Uniform Mechanical Code (UMC).

1.03 TESTING REQUIREMENTS

- A. General Requirements:
 - 1. Testing requirements are stipulated in Laws and Regulations; are specified in the specifications covering the various types of piping; and are specified herein.
 - 2. Requirements in Laws and Regulations supersede other requirements of Contract Documents, except where requirements of Contract Documents are more stringent, including higher test pressures, longer test times, and lower leakage allowances.
 - 3. Test plumbing piping in accordance with Laws and Regulations, the Uniform Plumbing Code, and UL requirements.
 - 4. When testing with water, the specified test pressure is considered to be the pressure at the highest point of the piping section under test. Lower test pressure as necessary to prevent testing the lowest point above a safe test pressure.
- B. Furnish necessary personnel, materials, and equipment, including bulkheads, restraints, anchors, temporary connections, pumps, water, pressure gauges, and other means and facilities required to perform tests.

- C. Water for Testing, Cleaning, and Disinfecting:
 - 1. Water for testing, cleaning, and disinfecting will be provided as specified in Section 01500.
- D. Pipes to be Tested:
 - 1. Test all pipes that have been installed as part of this Contract. Test new pipe sections prior to making final connections to existing piping. Furnish and install test plugs, bulkheads, and restraints required to isolate new pipe sections. Do not use existing valves as test plug or bulkhead.
 - 2. Test the existing recycled water transmission main in CSUMB property. Perform a low head pressure test followed by a high head pressure test.
 - 3. Test the existing recycled water transmission main in General Jim Moore Boulevard. Perform a low head pressure test followed by a high head pressure test.
- E. Unsuccessful Tests:
 - 1. Where tests are not successful, correct defects or remove defective piping and appurtenances and install piping and appurtenances that comply with the specified requirements.
 - 2. Repeat testing until tests are successful.
- F. Test Completion: Drain and leave piping clean after successful testing.
- G. Test Water Disposal: Dispose of testing water to nearest sanitary sewer in accordance with requirements of federal, state, county, and city regulations governing disposal of wastes in the location of the Project and disposal site.

1.04 SUBMITTALS

- A. Schedule and Notification of Tests:
 - 1. Submit a list of scheduled piping tests by noon of the working day preceding the date of the scheduled tests.
 - 2. Notification of Readiness to Test: Immediately before testing, notify ENGINEER in writing of readiness, not just intention, to test piping. Have personnel, materials, and equipment specified in place before submitting notification of readiness.
 - 3. Testing plan.

1.05 SEQUENCE

- A. Clean piping before pressure or leak tests.
- B. Develop and submit a test plan for approval. The test plan shall indicate locations of all temporary systems and permanent appurtenances used for testing. The test plan shall indicate the source of water and planned water disposal. A contingency plan shall be developed to identify a method of dewatering the pipeline in the event of a leak or pipeline break.
- C. Test gravity piping underground, including sanitary sewers, for visible leaks before backfilling and compacting.
- D. Underground pressure piping may be tested before or after backfilling when not indicated or specified otherwise.

- E. Backfill and compact trench, or provide blocking that prevents pipe movement before testing underground piping with a maximum leakage allowance.
- F. Test underground piping before encasing piping in concrete or covering piping with slab, structure, or permanent improvement.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 TESTING ALIGNMENT, GRADE, AND DEFLECTION

- A. Alignment and Grade:
 - 1. Visually inspect the interior of gravity piping with artificial light, reflected light, or laser beam.
 - 2. Consider inspection complete when no broken or collapsed piping, no open or poorly made joints, no grade changes that affect the piping capacity, or no other defects are observed.
- B. Deflection Test:
 - 1. Pull a mandrel through the clean piping section under test.
 - 2. Perform the test not sooner than 30 days after installation and not later than 60 days after installation.
 - 3. Use a 9 rod mandrel with a contact length of not less than the nominal diameter of the pipe within one percent plus or minus.
 - 4. Consider test complete when the mandrel can be pulled through the piping with reasonable effort by 1 person, without the aid of mechanical equipment.

3.02 TESTING GRAVITY FLOW PIPING

- A. Test Gravity Flow Piping Indicated with "GR" in the Piping Schedule, as Follows:
 - 1. Unless Specified Otherwise, Subject Gravity Flow Piping to the Following Tests:
 - a. Alignment and grade.
 - b. For plastic piping test for deflection.
 - c. Visible leaks and pressure with maximum leakage allowance, except for storm drains and culverts.
 - 2. Inspect piping for visible leaks before backfilling. Provide temporary restraints when needed to prevent movement of piping. Pressure test piping with maximum leakage allowance after backfilling.
 - 3. With the lower end plugged, fill piping slowly with water while allowing air to escape from high points. Keep piping full under a slight head for the water at least 24 hours:
 - a. Examine piping for visible leaks. Consider examination complete when no visible leaks are observed.
 - b. Maintain piping with water, or allow a new water absorption period of 24 hours for the performance of the pressure test with maximum leakage allowance.

- c. After successful completion of the test for visible leaks and after the piping has been restrained and backfilled, subject piping to the test pressure for minimum of four hours while accurately measuring the volume of water added to maintain the test pressure:
 - 1) Consider the test complete when leakage is equal to or less than the following maximum leakage allowances:
 - a) For Concrete Piping with Rubber Gasket Joints: 80 gallons per day per inch of diameter per mile of piping under test:
 - (1) Advise manufacturer of concrete piping with rubber gasket joints of more stringent than normal maximum leakage allowance.
 - b) For Vitrified Clay and Other Piping: 500 gallons per day per inch of diameter per mile of piping under test.

3.03 TESTING HIGH-HEAD PRESSURE PIPING

- A. Test piping for which the specified test pressure in the Piping Schedule is 20 pounds per square inch gauge or greater, by the high head pressure test method, indicated "HH" in the Piping schedule.
- B. General:
 - 1. Test connections, hydrants, valves, blowoffs, and closure pieces with the piping.
 - 2. Do not use installed valves for shutoff when the specified test pressure exceeds the valve's maximum allowable seat differential pressure. Provide blinds or other means to isolate test sections.
 - 3. Do not include valves, equipment or piping specialties in test sections if test pressure exceeds the valve, equipment or piping specialty safe test pressure allowed by the item's manufacturer.
 - 4. During the performance of the tests, test pressure shall not vary more than plus or minus 5 pounds per square inch gauge with respect to the specified test pressure.
 - 5. Select the limits of testing to sections of piping. Select sections that have the same piping material and test pressure.
 - 6. When Test Results Indicate Failure of Selected Sections, Limit Tests to Piping:
 - a. Between valves.
 - b. Between a valve and the end of the piping.
 - c. Less than 500 feet long.
 - 7. Test piping for minimum 2 hours for visible leaks test and minimum 2 hours for the pressure test with maximum leakage allowance.
- C. Testing Procedures:
 - 1. Fill piping section under test slowly with water while venting air. Use potable water for all potable waterlines and where noted on the Piping Schedule.
 - 2. Before pressurizing for the tests, retain water in piping under slight pressure for a water absorption period of minimum 24 hours.
 - 3. Raise pressure to the specified test pressure and inspect piping visually for leaks. Consider visible leakage testing complete when no visible leaks are observed.
- D. Pressure Test with Maximum Leakage Allowance:
 - 1. Leakage allowance is zero for piping systems using flanged, National Pipe Thread threaded and welded joints.

2. Pressure test piping after completion of visible leaks test.
3. For piping systems using joint designs other than flanged threaded or welded joints, accurately measure the makeup water necessary to maintain the pressure in the piping section under test during the pressure test period:
 - a. Consider the pressure test to be complete when makeup water added is less than the allowable leakage and no damage to piping and appurtenances has occurred.
 - b. Successful completion of the pressure test with maximum leakage allowance shall have been achieved when the observed leakage during the test period is equal or less than the allowable leakage and no damage to piping and appurtenances has occurred.
 - c. When leakage is allowed, calculate the allowable leakage by the following formula:

$$L = S \times D \times P^{1/2} \times 133,200^{-1}$$

wherein the terms shall mean:

L = Allowable leakage in gallons per hour.

S = Length of the test section in feet.

D = Nominal diameter of the piping in inches.

P = Average observed test pressure in pounds per square inches, gauge, at the lowest point of the test section, corrected for elevation of the pressure gauge.

x = The multiplication symbol.

3.04 TESTING LOW-HEAD PRESSURE PIPING

- A. Test piping for which the specified test pressure is less than 20 pounds per square inch gauge, by the low head pressure test method, indicated "LH" in the Piping Schedule.
- B. General:
 1. Test pressures shall be as scheduled in Section 15052.
 2. During the performance of the tests, test pressure shall not vary more than plus or minus 2 pounds per square inch gauge with respect to the specified test pressure.
 3. Test connections, blowoffs, vents, closure pieces, and joints into structures, including existing bell rings and other appurtenances, with the piping.
 4. Test piping for minimum 2 hours for visible leaks test and minimum 2 hours for the pressure test with maximum leakage allowance.
- C. Visible Leaks Test:
 1. Subject piping under test to the specified pressure measured at the lowest end.
 2. Fill piping section under test slowly with potable water while venting air.

3. Before pressurizing for the tests, retain water in piping under slight pressure for the water absorption period of minimum 24 hours.
 4. Raise pressure to the specified test pressure and inspect piping visually for leaks. Consider testing complete when no visible leaks are observed.
- D. Pressure Test with Maximum Leakage Allowance:
1. Pressure test piping after completion of visible leaks test.
 2. Accurately measure the makeup water necessary to maintain the pressure in the piping section under test during the pressure test period:
 - a. Consider the pressure test to be complete when makeup water added is less than the allowable leakage of 80 gallons per inch of nominal diameter, per mile of piping section under test after 24 hours and no damage to piping and appurtenances has occurred.
 - b. Successful completion of the leakage test shall have been achieved when the observed leakage is equal or less than the allowable leakage and no damage to piping and appurtenances has occurred.

END OF SECTION

SECTION 15958

MECHANICAL EQUIPMENT TESTING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes: Testing of mechanical equipment and systems.
- B. Related Sections:
 - 1. Section 01756 - Testing, Training, and Facility Start-Up.
 - 2. Section 02318 - Trenching.
 - 3. Section 16222 - Low Voltage Motors Up to 500 HP.
 - 4. Section 15956 - Piping Systems Testing.
 - 5. Section 16950 - Electrical Testing.

1.02 REFERENCES

- A. American National Standards Institute (ANSI):
 - 1. ANSI S1.4 Specification for Sound Level Meters.
- B. American National Standards Institute/Hydraulic Institute (ANSI/HI):
 - 1. ANSI/HI 1.1-1.5 Standard for Centrifugal Pumps for Nomenclature, Definitions, Application and Operation.
 - 2. ANSI/HI 1.6 Standard for Centrifugal Pump Tests.
 - 3. ANSI/HI 2.1-2.5 Standard for Vertical Pumps for Nomenclature, Definitions, Application and Operation.
 - 4. ANSI/HI 2.6 Standard for Vertical Pump Tests.
 - 5. ANSI/HI 3.1-3.5 Standard for Rotary Pumps for Nomenclature, Definitions, Application and Operation.
 - 6. ANSI/HI 3.6 Standard for Rotary Pump Tests.
 - 7. ANSI/HI 4.1-4.6 Standard for Sealless Rotary Pumps for Nomenclature, Definitions, Application, Operation and Test.
 - 8. ANSI/HI 5.1-5.6 Standard for Sealless Centrifugal Pumps for Nomenclature, Definitions, Application, Operation and Test.
 - 9. ANSI/HI 6.1-6.5 Standard for Reciprocating Power Pumps for Nomenclature, Definitions, Application and Operation.
 - 10. ANSI/HI 6.6 Standard for Reciprocating Pump Tests.
 - 11. ANSI/HI 7.1-7.5 Standard for Controlled Volume Pumps for Nomenclature, Definitions, Application and Operation.
 - 12. ANSI/HI 8.1-8.5 Standard for Direct Acting for Steam Pumps for Nomenclature, Definitions, Application and Operation.
 - 13. ANSI/HI 9.1-9.5 Standard for Pumps - General Guidelines for Types, Definitions, Application and Sound Measurement.

1.03 SUBMITTALS

- A. Schedule of factory tests and field tests as specified in Section 01756 and this Section.

- B. Test instrumentation calibration data.
- C. Start-up plan as specified in Section 01756.
- D. Test Plan specified in this Section.
- E. Test result reports.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.01 QUALITY CONTROL TESTING AND REPORTING

- A. Scheduling and Notification:
 - 1. Witnessed Source Quality Control Tests: Schedule test date and notify ENGINEER at least 30 days prior to start of test.
 - 2. Field Quality Control Tests: Schedule test date and notify ENGINEER at least 7 days prior to start of test.
- B. Testing Levels:
 - 1. Test equipment based on test levels specified in the equipment Section of the Specifications.
 - 2. Requirements for Test Levels 1 to 4 are defined below.
 - 3. Test levels apply for both Source (Factory) Quality Control Tests and Field Quality Control Tests as specified in the individual equipment Sections of the Specifications.
 - 4. If testing is not specified in the equipment Section, provide Level 1 testing.
 - 5. Requirements of Section 01756 apply to Test Levels.
- C. Witnessing: Source Quality Control Tests not witnessed unless specified otherwise in the equipment specification Section or Section 01756; Field Quality Control Tests shall be witnessed.
- D. Instrumentation: Provide necessary test instrumentation which has been calibrated within one year from date of test to recognized test standards traceable to the National Institute of Standards and Technology, Washington, D.C. or approved source. Properly calibrated field instrumentation permanently installed as a part of the Work may be utilized for Field Quality Control Tests.
- E. Temporary Facilities and Labor: Provide necessary fluids, utilities, temporary piping, temporary supports, temporary access platforms or access means and other temporary facilities and labor necessary to safely operate the equipment and accomplish the specified testing. With OWNER's permission, some utilities may be provided by fully tested permanently installed utilities that are part of the Work.
- F. Test Fluids:
 - 1. Factory Tests: Use water or air as appropriate at ambient conditions unless specified otherwise in the equipment Section.
 - 2. Field Tests: Use specified process fluid at available conditions.

- G. Pressure Testing: Hydrostatically pressure test pressure containing parts in the factory at the appropriate standard or code required level above the equipment component specified design pressure or operating pressure, whichever is higher. Submit pressure test reports before shipping.
- H. Test Measurement and Result Accuracy:
 - 1. Use test instruments with accuracies as recommended in the appropriate referenced standards. When no accuracy is recommended in the referenced standard, use 1 percent or better accuracy test instruments. Improved (lower error tolerance) accuracies specified elsewhere prevail over this general requirement.
 - 2. Do not adjust results of tests for instrumentation accuracy. Measured values and values directly calculated from measured values shall be the basis for comparing actual equipment performance to specified requirements.
- I. Field Testing:
 - 1. Submit test plan as specified in Section 01756 and this Section. Indicate test start time and duration, equipment to be tested, other equipment involved or required; temporary facilities required, number and skill or trade of personnel involved; safety issues and planned safety contingencies; anticipated effect on OWNER's existing equipment and other information relevant to the test. Provide locations of all instruments to be used for testing. Provide calibration records for all instrumentation.
 - 2. Perform general start-up and testing procedures as specified in Section 01756.
 - 3. Prior to testing, verify equipment protective devices and safety devices have been installed, calibrated, and tested.
- J. Reports: Submit reports for Source and Field testing. Submit Source Quality Control Test result reports before shipping equipment to the field. Report features:
 - 1. Report results in a bound document in generally accepted engineering format with title page, written summary of results compared to specified requirements, and appropriate curves or plots of significant variables in English units.
 - 2. Include appendix with a copy of raw, unmodified test data sheets indicating test value, date and time of reading, and initials of person taking the data.
 - 3. Include appendix with sample calculations for adjustments to raw test data and for calculated results.
 - 4. Include appendix with the make, model, and last calibration date of instrumentation used for test measurements.
 - 5. Include in body of report a drawing or sketch of the test system layout showing location and orientation of the test instruments relative to the tested equipment features.

3.02 EQUIPMENT TESTING, GENERAL

- A. Tests for Pumps, All Levels of Testing:
 - 1. Test in accordance with applicable Hydraulic Institute Standards in addition to the requirements in this and other Sections.
 - 2. Test Tolerances: In accordance with appropriate Hydraulic Institute Standards, except the following modified tolerances apply:
 - a. From 0 to plus 5 percent of head at the specified flows.
 - b. From 0 to plus 5 percent of flow at the rated design point head.

- c. No negative tolerance for the efficiency at the specified flows.
 - d. No positive tolerance for vibration limits. Vibration limits and test methods in Hydraulic Institute Standards do not apply, use limits and methods specified in this or other Sections of the Specifications.
- B. Tests for Drivers: Test motors as specified in Section 16222. Test other drivers as specified in the driver equipment Section.

3.03 REQUIREMENTS FOR VIBRATION TESTING

- A. Definitions:
1. Peak to Peak Displacement: The root mean squared average of the peak to peak displacement multiplied by the square root of 2.
 2. Peak Velocity: The root mean squared average of the peak velocity multiplied by the square root of 2.
 3. Peak Acceleration: The root mean squared average of the peak acceleration multiplied by the square root of 2.
 4. High Frequency Enveloping: A process to extract very low amplitude time domain signals associated with impact or impulse events such as bearing or gear tooth defects and display them in a frequency spectrum of acceleration versus frequency. Manufacturers: One of the following or equal:
 - a. Rockwell Automation, Entek Group, "Spike Energy" analysis.
 - b. CSI, "PeakVue."
 5. Low Speed Equipment: Equipment or components of equipment rotating at less than 600 revolutions per minute.
 6. High Speed Equipment: Equipment and equipment components operating at or above 600 revolutions per minute.
- B. Vibration Instrumentation Requirements:
1. Analyzers: Use digital type analyzers or data collectors with anti-aliasing filter, 12 bit A/D converter, fast fourier transform circuitry, phase measurement capability, time wave form data storage, high frequency enveloping capabilities, 35 frequency ranges from 21 to 1,500,000 cycles per minute, adjustable fast fourier transform resolution from 400 to 6,400 lines, storage for up to one hundred 3,200 line frequency spectra, RS232C data output port, circuitry for integration of acceleration data to velocity or double integration to displacement. Manufacturers: One of the following or equal:
 - a. Entek-IRD, Division of Rockwell Automation, Enpac 1200 with applicable data analysis software or Entek Model 838 analyzer with built in printer.
 - b. Computational Systems Inc., (CSI) Division of Emerson Electric, Model 2120A, Data Collector/analyzer with applicable analysis software.
 2. Analyzer Settings:
 - a. Units: English, inches/second, mils, and g's.
 - b. Fast Fourier Transform Lines: Most equipment 1,600 minimum; for motors, enough lines as required to distinguish motor current frequencies from rotational frequencies, use 3,200 lines for motors with a nominal speed of 3,600 rpm; 3,200 lines minimum for High Frequency Enveloping; 1600 lines minimum for low speed equipment.
 - c. Sample Averages: 4 minimum.
 - d. Maximum Frequency (Fmax): 40 times rotational frequency for rolling element bearings, 10 times rotational frequency for sleeve bearings.

- e. Amplitude Range: Auto select but full scale not more than twice the acceptance criteria or the highest peak, whichever is lower.
 - f. Fast Fourier Transform Windowing: Hanning Window.
 - g. High Pass Filter: Minus 3 dB at 120 cycles per minute for high speed equipment. Minus 3 dB at 21 cycles per minute for low speed equipment.
3. Accelerometers:
- a. For Low Speed Equipment: Low frequency, shear mode accelerometer, 500 millivolts per g sensitivity, 10 g range, plus/minus 5 percent frequency response from 0.5 hertz to 850 hertz, magnetic mount. Manufacturers: One of the following or equal:
 - 1) Wilcoxon Research, Model 797L.
 - 2) PCB, Model 393C.
 - b. For High Speed Equipment: General purpose accelerometer, 100 millivolts per g sensitivity, 50 g range, plus/minus 3dB frequency response from 2 hertz to 12,000 hertz when stud mounted, with magnetic mount holder. Manufacturers: One of the following or equal:
 - 1) Wilcoxon Research, Model 793.
 - 2) Entek-IRD Model 943.
- C. Accelerometer Mounting:
- 1. Use magnetic mounting or stud mounting.
 - 2. Mount on bearing housing in location with best available direct path to bearing and shaft vibration.
 - 3. Remove paint and mount transducer on flat metal surface or epoxy mount for High Frequency Enveloping measurements.
- D. Vibration Testing Results Presentation:
- 1. Provide equipment drawing with location and orientation of measurement points indicated.
 - 2. For each vibration measurement take and include appropriate data on equipment operating conditions at the time vibration data is taken; for pumps, compressors, and blowers record suction pressure, discharge pressure, and flow.
 - 3. When Vibration Spectra Data Required:
 - a. Plot peak vibration velocity versus frequency in cycles per minute.
 - b. Label plots showing actual shaft or part rotation frequency, bearing inner and outer race ball pass frequencies, gear mesh frequencies and relevant equipment excitation frequencies on the plot; label probable cause of vibration peaks whether in excess of specification limits or not.
 - c. Label plots with equipment identification and operating conditions such as tag number, capacity, pressure, driver horsepower, and point of vibration measurement.
 - d. Plot motor spectra on a log amplitude scale versus frequency.
 - 4. For low speed equipment, plot peak vibration displacement versus frequency as well as velocity versus frequency.
 - 5. Provide name of manufacturer and model number of the vibration instrumentation used, including analyzer and accelerometer used together with mounting type.

3.04 TESTING LEVELS

- A. Level 1 Quality Control Tests:
 - 1. Level 1 General Equipment Performance Test:
 - a. For equipment, operate, rotate, or otherwise functionally test for 15 minutes minimum after components reach normal operating temperatures.
 - b. Operate at rated design load conditions.
 - c. Confirm that equipment is properly assembled, equipment moves or rotates in the proper direction, shafting, drive elements and bearings are installed and lubricated in accordance with proper tolerances, and that no unusual power consumption, lubrication temperatures, bearing temperatures, or other conditions are observed.
 - 2. Level 1 Pump Performance Test:
 - a. Measure flow and head while operating at or near the rated condition; for factory testing, testing may be at reduced speeds with flow and head corresponding to the rated condition when adjusted for speed using the appropriate affinity laws.
 - b. Record measured flow, suction pressure, discharge pressure, and make observations on bearing temperatures and noise levels.
 - 3. Level 1 Vibration Test:
 - a. Test Requirement:
 - 1) Measure filtered vibration spectra versus frequency in three perpendicular planes at each normally accessible bearing housing on the driven equipment, any gears and on the driver; one plane of measurement to be parallel to the axis of rotation of the component.
 - 2) Vibration spectra versus frequency shall be in accordance with paragraph 15958-3.07.
 - b. Equipment Operating Condition: Test at specified maximum speed.
 - 4. Level 1 Noise Test:
 - a. Measure unfiltered overall A-weighted sound pressure level in dBA at 3 feet horizontally from the surface of the equipment and at a mid-point of the equipment height.
- B. Level 2 Quality Control Tests:
 - 1. Level 2 General Performance Test:
 - a. For equipment, operate, rotate, or otherwise functionally test for at least 2 hours after components reach normal operating temperatures.
 - b. Operate at rated design load conditions.
 - c. Confirm that equipment is properly assembled, equipment moves or rotates in the proper direction, shafting, drive elements and bearings are installed and lubricated in accordance with proper tolerances, and that no unusual power consumption, lubrication temperatures, bearing temperatures, or other conditions are observed.
 - 2. Level 2 Pump Performance Test:
 - a. Test 2 hours minimum for flow and head at the rated condition; for factory testing, testing may be at a reduced speeds with flow and head corresponding to the rated condition when adjusted for speed using the appropriate affinity laws.
 - b. Test for flow and head at two additional conditions; one at 25 percent below the rated flow and one at 10 percent above the rated flow.

- c. Record measured flow, suction pressure, discharge pressure, and observations on bearing temperatures and noise levels at each condition.
- 3. Level 2 Vibration Test:
 - a. Test Requirement:
 - 1) Measure filtered vibration spectra versus frequency and measure vibration phase in three perpendicular planes at each normally accessible bearing housing on the driven equipment, any gears and on the driver; one plane of measurement to be parallel to the axis of rotation of the component; measure actual rotational speeds for each vibration spectra measured using photometric or other tachometer input connected directly to the vibration data collector.
 - 2) Vibration spectra versus frequency shall be in accordance with paragraph 15958-3.07.
 - b. Equipment Operating Condition: Repeat test requirements at design specified maximum speed and at minimum speed for variable speed equipment.
 - c. Natural Frequency Test of Field Installed Equipment:
 - 1) Excite the installed equipment and support system in 3 perpendicular planes, use same planes as operating vibration measurement planes, and determine the as-installed natural resonant frequency of the driven equipment, the driver, gears and supports.
 - 2) Perform test at each bearing housing, at each support pedestal, and for pumps on the suction and discharge piping.
 - 3) Perform with equipment and attached piping full of intended service or process fluid.
- 4. Level 2 Noise Test:
 - a. Measure filtered A-weighted overall sound pressure level in dBA for each of 8 octave band mid-points beginning at 63 hertz measured at three feet horizontally from the surface of the equipment at mid-point height of the noise source.

C. Level 3 Quality Control Tests:

- 1. Level 3 General Equipment Performance Tests:
 - a. For equipment, operate, rotate, or otherwise functionally test for at least 4 hours after components reach normal operating temperatures.
 - b. Operate at rated design load conditions for one half the specified time; operate at each of any other specified conditions for a proportionate share of the remaining test time.
 - c. Confirm that equipment is properly assembled, equipment rotates in the proper direction, shafting and bearings are installed and lubricated in accordance with proper tolerances, and that no unusual noise, vibration or temperatures are observed.
 - d. Take appropriate capacity, power or fuel consumption, torque, revolutions per minute, pressure and temperature readings using appropriate test instrumentation to confirm equipment meets specified performance requirements at the design rated condition.
 - e. Bearing Temperatures: During maximum speed or capacity performance testing, measure and record the exterior surface temperature of each bearing versus time.
- 2. Level 3 Pump Performance Test:
 - a. Test four hours minimum for flow and head at or near the rated condition; for factory testing, testing may be at a reduced speeds with flow and head

- corresponding to the rated condition when adjusted for speed using the appropriate affinity laws.
- b. Test each specified flow and head condition at the rated speed and test at minimum as well as maximum specified speeds; operate at each test condition for a minimum of 15 minutes; for factory testing, test at other speeds may be omitted if test driver at reduced speeds is used for rated condition testing.
 - c. Record measured shaft revolutions per minute, flow, suction pressure, discharge pressure; record measured bearing temperatures (bearing housing exterior surface temperatures may be recorded when bearing temperature devices are not required by the equipment specification) and record observations on noise levels.
3. Level 3 Vibration Test:
- a. Requirements: Same as Level 2 vibration test except data taken at each operating condition tested and with additional requirements below.
 - b. Perform High Frequency Enveloping Analysis for gears and bearings:
 - 1) Measure bearing element vibration directly on each bearing cap in a location close as possible to the bearing load zone that provides a smooth surface and direct path to the bearing to detect bearing defects.
 - 2) Report results in units of acceleration versus frequency in cycles per minute.
 - c. Perform Time Wave Form analysis for gears, low speed equipment and reciprocating equipment; plot true peak amplitude velocity and displacement versus time and label the period between peaks with the likely cause of the periodic peaks (relate the period to a cause).
 - d. Plot vibration spectra on three different plots; peak displacement versus frequency, peak acceleration versus frequency and peak velocity versus frequency.
4. Level 3 Noise Test: Measure filtered, un-weighted overall sound pressure level in dB at 3 feet horizontally from the surface of the equipment at mid-point height and at four locations approximately 90 degrees apart in plan view; report results for each of 8 octave band mid-points beginning at 63 hertz.
- D. Level 4 Quality Control Tests:
1. Level 4 General Equipment Performance Test:
 - a. For equipment, operate, rotate, or otherwise functionally test for at least 8 hours after components reach normal operating temperatures.
 - b. Operate at rated design load conditions for one half the specified time; operate at each of any other specified conditions for a proportionate share of the remaining test time.
 - c. Confirm that equipment is properly assembled, equipment rotates in the proper direction, shafting and bearings are installed and lubricated in accordance with proper tolerances, and that no unusual noise, vibration or temperatures are observed.
 - d. Take appropriate capacity, power or fuel consumption, torque, revolutions per minute, pressure and temperature readings using appropriate test instrumentation to confirm equipment meets specified performance requirements at the design rated condition.
 - e. Bearing Temperatures: During maximum speed or capacity testing, measure and record the exterior surface temperature of each bearing versus time.

2. Level 4 Pump Performance Test:
 - a. Test 8 hours minimum for flow and head; begin tests at or near the rated condition; for factory and field testing, test with furnished motor at full speed.
 - b. Test each specified flow and head condition at the rated speed and test at minimum as well as maximum specified speeds; operate at each test condition for a minimum of 20 minutes or longer as necessary to measure required performance, vibration and noise data at each test condition.
 - c. Record measured shaft revolutions per minute, flow, suction pressure, discharge pressure; record measured bearing temperatures (bearing housing exterior surface temperatures may be recorded when bearing temperature devices not required by the equipment specification) and record observations on noise levels.
 - d. Bearing Temperatures: During maximum speed or capacity testing, measure and record the exterior surface temperature of each bearing versus time.
 - e. Perform efficiency and/or Net Positive Suction Head Required (NPSHr) and/or priming time tests when specified in the equipment Section in accordance with the appropriate ANSI/HI standard and as follows:
 - 1) Perform NPSHr testing at maximum rated design speed, head and flow with test fluids at ambient conditions; at maximum rated speed, test at 15 percent above rated design flow, and 25 percent below rated design flow.
 - 2) Perform efficiency testing with test fluids at maximum rated speed.
 - 3) Perform priming time testing with test fluids at maximum rated speed.
3. Level 4 Vibration Test: Same as Level 3 vibration test.
4. Level 4 Noise Test: Same as Level 3 Noise Test except with data taken at each operating condition tested.

3.05 SOURCE QUALITY CONTROL

- A. Test equipment as specified for each type of test at the test levels specified in individual equipment sections. Prepare and submit test reports as specified.
- B. Inspection and Balancing:
 1. Statically and dynamically balance each of the individual rotating parts as required to achieve the required field vibration limits. Statically and dynamically balance the completed equipment rotating assembly and drive shaft components.
 2. Furnish copies of material and component inspection reports including balancing reports for equipment system components and for the completed rotating assembly.
- C. Critical Speed of Rotating Equipment: Satisfy the following:
 1. The first lateral and torsional critical speed of all constant, variable, and 2-speed driven equipment that is considered rigid such as horizontal pumps, all non-clog pumps, blowers, air compressors, and engines shall be at least 25 percent above the equipment's maximum operating speed.
 2. The first lateral and torsional critical speed of all constant, variable, and 2-speed driven equipment that is considered flexible or flexibly mounted such as vertical pumps (vertical in-line and vertical non-clog pumps excluded) and fans shall at least 25% below the equipment's lowest operating speed.

3. The second lateral and torsional critical speed of all constant, variable, and 2-speed equipment that is considered flexible or flexibly mounted shall be at least 25 percent above the maximum operating speed.

3.06 FIELD QUALITY CONTROL

- A. Test equipment as specified for each type of test at the test levels specified in individual equipment Sections. Prepare and submit test reports as specified. Comply with latest version of applicable standards.
- B. For variable speed equipment, conduct test to establish performance over the entire speed range and at the average operating condition. Establish performance curves for:
 1. The speed corresponding to the rated maximum capacity.
 2. The speed corresponding to the minimum capacity.
 3. The speed corresponding to the average operating conditions.

3.07 VIBRATION ACCEPTANCE CRITERIA

- A. Testing of Rotating Mechanical Equipment: Tests are to be performed by an experienced, factory trained, and independent authorized vibration analysis expert.
- B. Vibration Displacement Limits: Unless otherwise specified, equipment operating at speeds 600 RPM or less is not to exhibit unfiltered readings in excess of following:

Operating Speed (revolutions per minute)	Unfiltered (Overall) Peak-to-Peak Amplitude (mils)
	All Rotating Equipment
0 - 300	6.5
301 - 600	4.5
Note: For all equipment, axial shaft displacements not to exceed 50 percent of the maximum radial shaft displacements shown in the table relative to the casing.	

- C. Vibration Velocity Limits: Unless otherwise specified, equipment operating at speeds greater than 600 rpm is not to exceed the following peak velocity limits:

Item	Unfiltered Overall Limit (inches per second)	Any Filtered Peak Limit (inches per second)
Horizontal and Vertical In-Line Centrifugal Pumps (other than Non-Clog type)	0.18 (Input BHP 25 or less)	0.14 (Input BHP 25 or less)
	0.22 (Input BHP more than 25 but less than 100)	0.18 (Input BHP more than 25 but less than 100)
	0.25 (Input BHP 100 or more)	0.20 (Input BHP 100 or more)
	0.33 (Input BHP 125 or more)	0.24
Motors	See Applicable Motor Specification	
Gear Reducers, Radial	Not to exceed AGMA 6000-A88 limits	

- D. Equipment Operation: Measurements are to be obtained with equipment installed and operating within capacity ranges specified and without duplicate equipment running.
- E. Additional Criteria:
 - 1. No narrow band spectral vibration amplitude components, whether sub-rotational, higher harmonic, or synchronous multiple of running speed, are to exceed 40 percent of synchronous vibration amplitude component without manufacturer's detailed verification of origin and ultimate effect of such excitation.
 - 2. The presence of discernable vibration amplitude peaks in Test Level 2 or 3 vibration spectra at bearing inner or outer race frequencies shall be cause for rejection of the equipment.
 - 3. For Motors, the Following Shall be Cause for Rejection:
 - a. Stator eccentricity evidenced by a spectral peak at 2 times electrical line frequency that are more than 40 percent of the peak at rotational frequency.
 - b. Rotor eccentricity evidenced by a spectral peak at 2 times electrical line frequency with spectra side bands at the pole pass frequency around the 2 times line frequency peak.
 - c. Other rotor problems evidenced by pole pass frequency side bands around operating speed harmonic peaks or 2 times line frequency side bands around rotor bar pass frequency or around two times the rotor bar pass frequency.
 - d. Phasing problems evidenced by one third line frequency side band spectral peaks around the 2 times electrical line frequency peak.
 - 4. The presence of peaks in a High Frequency Enveloping spectra plot corresponding to bearing, gear or motor rotor bar frequencies or harmonics of these frequencies shall be cause for rejection of the equipment; since inadequate lubrication of some equipment may be a cause of these peaks, lubrication shall be checked, corrected as necessary and the high frequency envelope analysis repeated.

3.08 NOISE REQUIREMENTS AND CONTROL

- A. Make measurements in relation to reference pressure of 0.0002 microbar.
- B. Make measurements of emitted noise levels on sound level meter meeting or exceeding ANSI S1.4, Type II.
- C. Set sound level meter to slow response.
- D. Unless otherwise specified, maximum free field noise level not to exceed 85 dBA measured as sound pressure level at 3 feet from the equipment.

3.09 FUNCTIONAL AND OPERATIONAL TESTING OF EQUIPMENT

- A. Functional testing as specified in Section 01756 and this Section.

- B. General Checkout: Prior to operating equipment, inspect, test, and check supporting systems, including but not limited to power systems, control systems, piping systems, lubrication systems, and safety systems:
 - 1. Test and calibrate instrumentation and electrical devices as specified in Sections 13410 and 16950.
 - 2. Test and prepare piping as specified in Sections 02318 and 15956.
 - 3. As a minimum for control systems associated with the equipment, perform the following:
 - a. Individual Loop Tests: Test from field device to intermediate terminations to controller and back to controlled element.
 - b. End to End Test: Simulate input at field device and observe control system response at the final field control element.
 - 4. Prior to testing, provide signed and dated certificates of calibration for test instrumentation and equipment.
- C. Operation of Related Existing Equipment: OWNER will operate related existing equipment or facilities necessary to accomplish the testing.
- D. Acceptable Tests: Demonstrate the equipment performance meets the requirements of this Section and the equipment Section; when the equipment fails to meet the specified requirements, perform additional more detailed testing to determine the cause, correct, repair, or replace the causative components and repeat the testing that revealed the deficiency.
- E. Operational Testing: As specified in Section 01756.

END OF SECTION

SECTION 16050

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. General requirements applicable to all Electrical Work.
 - 2. General requirements for electrical submittals.

- B. Related sections:
 - 1. Document 00200 - Instructions to Bidders.
 - 2. Document 00700 - General Conditions.
 - 3. Section 01140 - Work Restrictions.
 - 4. Section 01292 - Schedule of Values.
 - 5. Section 01312 - Project Meetings.
 - 6. Section 01324A - Progress Schedules and Reports.
 - 7. Section 01329 - Safety Plan.
 - 8. Section 01330 - Submittal Procedures.
 - 9. Section 01410 - Regulatory Requirements.
 - 10. Section 01450 - Quality Control.
 - 11. Section 01500 - Temporary Facilities and Controls.
 - 12. Section 01600 - Product Requirements.
 - 13. Section 01612 - Seismic Design Criteria.
 - 14. Section 01614 - Wind Design Criteria.
 - 15. Section 01756 - Testing, Training, and Facility start-up.
 - 16. Section 01770 - Closeout Procedures.
 - 17. Section 01782 - Operation and Maintenance Data.
 - 18. Section 16075 - Identification for Electrical Systems.
 - 19. Section 16130 - Conduits. Section 16305 - Electrical System Studies.
 - 20. Section 16950 - Field Electrical Acceptance Tests.

- C. Interfaces to equipment, instruments, and other components:
 - 1. The Drawings, Specifications, and overall design are based on preliminary information furnished by various equipment manufacturers which identify a minimum scope of supply from the manufacturers. This information pertains to, but is not limited to, instruments, control devices, electrical equipment, packaged mechanical systems, and control equipment provided with mechanical systems.
 - 2. Provide all material and labor needed to install the actual equipment furnished, and include all costs to add any additional conduit, wiring, terminals, or other electrical hardware to the Work, which may be necessary to make a complete, functional installation based on the actual equipment furnished:
 - a. Make all changes necessary to meet the manufacturer's wiring requirements.
 - 3. Submit all such changes and additions to the Engineer for acceptance as specified in Document 00700.

4. Review the complete set of Drawings and Specifications in order to ensure that all items related to the electrical power and control systems are completely accounted for. Include any such items that appear on the Drawings or in the Specifications from another discipline in the scope of Work:
 - a. If a conflict between Drawings and Specifications is discovered, refer conflict to the Engineer as soon as possible for resolution.

- D. All electrical equipment and systems for the entire Project must comply with the requirements of the Electrical Specifications, whether referenced in the individual Equipment Specifications or not:
 1. The requirements of the Electrical Specifications apply to all Electrical Work specified in other sections.
 2. Inform all vendors supplying electrical equipment or systems of the requirements of the Electrical Specifications.
 3. The Owner is not responsible for any additional costs due to the failure of the Contractor to notify all subcontractors and suppliers of the Electrical Specifications requirements.

- E. Contract Documents:
 1. General:
 - a. The Drawings and Specifications are complementary and are to be used together in order to fully describe the Work.
 2. Specifications:
 - a. The General and Supplementary Conditions of the Contract Documents govern the Work.
 - b. These requirements are in addition to all General Requirements.
 3. Contract Drawings:
 - a. The Electrical Drawings show desired locations, arrangements, and components of the Electrical Work in a diagrammatic manner.
 - b. Locations of equipment, control devices, instruments, boxes, panels, etc. are approximate only; exercise professional judgment in executing the Work to ensure the best possible installation:
 - 1) The equipment locations and dimensions indicated on the Drawings are approximate. Use the shop drawings to determine the proper layout, foundation, and pad requirements, etc. for final installation. Make changes required to accommodate differences in equipment dimensions.
 - c. Installation details:
 - 1) The Contract Drawings include typical installation details the Contractor is to use to complete the Electrical Work. For cases where a typical detail does not apply, develop installation details that may be necessary for completing the Work, and submit these details for review by the Engineer.
 - 2) Not all typical installation details are referenced within the Drawing set. Apply and use typical details where appropriate.
 - d. Schematic diagrams:
 - 1) All controls are shown de-energized.
 - 2) Schematic diagrams show control function only. Incorporate other necessary functions for proper operation and protection of the system.

- 3) Add slave relays, where required, to provide all necessary contacts for the control system or where needed to function as interposing relays for control voltage coordination, equipment coordination, or control system voltage drop considerations.
- 4) Mount all devices shown on motor controller schematic diagrams in the controller compartment enclosure, unless otherwise noted or indicated.
- 5) Schematic diagrams are to be used in conjunction with the descriptive operating sequences in the Contract Documents. Combine all information and furnish a coordinated and fully functional control system.

F. Alternates/Alternatives:

1. Coordinate with Document 00700 for substitute item provisions.

G. Changes and change orders:

1. As specified in Document 00700.

1.02 REFERENCES

A. Code compliance:

1. As specified in Section 01410.
2. The publications are referred to in the text by the basic designation only. The latest edition accepted by the Authority Having Jurisdiction of referenced publications in effect at the time of the bid governs.
3. The standards listed are hereby incorporated into this Section:
 - a. American National Standards Institute (ANSI).
 - b. American Society of Civil Engineers (ASCE):
 - 1) ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
 - c. ASTM International (ASTM).
 - d. Illuminating Engineering Society (IES). Institute of Electrical and Electronics Engineers (IEEE).
 - e. Insulated Cable Engineers Association (ICEA).
 - f. International Code Council (ICC):
 - 1) International Code Council Evaluation Service (ICC-ES):
 - a) AC 156 – Acceptance Criteria for Seismic Certification by Shake Table Testing of Non-Structural Components (ICC-ES AC 156).
 - g. International Society of Automation (ISA).
 - h. National Electrical Manufacturers Association (NEMA):
 - 1) 250 - Enclosures for Electrical Equipment (1000 V Maximum).
 - i. National Fire Protection Association (NFPA):
 - 1) 70 - National Electrical Code (NEC).
 - j. National Institute of Standards and Technology (NIST).
 - k. Underwriters' Laboratories, Inc. (UL).

B. Compliance with laws and regulations:

1. As specified in Document 00700.

1.03 DEFINITIONS

A. Definitions of terms and other electrical and instrumentation considerations as set forth by:

1. IEEE.

2. NETA.
3. IES.
4. ISA.
5. NEC.
6. NEMA.
7. NFPA.
8. NIST.

B. Specific definitions:

1. FAT: Factory acceptance test.
2. ICSC: Instrumentation and controls subcontractor.
3. LCP: Local control panel: Operator interface panel that may contain an HMI, pilot type control devices, operator interface devices, control relays, etc. and does not contain a PLC or RIO.
4. PCM: Process control module: An enclosure containing any of the following devices: PLC, RTU, or RIO.
5. PCIS: Process control and instrumentation system.
6. RTU: Remote telemetry unit: A controller typically consisting of a PLC, and a means for remote communications. The remote communications devices typically are radios, modems, etc.
7. Space: That portion of the switchgear, motor control center, panelboard, switchboard or control panel that does not physically contain a device but is capable of accepting a device with no modifications to the equipment, i.e., provide all standoffs, bus, and hardware, as part of the space.
8. Spare: That portion of the switchgear, motor control center, panelboard, switchboard or control panel that physically contains a device with no load connections to be made.
9. VCP: Vendor control panel: Control panels that are furnished with particular equipment by a vendor other than the ICSC. These panels may contain PLCs, RIO, OIT, HMI, etc.
10. Unequipped space: That portion of the switchgear, motor control center, panelboard, switchboard or control panel that does not physically contain a device, standoff, bus, hardware, or other equipment.

1.04 SYSTEM DESCRIPTION

A. General requirements:

1. The Work includes everything necessary for and incidental to executing and completing the Electrical Work indicated on the Drawings and specified in the Specifications and reasonably inferable there from:
 - a. The Electrical Drawings are schematic in nature; use the Mechanical, and Civil Drawings for all dimensions and scaling purposes.
2. It is the intent of these Specifications that the entire electrical power, instrumentation, and control system be complete and operable. Provide all necessary material and labor for the complete system from source of power to final utilization equipment, including all connections, testing, calibration of equipment furnished by others as well as equipment furnished by the Contractor, whether or not specifically mentioned but which are necessary for successful operation.
3. Provide all Electrical Work, including conduit, field wiring, and connections by the electrical subcontractor under the provisions of the Electrical Specifications for all aspects of the Work.

4. Coordinate all aspects of the Work with the electrical subcontractor and other subcontractors before bidding in order to ensure that all costs associated with a complete installation are included. The Owner is not responsible for any change orders due to lack of coordination of the Work between the Contractor, the electrical subcontractor, the other subcontractors or suppliers.
5. Portions of this Project involve installation in existing facilities and interfaces to existing circuits, power systems, controls, and equipment:
 - a. Perform and document comprehensive and detailed field investigations of existing conditions (circuits, power systems, controls, equipment, etc.) before starting any Work. Determine all information necessary to document, interface with, modify, upgrade, or replace existing circuits, power systems, controls, and equipment.
 - b. Provide and document interface with, modifications to, upgrades, or replacement of existing circuits, power systems, controls, and equipment.
6. Provide all trenching, forming, rebar, concrete, back filling, hard surface removal and replacement, for all items associated with the Electrical Work and installation:
 - a. As specified in the Contract Documents.
7. Defective work:
 - a. As specified in Document 00700.

B. Operating facility:

1. As specified in Section 01140.
2. The Blackhorse Reservoir is an operating facility. Portions of this facility must remain fully functional throughout the entire construction period. In consideration of this requirement, comply with the following guidelines:
 - a. All outages must be of minimal duration and fully coordinated and agreed to by the Owner. Adjust the construction schedule to meet the requirements of the Owner. All changes in schedule and any needs to reschedule are included in the Work.
 - b. As weather and water demand conditions dictate, re-adjust the construction schedule to meet the demands placed upon Owner by its users.
 - c. Coordinate the construction and power renovation, bear all costs, so that all existing facilities can continue operation throughout construction.
3. According to individual circumstances and in compliance with the Drawings, extend or replace conduit and cable connections from existing locations.
4. The standards of documentation, instrument tagging, cable and conductor ferruling, terminal identification and labeling that apply to the new installation apply equally to the existing installation which forms part of the modified system.

1.05 SUBMITTALS

A. Furnish submittals as specified in Section 01330 and this Section.

B. General:

1. Instruct all equipment suppliers of submittals and operation and maintenance manuals of the requirements in this Section.
2. Furnish the submittals required by each section in the Electrical Specifications.

3. Adhere to the wiring numbering scheme specified in Section 16075 throughout the Project:
 - a. Uniquely number each wire.
 - b. Wire numbers must appear on all Equipment Drawings.
 4. Use equipment and instrument tags, as indicated on the Drawings, for all submittals.
- C. Operation and maintenance manuals:
1. As specified in Section 01782.
 2. Furnish the Engineer with a complete set of written operation and maintenance manuals 8 weeks before Functional Acceptance Testing.
- D. Material and equipment schedules:
1. Furnish a complete schedule and/or matrix of all materials, equipment, apparatus, and luminaries that are proposed for use:
 - a. Include sizes, names of manufacturers, catalog numbers, and such other information required to identify the items.
- E. Schedule of values:
1. In addition to completing all items referred to in the schedule of values, Section 01292, submit per unit material and labor costs used in developing the final bid for the electrical system, for the express purpose of pricing and cost justification for any proposed change orders. In addition to the items shown on the schedule of values, provide per unit material and labor costs for conduit and wire installation for specific types, sizes, and locations as indicated on the Drawings and Conduit Schedule. It is the responsibility of the electrical subcontractor to prove to the Engineer's satisfaction that said per unit costs were used in the development of the final Bid amount.
- F. Record Documents:
1. Furnish as specified in Section 01770.
- G. Test reports:
1. As specified in Section 01330.
 2. Additional requirements for field acceptance test reports are specified in Sections 01756.
- H. Calculations:
1. Where required by specific Electrical Specifications:
 - a. Because these calculations are being provided by a registered professional engineer, they will be reviewed for form, format, and content but will not be reviewed for accuracy and calculation means.

1.06 QUALITY ASSURANCE

- A. Furnish all equipment listed by and bearing the label of UL or of an independent testing laboratory acceptable to the Engineer and the Authority Having Jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. As specified in Section 01600.

1.08 PROJECT OR SITE CONDITIONS

- A. Site conditions:
1. Provide an electrical, instrumentation and control system, including all equipment, raceways, and any other components required for a complete installation that meets the environmental conditions for the Site as specified in the General Requirements and below.
 2. Seismic load resistance:
 - a. Provide electrical equipment with construction and anchorage to supporting structures designed to resist site seismic loads as specified in Section 01612.
 3. Wind load resistance:
 - a. Provide electrical equipment with construction and anchorage to supporting structures designed to resist site wind loads as specified in Section 01614.
 4. Altitude, temperature and humidity:
 - a. Provide all electrical components and equipment fully rated for continuous operation at this altitude, with no additional derating factors applied.
 5. Site security:
 - a. Abide by all security and safety rules concerning the Work on the Site, as specified in Sections 01329 and 01500.
 6. Outdoor installations:
 - a. Provide electrical, instrumentation and control equipment suitable for operation in the ambient conditions where the equipment is located.
- B. Provide enclosures for electrical, instrumentation and control equipment, regardless of supplier or subcontractor furnishing the equipment, that meet the requirements outlined in NEMA Standard 250 for the following types of enclosures:
1. NEMA Type 1: Intended for indoor use, primarily to provide a degree of protection from accidental contact with energized parts or equipment.
 2. NEMA Type 4: Intended for indoor or outdoor use, primarily to protect equipment from exposure to windblown dust and rain, splashing or hose directed water, ice formation and freezing.
 3. NEMA Type 4X: Made from corrosion resistant materials (fiberglass reinforced plastic, 316 stainless steel or equal) and are intended for indoor or outdoor use, primarily to protect equipment from exposure to windblown dust and rain, splashing or hose directed water, ice formation and freezing, and corrosion.
 4. NEMA Type 12: Intended for indoor use, primarily to provide a degree of protection from dust, falling dirt and dripping non-corrosive liquids.
- C. Plant area Electrical Work requirements:
1. Provide all Electrical Work in accordance with the following table, unless otherwise specifically indicated on the Drawings:

PLANT AREA	NEMA ENCLOSURE TYPE	EXPOSED CONDUIT TYPE	ENVIRONMENT W = WET D = DAMP C = CLEAN/DRY X = CORROSIVE H = HAZARDOUS	SUPPORT MATERIALS
Pump Building	NEMA 1	GRC	C	Galvanized Steel
Pump Pad Area and outdoors	NEMA 4X	PCS. GRC	C	Stainless Steel

2. Modify exposed conduit runs as specified in Section 16130.

1.09 SEQUENCING (NOT USED)

1.10 SCHEDULING

- A. General:
 1. As specified in Sections 01312 and 01756.
 2. Testing requirements are specified in Section 01756, and other sections.
 3. General scheduling requirements are specified in Section 01324A.
 4. Work restrictions and other scheduling requirements are specified in Section 01140.
 5. Commissioning and Process Start-up requirements as specified in Section 01756.

1.11 WARRANTY

- A. Warrant the Electrical Work as specified in Document 00700:
 1. Provide additional warranty as specified in the individual Electrical Specifications.

1.12 SYSTEM START-UP

- A. Replace or modify equipment and materials that do not achieve design requirements after installation in order to attain compliance with the design requirements:
 1. Following replacement or modification, retest the system and perform additional testing to place the complete system in satisfactory operation and obtain compliance acceptance from the Engineer.

1.13 OWNER'S INSTRUCTIONS (NOT USED)

1.14 MAINTENANCE

- A. Before Substantial Completion, perform all maintenance activities required by any sections of the Specifications including any calibrations, final adjustments, component replacements or other routine service required before placing equipment or systems in service.
- B. Furnish all spare parts as required by other sections of the Specifications.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide similar items of same manufacturer throughout the electrical and instrumentation portion of the Project.
- B. Allowable manufacturers are specified in individual Electrical Specifications.

2.02 EXISTING PRODUCTS (NOT USED)

2.03 MATERIALS

- A. Furnish all materials under this Contract that are new, free from defects, and standard products produced by manufacturers regularly engaged in the production of these products and that bear all approvals and labels as required by the Specifications.
- B. Provide materials complying with the applicable industrial standard as specified in Document 00700.
- C. Stainless steel:
 - 1. Where stainless steel is indicated or used for any portion of the Electrical Work, provide a non-magnetic, corrosion-resistant alloy, ANSI Type 316, satin finish.
 - 2. Provide exposed screws of the same alloys.
 - 3. Provide finished material free of any burrs or sharp edges.
 - 4. Use only stainless steel hardware, when chemically compatible, in all areas that are or could be in contact with corrosive chemicals.
 - 5. Use stainless steel hardware, when chemically compatible, in all chemical areas or areas requiring NEMA Type 4X construction.
 - 6. Do not use stainless steel in any area containing chlorine, gas or solution, chlorine products or ferric chloride.

2.04 MANUFACTURED UNITS (NOT USED)

2.05 EQUIPMENT (NOT USED)

2.06 COMPONENTS (NOT USED)

2.07 ACCESSORIES (NOT USED)

2.08 MIXES (NOT USED)

2.09 FABRICATION (NOT USED)

2.10 FINISHES (NOT USED)

2.11 SOURCE QUALITY CONTROL

- A. Provide all equipment that is new, free from defects, and standard products produced by manufacturers regularly engaged in the production of these products.

PART 3 EXECUTION

3.01 EXAMINATION

- A. It is the electrical subcontractor's responsibility to be fully familiar with the existing conditions and local requirements and regulations.
- B. Review the site conditions and examine all shop drawings for the various items of equipment in order to determine exact routing and final terminations for all wiring and cables.

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

- A. Equipment locations shown on Electrical Drawings may change due to variations in equipment size or minor changes made by others during construction:
 - 1. Verify all dimensions indicated on the Drawings:
 - a. Actual field conditions govern all final installed locations, distances, and levels.
 - 2. Review all Contract Documents and approved equipment shop drawings and coordinate Work as necessary to adjust to all conditions that arise due to such changes.
 - 3. Make minor changes in location of equipment before rough in, as directed by the Owner or Engineer.
 - 4. Provide a complete electrical system:
 - a. Install all extra conduits, cables, and interfaces as may be necessary to provide a complete and operating electrical system.
- B. Install the equipment in accordance with the accepted installation instructions and anchorage details to meet the seismic and wind load requirements at the Project site.
- C. Cutting and patching:
 - 1. Perform all cutting, patching, channeling, core drilling, and fitting required for the Electrical Work, except as otherwise directed:
 - a. Secure the permission of the Engineer before performing any operation likely to affect the strength of a structural member such as drilling, cutting or piercing:
 - 1) Before cutting, channeling, or core drilling any surface, ensure that no penetration of any other systems will be made:
 - a) Verify that area is clear and free of conduits, cables, piping, ductwork, post-tensioning cables, etc.
 - b) Use tone-locate system or X-ray to ensure that area is clear of obstructions.
 - 2) Review the complete Drawing set to ensure that there are no conflicts or coordination problems before cutting, channeling, or core drilling any surface.
 - b. Review the complete Drawing set to ensure that there are no conflicts or coordination problems before cutting, channeling, or core drilling any surface.
 - 2. Perform all patching to the same quality and appearance as the original work. Employ the proper tradesmen to secure the desired results. Seal around all conduits, wires, and cables penetrating walls, ceilings, and floors in all locations with a fire stop material, typically:
 - a. 3M CP 25WB+ Caulk.

- b. 3M Fire Barrier Putty.
 - 3. Use the installation details indicated on the Drawings as a guide for acceptable sealing methods.
- D. Install all conduits in such a manner as to avoid all obstructions and to preserve headroom and keep openings and passageways clear:
 - 1. Install all conduits and equipment in accordance with working space requirements in accordance with the NEC:
 - a. Adjust equipment locations as necessary to avoid any obstruction or interferences.
 - 2. Where an obstruction interferes with equipment operation or safe access, relocate the equipment.
 - 3. Where the Drawings do not indicate the exact mounting and/or supporting method to be used, use materials and methods similar to the mounting details indicated on the Drawings.
- E. Earthwork and concrete:
 - 1. Install all trenching, shoring, concrete, backfilling, grading and resurfacing associated with the Electrical Work:
 - a. Requirements as specified in the Contract Documents.
- F. Terminations:
 - 1. Provide and terminate all conductors required to interconnect power, controls, instruments, panels, and all other equipment.
- G. Miscellaneous installation requirements:
 - 1. In case of interference between electrical equipment indicated on the Drawings and the other equipment, notify the Engineer as specified in Document 00700.
 - 2. Location of handholes indicated on the Drawings are approximate. Coordinate exact location of manholes and pullboxes with Mechanical and Civil Work.
 - 3. Provide additional handholes to those shown where they are required to make a workable installation.
- H. Labeling:
 - 1. Provide all nameplates and labels as specified in Sections 16075.

3.04 ERECTION, INSTALLATION, APPLICATION, CONSTRUCTION (NOT USED)

3.05 REPAIR/RESTORATION (NOT USED)

3.06 RE-INSTALLATION (NOT USED)

3.07 COMMISSIONING

- A. As specified in Section 01756.

3.08 FIELD QUALITY CONTROL

- A. Inspection:
 - 1. Allow for inspection of electrical system installation as specified in Section 01450.
 - 2. Provide any assistance necessary to support inspection activities.

3. Engineer inspections may include, but are not limited to, the following:
 - a. Inspect equipment and materials for physical damage.
 - b. Inspect installation for compliance with the Drawings and Specifications.
 - c. Inspect installation for obstructions and adequate clearances around equipment.
 - d. Inspect equipment nameplate data to verify compliance with design requirements.
 - e. Inspect raceway installation for quality workmanship and adequate support.
 - f. Inspect cable terminations.
- B. Workmanship:
 1. Leave wiring in panels, manholes, boxes, and other locations neat, clean, and organized:
 - a. Neatly coil and label spare wiring lengths.
 - b. Shorten, re-terminate, and re-label excessive used as well as spare wire and cable lengths, as determined by the Engineer.

3.09 ADJUSTING (NOT USED)

3.10 CLEANING

- A. As specified in Section 01770.
- B. Remove all foreign material and restore all damaged finishes to the satisfaction of the Engineer and Owner.
- C. Clean and vacuum all enclosures to remove all metal filings, surplus insulation and any visible dirt, dust or other matter before energization of the equipment or system start-up:
 1. Use of compressors or air blowers for cleaning is not acceptable.
- D. Clean luminaries that were used in the areas affected by the construction.
- E. As specified in other sections of the Contract Documents.

3.11 PROTECTION

- A. Protect all Work from damage or degradation until Substantial Completion.

3.12 SCHEDULES (NOT USED)

END OF SECTION

SECTION 16060
GROUNDING AND BONDING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Grounding materials and requirements.

- B. Related sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 01756 - Testing, Training, and Facility Start-up.
 - 3. Section 16050 - Common Work Results for Electrical.
 - 4. Section 16950 - Field Electrical Acceptance Tests.

1.02 REFERENCES

- A. As specified in Section 16050.

- B. ASTM International (ASTM):
 - 1. B3 - Standard Specification for Soft or Annealed Copper Wire.
 - 2. B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

- C. Institute of Electrical and Electronics Engineers (IEEE):
 - 1. 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System.

- D. Underwriters Laboratories, Inc. (UL):
 - 1. 467 - Ground and Bonding Equipment.

1.03 DEFINITIONS

- A. As specified in Section 16050.

1.04 SYSTEM DESCRIPTION

- A. Ground equipment and raceway systems so that the completed installation conforms to all applicable code requirements.

- B. Provide a complete electrical grounding system as indicated on the Drawings and as specified including but not limited to:
 - 1. Grounding electrodes.
 - 2. Bonding jumpers.
 - 3. Ground connections.

- C. Provide bonding jumpers and wire, grounding bushings, clamps and appurtenances required for complete grounding system to bond equipment and raceways to equipment grounding conductors.

- D. The ground system resistance (electrode to ground) of the completed installation, as determined by tests specified in Section 16950, shall be:
 - 1. 5 ohms or less for industrial systems.

1.05 SUBMITTALS

- A. Furnish submittals as specified in Sections 01330 and 16050.
- B. Product data:
 - 1. Catalog cut sheets.

1.06 QUALITY ASSURANCE

- A. As specified in Section 16050.
- B. All grounding components and materials shall be UL listed and labeled.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. As specified in Section 16050.

1.08 PROJECT/SITE CONDITIONS (NOT USED)

1.09 SEQUENCING (NOT USED)

1.10 SCHEDULING (NOT USED)

1.11 WARRANTY

- A. As specified in Section 16050.

1.12 SYSTEM START-UP

- A. As specified in Section 16050.

1.13 OWNER'S INSTRUCTIONS (NOT USED)

1.14 MAINTENANCE (NOT USED)

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Compression connectors: One of the following or equal:
 - 1. FCI Burndy.
 - 2. Thomas & Betts.
- B. Ground rods: One of the following or equal:
 - 1. Erico.
 - 2. Harger.
 - 3. Conex.

- C. Ground cable: One of the following or equal:
 - 1. Nehring.
 - 2. Harger.
 - 3. Southwire.

- D. Precast ground well boxes: One of the following or equal:
 - 1. Brooks Products, 3-RT Valve Box.
 - 2. Christy Concrete Products, G12 Valve Box.

2.02 EXISTING PRODUCTS (NOT USED)

2.03 MATERIALS

- A. Ground rod:
 - 1. Minimum: 3/4-inch diameter, 10 feet long.
 - 2. Uniform 10 mil covering of electrolytic copper metallically bonded to a rigid steel core:
 - a. The copper-to-steel bond shall be corrosion resistant.
 - 3. In accordance with UL 467.
 - 4. Sectional type joined by threaded copper alloy couplings.
 - 5. Fit the top of the rod with a threaded coupling and steel-driving stud.

- B. Ground cable:
 - 1. Requirements:
 - a. Soft drawn (annealed).
 - b. Concentric lay, coarse stranded in accordance with ASTM B8.
 - c. Bare copper in accordance with ASTM B3.
 - 2. Size is as indicated on the Drawings, but not less than required by the NEC.

- C. Compression connectors:
 - 1. Manufactured of high copper alloy specifically for the particular grounding application.
 - 2. Suitable for direct burial in earth and concrete.
 - 3. Identifying compression die number inscription to be impressed on compression fitting.

- D. Equipment grounding conductors:
 - 1. Conductors shall be the same type and insulation as the load circuit conductors:
 - a. Use 600-volt insulation for the equipment grounding conductors for medium voltage systems.
 - 2. Minimum size in accordance with the NEC.

- E. Grounding electrode conductors:
 - 1. Minimum size in accordance with the NEC.

2.04 MANUFACTURED UNITS (NOT USED)

2.05 EQUIPMENT (NOT USED)

2.06 COMPONENTS (NOT USED)

2.07 ACCESSORIES

- A. Precast ground well boxes:
 - 1. Minimum 10 inch interior diameter.
 - 2. Traffic-rated cast iron cover.
 - 3. Permanent "GROUND" marking on cover.

2.08 MIXES (NOT USED)

2.09 FABRICATION (NOT USED)

2.10 FINISHES (NOT USED)

2.11 SOURCE QUALITY CONTROL (NOT USED)

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

- A. As specified in Section 16050.
- B. Provide a separate, green insulated, grounding conductor in each raceway independent of raceway material:
 - 1. Multi-conductor power and control cables shall include an integral green insulated grounding conductor.
 - 2. Provide a separate grounding conductor in each individual raceway for parallel feeders.
- C. Provide a separate grounding conductor for each motor and connect at motor terminal box. Do not use bolts securing motor box to frame or cover for grounding connectors:
 - 1. When grounding motors driven by variable frequency drives (VFD) comply with the requirements of the VFD manufacturer.
- D. Duct bank ground system:
 - 1. Provide a bare copper grounding conductor the entire length of each duct bank, embedded in the concrete of the duct bank as indicated on the Drawings and specified in the Specifications.
 - 2. Bond duct bank ground conductors together where duct banks join, merge, intersect, or split.
- E. Ground connections:
 - 1. All connections to the ground grid system, the duct bank grounding system, equipment, ground rods, etc., shall be made using compression type grounding connectors as indicated on the Drawings, UL listed, and labeled for the application.
 - 2. Make ground connections in accordance with the manufacturer's instructions.

3. Do not conceal or cover any ground connections until the Engineer or authorized representative has established and provided written confirmation that every grounding connection is as indicated on the Drawings and specified in the Specifications.

F. Grounding electrode system:

1. Ground ring:
 - a. Provide all trenching and materials necessary to install the ground ring as indicated on the Drawings.
 - b. Ground ring conductor shall be in direct contact with the earth, or where embedded, concrete, of the size as indicated on the Drawings.
 - c. Minimum burial depth 36 inches or as indicated on the Drawings.
 - d. Re-compact disturbed soils to original density in 6-inch lifts.
2. Ground rods:
 - a. Locations as indicated on the Drawings.
 - b. Length of rods forming an individual ground array shall be equal in length.
 - c. Drive ground rods and install grounding conductors before construction of concrete slabs and duct banks.

G. Shield grounding:

1. Shielded instrumentation cable shall have its shield grounded at one end only unless shop drawings indicate otherwise:
 - a. The grounding point shall be at the control panel or at the power source end of the signal carried by the cable.
2. Terminate the shield drain wire on a dedicated terminal block.
3. Use manufacturer's terminal block jumpers to interconnect ground terminals.
4. Connection to the panel main ground bus shall be via a green No. 12 conductor to the main ground bus for the panel.

H. Where indicated on the Drawings, install ground rods in precast ground wells.

3.04 ERECTION, INSTALLATION, APPLICATION, CONSTRUCTION (NOT USED)

3.05 REPAIR/RESTORATION (NOT USED)

3.06 RE-INSTALLATION (NOT USED)

3.07 COMMISSIONING

- A. As specified in Section 01756.

3.08 FIELD QUALITY CONTROL

- A. As specified in Section 16050.
- B. Measure grounding electrode system resistance to ground in accordance with IEEE 81.

3.09 ADJUSTING

- A. Under the direction of the Engineer, add additional parallel connected ground rods and/or deeper driven rods until the ground resistance measurement meets the specified resistance requirements:
 - 1. Use of salts, water, or compounds to attain the specified ground resistance is not acceptable.

3.10 CLEANING (NOT USED)

3.11 PROTECTION

- A. As specified in Section 16050.

3.12 SCHEDULES (NOT USED)

END OF SECTION

SECTION 16070
HANGERS AND SUPPORTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Mounting and supporting electrical equipment and components.

- B. Related sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 01410 - Regulatory Requirements.
 - 3. Section 01756 - Testing, Training, and Facility Start-up.
 - 4. Section 05190 - Mechanical Anchoring and Fastening to Concrete and Masonry.
 - 5. Section 09910 - Painting.
 - 6. Section 16050 - Common Work Results for Electrical.

1.02 REFERENCES

- A. As specified in Section 16050.

- B. ASTM International (ASTM):
 - 1. A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 2. A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 3. A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

1.03 DEFINITIONS

- A. As specified in Section 16050.

1.04 SYSTEM DESCRIPTION

- A. Design requirements:
 - 1. Conform to the requirements of the Building Code as specified in Section 01410.
 - 2. Demonstrate the following using generally accepted engineering methods:
 - a. That the anchors to the structure are adequate to resist the loads generated in accordance with the Building Code and equipment requirements.
 - b. That the required load capacity of the anchors can be fully developed in the structural materials to which they are attached.

3. Design loading and anchoring requirements:
 - a. As indicated in the Building Code unless otherwise specified.
 - b. Seismic loading requirements:
 - 1) Freestanding, suspended or wall-hung equipment shall be anchored in place by methods that will satisfy the requirements for the seismic design specified in Section 16050.
 - c. Wind loading requirements:
 - 1) All exterior equipment shall be anchored in place by methods that will satisfy the requirements for wind design specified in Section 16050.
 - d. Minimum safety factor against overturning: 1.5.
 - e. The foundation and structures to which hangers and supports are attached shall be capable of withstanding all anchor loads.
- B. Performance requirements:
 1. Hangers and supports individually and as a system shall resist all weights and code-required forces without deflections and deformations that would damage the supporting elements, the equipment supported, or the surrounding construction.

1.05 SUBMITTALS

- A. Furnish submittals as specified in Sections 01330 and 16050.
- B. Product data:
 1. Supports:
 - a. Materials.
 - b. Geometry.
 - c. Manufacturer.
 2. Hardware:
 - a. Materials.
 - b. Manufacturer.
- C. Shop drawings:
 1. Complete dimensioned and scalable shop drawings of all supporting structures, trapezes, wall supports, etc.
 2. Complete anchoring details for equipment, lighting and raceway, supporting structures, trapezes, wall supports for all equipment in excess of 200 pounds, and all freestanding supports:
 - a. Stamped by a professional engineer licensed in the state where the Project is being constructed.
 - b. Said submittals, by virtue of the fact that they bear the stamp of a registered engineer, will be reviewed for general consistency with the requirements specified in the Contract Documents, but not for context, accuracy, or method of calculation.
 3. Include data on attachment hardware and construction methods that will satisfy the design loading and anchoring criteria.
- D. Installation instructions:
 1. Furnish anchorage instructions and requirements based on the seismic and wind conditions of the Site:
 - a. Stamped by a professional engineer licensed in the state where the Project is being constructed.

1.06 QUALITY ASSURANCE

A. As specified in Section 16050.

1.07 DELIVERY, STORAGE, AND HANDLING

A. As specified in Section 16050.

1.08 PROJECT OR SITE CONDITIONS

A. As specified in Section 16050.

1.09 SEQUENCING (NOT USED)

1.10 SCHEDULING (NOT USED)

1.11 WARRANTY

A. As specified in Section 16050.

1.12 SYSTEM STARTUP

A. As specified in Section 16050.

1.13 OWNER'S INSTRUCTIONS (NOT USED)

1.14 MAINTENANCE (NOT USED)

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. One of the following or equal:
1. Thomas & Betts.
 2. Power-Strut.
 3. Unistrut.
 4. Cooper B-Line.
 5. Robroy.
 6. Aickinstrut.

2.02 EXISTING PRODUCTS (NOT USED)

2.03 MATERIALS

- A. Use materials appropriate for the area as specified in Section 16050.
- B. Hot dip galvanized steel:
1. Supports:
 - a. In accordance with ASTM A123 or A153.
 - b. Minimum zinc coating thickness of 2.5 mils.

- 2. Hardware:
 - a. Electro-galvanized.
 - b. In accordance with ASTM A153.
- C. Stainless steel:
 - 1. Supports:
 - a. In accordance with ASTM A240.
 - b. ANSI Type 316 material.
 - 2. Hardware:
 - a. ANSI Type 316 material.

2.04 MANUFACTURED UNITS (NOT USED)

2.05 EQUIPMENT (NOT USED)

2.06 COMPONENTS (NOT USED)

2.07 ACCESSORIES

- A. Anchor bolts:
 - 1. As specified in Section 05190.

2.08 MIXES (NOT USED)

2.09 FABRICATION (NOT USED)

2.10 FINISHES

- A. Paint and finish all supporting structures as specified in Section 09910.

2.11 SOURCE QUALITY CONTROL (NOT USED)

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

- A. As specified in Section 16050.
- B. Mount all raceways, boxes, instruments, and devices on Contractor-fabricated racks unless otherwise indicated on the Drawings:
 - 1. Provide the necessary sway bracing to keep trapeze type structures from swaying under seismic events or wind loading.
- C. Corrosion protection:
 - 1. Isolate dissimilar metals, except where required for electrical continuity.
 - a. Use neoprene washers, 9-mil polyethylene tape, or gaskets for isolation.

- D. Raceway:
 - 1. Furnish all racks and trapeze structures needed to support the raceway from the structure:
 - a. Group raceway and position on racks to minimize crossovers.
 - b. Provide the necessary bracing to keep trapeze type structures from swaying under loads from cable installation, seismic forces, or wind forces.

- E. Anchoring methods:
 - 1. Solid concrete: Anchor bolts, anchor rods or post-installed anchors as specified in Section 05190.
 - 2. Metal surfaces: Machine screws or bolts.
 - 3. Hollow masonry units: Post-installed anchors as specified in Section 05190.

- F. Recoat or seal all drilled holes, cut or scratched surfaces or with products recommended by the manufacturer.

3.04 ERECTION, INSTALLATION, APPLICATION, CONSTRUCTION (NOT USED)

3.05 REPAIR/RESTORATION (NOT USED)

3.06 RE-INSTALLATION (NOT USED)

3.07 COMMISSIONING

- A. As specified in Section 01756.

3.08 FIELD QUALITY CONTROL

- A. As specified in Section 16050.

3.09 ADJUSTING (NOT USED)

3.10 CLEANING (NOT USED)

3.11 PROTECTION

- A. As specified in Section 16050.

3.12 SCHEDULES (NOT USED)

END OF SECTION

SECTION 16075

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Identification of electrical equipment, devices and components.
 - 2. Material, manufacturing and installation requirements for identification devices.
- B. Related sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 01756 - Testing, Training, and Facility Start-up.
 - 3. Section 16050 - Common Work Results for Electrical.
 - 4. Section 16130 - Conduits.

1.02 REFERENCES

- A. As specified in Section 16050.
- B. Occupational Safety and Health Administration (OSHA).

1.03 DEFINITIONS

- A. As specified in Section 16050.

1.04 SYSTEM DESCRIPTION

- A. Nameplates:
 - 1. Provide a nameplate for each piece of electrical equipment and devices, control panel and control panel components.
 - 2. Provide all nameplates of identical style, color, and material throughout the facility.
 - 3. Device nameplates information:
 - a. Designations as indicated on the Drawings and identified on the Process and Instrumentation Drawings.
- B. Wire numbers:
 - 1. Coordinate the wire numbering system with all vendors of equipment so that every field wire has a unique number associated with it for the entire system:
 - a. Wire numbers shall correspond to the wire numbers on the control drawings or the panel and circuit numbers for receptacles and lighting.
 - b. Wire numbers shall correspond to the terminal block number to which they are attached in the control panel.
 - c. Internal panel wires on a common terminal shall have the same wire number.
 - d. Multi-conductor cables shall be assigned a cable number that shall be attached to the cable at intermediate pull boxes and stub-up locations

beneath freestanding equipment. All multi-conductor and instrumentation cables shall be identified at pull points as described above:

- 1) Label armored multi-conductor cable using the conduit number as indicated on the Drawings, following the requirements for conduit markers in Section 16130.
2. Provide the following wiring numbering schemes throughout the project for field wires between process control module, (PCM), vendor control panels, (VCP), motor control centers, (MCC), field starters, field instruments, etc.

(ORIGIN LOC.)–(ORIGIN TERM.)/(DEST. LOC.)–(DEST. TERM.)

OR

**(ORIGIN LOC.)–(ORIGIN TERM.)
(DEST. LOC.)–(DEST. TERM.)**

Where:

ORIGIN LOC.	= Designation for originating panel or device
ORIGIN TERM.	= Terminal designation at originating panel or device
DEST. LOC.	= Designation for destination panel or device
DEST. TERM.	= Terminal designation at destination panel or device or PLC

I/O address at destination panel:

- a. Identify equipment and field instruments as the origin.
- b. PCMs are always identified as the destination.
- c. Location is the panel designation for VCP, LCP, or PCM. For connections to MCCs, location is the specific starter tag and loop number. Location is the tag and loop number for motor starters, field instruments and equipment. Any hyphen in the panel designation or tag and loop number shall be omitted.
- d. Terminal designation is the actual number on the terminal block where the conductor terminates at field devices and vendor control panels. For multi-conductor cables, all terminal numbers shall be shown, separated by commas.
- e. Terminal designations at motor leads shall be the motor manufacturer's standard terminal designation (e.g. T1, T2, T3, etc.).
- f. Terminal designations at PCMs where the field conductor connects to field terminal blocks for a PLC input or output shall be the PLC address (Note: the following PLC I/O numbering scheme is typical for Allen-Bradley, the numbering scheme should be modified to match that of the actual PLC manufacturer used for the project):
 - 1) Discrete Point: W:X:Y/Z
Analog Point: W:X:Y.Z
Where:
W = I for input, O for output
X = PLC number (1, 2, 3...)
Y = Slot number (01, 02, 03...)
Z = Terminal number (00, 01, 02...) for a discrete point or a word number for an analog point (1, 2, 3...)

- g. Terminal designations at PCMs where the conductor does not connect to a PLC I/O point shall be the terminal number with a "C" prefix (e.g. C0010). For common power after a fuse or neutrals after a switch, the subsequent points shall have and capital letter suffix starting with "A" (e.g. C0010A).
3. **Case 2:** Field instrument to process control module (PCM):
 Field wire number/label: E-F/C-D
 C = Process control module number without hyphen (PCM#)
 D = Either the PLC address if the field terminal is connected directly to a PLC input or output point or the terminal number with a "C" prefix if not connected directly to a PLC I/O point (C0010)
 E = Field mounted instrument tag and loop numbers without hyphen (EDV#)
 F = Manufacturer's standard terminal number within instrument. Use both terminal numbers for analog points separated by a comma
- Examples: TIT#-2,3/PCM#-I:1:01.1
 TSH#-1/PCM#-I:2:01/00
4. **Case 3:** Motor control center (MCC) to process control module (PCM):
 Field wire number/label: G-B/C-D
 B = Terminal number within Motor Control Center (manufacturer's or vendor's standard terminal number)
 C = Process control module without hyphen (PCM#)
 D = Either the PLC address if the field terminal is connected directly to a PLC input or output point or the terminal number with a "C" prefix if not connected directly to a PLC I/O point (C0010)
 G = Actual starter designation in the motor control center without hyphen (MMS#)
- Examples: MMS#-10/PCM#-I:1:01/01
 MMS#-10/PCM#-O:1:10/07
 MMS#-10/PCM#-C0100
5. **Case 5:** Motor leads to a motor control center (MCC):
 Field wire number/label: H-I/G-B
 B = Terminal number within motor control center (manufacturer's standard terminal number)
 G = Actual starter designation in the motor control center without hyphen (MMS#)
 H = Equipment tag and loop number without hyphen (PMP#)
 I = Motor manufacturer's standard motor lead identification (e.g. T1, T2, T3, etc.)
- Example: PMP#-T3/MMS#-T3
6. Identify all spare conductors as required for other field wires with an "S" prefix:
- Example: S MMS#-10/PCM#-C011

1.05 SUBMITTALS

- A. Furnish submittals as specified in Sections 01330 and 16050.
- B. Product data:
 - 1. Nameplates:
 - a. Color.
 - b. Size:
 - 1) Outside dimensions.
 - 2) Lettering.
 - c. Material.
 - d. Mounting means.
 - 2. Nameplate schedule:
 - a. Show exact wording for each nameplate.
 - b. Include nameplate and letter sizes.
 - 3. Wire numbers:
 - a. Manufacturer's catalog data for wire labels and label printer.
- C. Record documents:
 - 1. Update the conduit schedule to reflect the exact quantity of wire numbers including spares and destination points for all wires.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 DELIVERY, STORAGE, AND HANDLING

- A. As specified in Section 16050.

1.08 PROJECT SITE CONDITIONS (NOT USED)

1.09 SEQUENCING (NOT USED)

1.10 SCHEDULING (NOT USED)

1.11 WARRANTY

- A. As specified in Section 16050.

1.12 SYSTEM START-UP

- A. As specified in Section 16050.

1.13 OWNER'S INSTRUCTIONS (NOT USED)

1.14 MAINTENANCE (NOT USED)

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Nameplates and signs:
 - 1. One of the following or equal:
 - a. Brady.
 - b. Seton.

- B. Conductor and cable markers:
 - 1. Heat-shrinkable tubing:
 - a. One of the following or equal:
 - 1) Raychem.
 - 2) Brady.
 - 3) Thomas & Betts.
 - 4) Kroy.

- C. Conduit and raceway markers:
 - 1. One of the following or equal:
 - a. Almetek: Mini Tags.
 - b. Lapp Group: Maxi System.

2.02 EXISTING PRODUCTS (NOT USED)

2.03 MATERIALS

- A. Nameplates:
 - 1. Fabricated from white-center and black face laminated plastic engraving stock:
 - a. 3/32-inch thick material.
 - b. Two-ply.
 - c. With chamfered edges.
 - d. Block style engraved characters of adequate size to be read easily from a distance of 6 feet:
 - 1) No characters smaller than 1/8-inch in height.

- B. Signs:
 - 1. Automatic equipment and high voltage signs:
 - a. Suitable for exterior use.
 - b. In accordance with OSHA regulations.

- C. Conductor and cable markers:
 - 1. Machine printed black characters on white tubing.
 - 2. Ten point type or larger.

- D. Conduit and raceway markers:
 - 1. Non-metallic:
 - a. UV resistant holder and letters.
 - b. Black letters on yellow background.
 - c. Minimum letter height: 1/2-inch.
 - d. Adhesive labels are not acceptable.

2.04 MANUFACTURED UNITS (NOT USED)

2.05 EQUIPMENT (NOT USED)

2.06 COMPONENTS (NOT USED)

2.07 ACCESSORIES (NOT USED)

2.08 MIXES (NOT USED)

2.09 FABRICATION (NOT USED)

2.10 FINISHES (NOT USED)

2.11 SOURCE QUALITY CONTROL

A. Nameplates:

1. Provide all nameplates for control panel operator devices (e.g. pushbuttons, selector switches, pilot lights, etc.):
 - a. Same material and same color and appearance as the device nameplates, in order to achieve an aesthetically consistent and coordinated system.

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

A. As specified in Section 16050.

B. Nameplates:

1. Attach nameplates to equipment with rivets, bolts or sheet metal screws, approved waterproof epoxy-based cement or install in metal holders welded to the equipment.
2. Nameplates shall be aligned and level or plumb to within 1/64 inch over the entire length:
 - a. Misaligned or crooked nameplates shall be remounted, or provide new enclosures at the discretion of the Engineer.

C. Conductor and cable markers:

1. Apply all conductor and cable markers before termination.
2. Heat-shrinkable tubing:
 - a. Tubing shall be shrunk using a heat gun that produces low temperature heated air.
 - b. Tubing shall be tight on the wire after it has been heated.
 - c. Characters shall face the open panel and shall read from left to right or top to bottom.
 - d. Marker shall start within 1/32 inch of the end of the stripped insulation point.

- D. Conduit markers:
 - 1. Furnish and install conduit markers for every conduit in the electrical system that is identified in the conduit schedule or part of the process system:
 - a. Conduit markings shall match the conduit schedule.
 - 2. Mark conduits at the following locations:
 - a. Each end of conduits that are greater than 10 feet in length.
 - b. Where the conduit penetrates a wall or structure.
 - c. Where the conduit emerges from the ground, slab, etc.
 - d. The middle of conduits that are 10 feet or less in length.
 - 3. Mark conduits after the conduits have been fully painted.
 - 4. Position conduit markers so that they are easily read from the floor.
 - 5. Attach non-metallic conduit markers with nylon cable ties:
 - a. Provide ultraviolet resistant cable ties for conduit markers exposed to direct sunlight.
 - 6. Mark conduits before construction review by Engineer for punch list purposes.
 - 7. Label intrinsically safe conduits in accordance with the requirements of the NEC.

- E. Signs and labeling:
 - 1. Furnish and install permanent warning signs at mechanical equipment that may be started automatically or from remote locations:
 - a. Fasten warning signs with round head stainless steel screws or bolts.
 - b. Locate and mount in a manner to be clearly legible to operations personnel.

3.04 ERECTION, INSTALLATION, APPLICATION, CONSTRUCTION (NOT USED)

3.05 REPAIR/RESTORATION (NOT USED)

3.06 RE-INSTALLATION (NOT USED)

3.07 COMMISSIONING

- A. As specified in Section 01756.

3.08 FIELD QUALITY CONTROL

- A. Replace any nameplates, signs, conductor markers, cable markers or raceway labels that in the sole opinion of the Engineer do not meet the Engineer's aesthetic requirements.

3.09 ADJUSTING (NOT USED)

3.10 CLEANING (NOT USED)

3.11 PROTECTION (NOT USED)

3.12 SCHEDULES (NOT USED)

END OF SECTION

SECTION 16123

600-VOLT OR LESS WIRES AND CABLES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. 600 volt class or less wire and cable.
- B. Related sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 01756 - Testing, Training, and Facility Start-up.
 - 3. Section 16050 - Common Work Results for Electrical.
 - 4. Section 16060 - Grounding and Bonding.
 - 5. Section 16075 - Identification for Electrical Systems.

1.02 REFERENCES

- A. As specified in Section 16050.
- B. ASTM International (ASTM):
 - 1. B3 - Standard Specification for Soft or Annealed Copper Wire.
 - 2. B8 - Standard Specification for Concentric-Lay–Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
- C. CSA International (CSA).
- D. Insulated Cable Engineers Association (ICEA):
 - 1. NEMA WC 70/ICEA S-95-658-1999 - Standard for Nonshielded Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.
 - 2. NEMA WC 57/ICEA S-73-532 - Standard for Control, Thermocouple Extension, and Instrumentation Cables.
- E. National Fire Protection Association (NFPA):
 - 1. 70 - National Electrical Code (NEC).
 - 2. 72 - National Fire Alarm and Signaling Code.
 - 3. 101 - Life Safety Code.
- F. Telecommunications Industry Association/Electronics Industry Association (TIA/EIA):
 - 1. 568-C.2 - Balanced Twisted-Pair Telecommunication Cabling and Components Standard.
- G. Underwriter's Laboratories Inc., (UL):
 - 1. 44 - Thermoset-Insulated Wires and Cables.
 - 2. 1277 - Standard for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.
 - 3. 1424 - Standard for Cables for Power-Limited Fire-Alarm Circuits.

4. 1569 - Standard for Metal-Clad Cables.
5. 2196 - Standard for Tests for Fire Resistive Cables.
6. 2225 - Standard for Cables and Cable-Fittings For Use in Hazardous (Classified) Locations.

1.03 DEFINITIONS

- A. As specified in Section 16050.
- B. Definitions of terms and other electrical considerations as set forth in the:
 1. ASTM.
 2. ICEA.

1.04 SYSTEM DESCRIPTION

- A. Furnish and install the complete wire and cable system.

1.05 SUBMITTALS

- A. Furnish submittals as specified in Sections 01330 and 16050.
- B. Product data:
 1. Manufacturer of wire and cable.
 2. Insulation:
 - a. Type.
 - b. Voltage class.
 3. American wire gauge (AWG) size.
 4. Conductor material.
 5. Pulling compounds.
- C. Shop drawings:
 1. Show splice locations:
 - a. For each proposed splice location provide written justification describing why the splice is necessary.
- D. Test reports:
 1. Submit test reports for meg-ohm tests.
- E. Calculations:
 1. Submit cable pulling calculations to the Engineer for review and comment for all cables that will be installed using mechanical pulling equipment. Show that the maximum cable tension and sidewall pressure will not exceed manufacturer recommended values:
 - a. Provide a table showing the manufacturer's recommended maximum cable tension and sidewall pressure for each cable type and size included in the calculations.
 - b. Submit the calculations to the Engineer a minimum of 2 weeks before conduit installation.

1.06 QUALITY ASSURANCE

- A. As specified in Section 16050.
- B. All wires and cables shall be UL listed and labeled.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. As specified in Section 16050.

1.08 PROJECT OR SITE CONDITIONS (NOT USED)

1.09 SEQUENCING (NOT USED)

1.10 SCHEDULING (NOT USED)

1.11 WARRANTY

- A. As specified in Section 16050.

1.12 SYSTEM START-UP

- A. As specified in Section 16050.

1.13 OWNER`S INSTRUCTIONS (NOT USED)

1.14 MAINTENANCE (NOT USED)

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. One of the following or equal:
 - 1. 600 volt class wire and cable:
 - a. General Cable.
 - b. Okonite Company.
 - c. Southwire Company.
 - 2. Instrumentation class wire and cable:
 - a. Alpha Wire Company.
 - b. Belden CDT.
 - c. General Cable BICC Brand.
 - d. Okonite Company.
 - e. Rockbestos Surprenant Cable Corporation.

2.02 EXISTING PRODUCTS (NOT USED)

2.03 MATERIALS

- A. Conductors:
 - 1. Copper in accordance with ASTM B3.

2.04 MANUFACTURED UNITS

- A. General:
 - 1. Provide new wires and cables manufactured within 1 year of the date of delivery to the Site.
 - 2. Permanently mark each wire and cable with the following at 24-inch intervals:
 - a. AWG size.
 - b. Voltage rating.
 - c. Insulation type.
 - d. UL symbol.
 - e. Month and year of manufacture.
 - f. Manufacturer's name.
 - 3. Identify and mark wire and cable as specified in Section 16075:
 - a. Use integral color insulation for Number 2 AWG and smaller wire.
 - b. Wrap colored tape around cable larger than Number 2 AWG.
- B. 600 volt class wire and cable:
 - 1. Provide AWG or kcmil sizes as indicated on the Drawings or in the Conduit Schedules:
 - a. When not indicated on the Drawings, size wire as follows:
 - 1) In accordance with the NEC:
 - a) Use 75 degree Celsius ampacity ratings.
 - b) Ampacity rating after all derating factors, equal to or greater than rating of the overcurrent device.
 - 2) Provide Number 12 AWG minimum for power conductors.
 - 3) Provide Number 14 AWG minimum for control conductors.
 - 2. Provide Class B stranding in accordance with ASTM B8:
 - a. Provide Class C stranding where extra flexibility is required.
 - 3. Insulation:
 - a. XHHW-2.
 - b. 90 degrees Celsius rating.
- C. Instrumentation class cable:
 - 1. Type TC.
 - 2. Suitable for use in wet locations.
 - 3. Voltage rating: 600 volts.
 - 4. Temperature rating:
 - a. 90 degrees Celsius rating in dry locations.
 - b. 75 degrees Celsius rating in wet locations.
 - 5. Conductors:
 - a. Insulation:
 - 1) Flame-retardant PVC, 15 mils nominal thickness, with nylon jacket 4 mils nominal thickness.
 - b. Number 16 AWG stranded and tinned.
 - c. Color code:
 - 1) Pair: Black and white.
 - 2) Triad: Black, white and red.
 - 3) Multiple pairs or triads:
 - a) Color-coded and numbered.
 - 6. Drain wire:
 - a. 18 AWG.
 - b. Stranded, tinned.

7. Jacket:
 - a. Flame retardant, moisture and sunlight resistant PVC.
 - b. Ripcord laid longitudinally under jacket to facilitate removal.
8. Shielding:
 - a. Individual pair/triad:
 - 1) Minimum 1.35-mil double-faced aluminum foil/polyester tape overlapped to provide 100 percent coverage.
 - b. Multiple pair or triad shielding:
 - 1) Group shield: Minimum 1.35-mil double-faced aluminum foil/polyester tape overlapped to provide 100 percent coverage.
 - 2) Completely isolate group shields from each other.
 - 3) Cable shield: 2.35 mils double-faced aluminum and synthetic polymer backed tape overlapped to provide 100 percent coverage.
 - c. All shielding to be in contact with the drain wire.

2.05 EQUIPMENT (NOT USED)

2.06 COMPONENTS (NOT USED)

2.07 ACCESSORIES

- A. Wire ties:
 1. One of the following or equal:
 - a. T&B "Ty-Rap" cable ties.
 - b. Panduit cable ties.
- B. Wire markers:
 1. As specified in Section 16075.

2.08 MIXES (NOT USED)

2.09 FABRICATION (NOT USED)

2.10 FINISHES (NOT USED)

2.11 SOURCE QUALITY CONTROL

- A. Assembly and testing of cable shall comply with the applicable requirements of ICEA S-95-658-1999.
- B. Test Type XHHW-2 in accordance with the requirements of UL 44.

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

- A. As specified in Section 16050.
- B. Color-coding:
 - 1. Color-coding shall be consistent throughout the facility.
 - 2. The following color code shall be followed for all 240/120 volt and 208/120 volt systems:
 - a. Phase A - Black.
 - b. Phase B - Red.
 - c. Phase C - Blue.
 - d. Single phase system - Black for one hot leg, red for the other.
 - e. Neutral - White.
 - f. High phase or wild leg - Orange.
 - g. Equipment ground - Green.
 - 3. The following color code shall be followed for all 480/277 volt systems:
 - a. Phase A - Brown.
 - b. Phase B - Orange.
 - c. Phase C - Yellow.
 - d. Neutral - Gray.
 - e. Equipment ground - Green.
 - 4. The following color code shall be followed for all 120 VAC control wiring:
 - a. Power - Red.
 - b. Neutral - White.
 - 5. The following color code shall be followed for all general purpose DC control circuits:
 - a. Grounded conductors - White with blue stripe.
 - b. Ungrounded conductors - Blue.
 - 6. Wire colors shall be implemented in the following methods:
 - a. Wires manufactured of the desired color.
 - b. Continuously spiral wrap the first 6 inches of the wire from the termination point with colored tape:
 - 1) Colored tape shall be wrapped to overlap 1/2 of the width of the tape.
- C. Install conductors only after the conduit installation is complete, and all enclosures have been vacuumed clean, and the affected conduits have been swabbed clean and dry:
 - 1. Install wires only in approved raceways.
 - 2. Do not install wire:
 - a. In incomplete conduit runs.
- D. Properly coat wires and cables with pulling compound before pulling into conduits.
- E. Cable pulling:
 - 1. Prevent mechanical damage to conductors during installation.
 - 2. For cables Number 1 AWG and smaller, install cables by hand.
 - 3. Make splices or add a junction box or pullbox where required to prevent cable pulling tension or sidewall pressure from exceeding 75 percent of manufacturer's recommendation for the specified cable size:
 - a. Make splices in manholes or pull boxes only.
 - b. Leave sufficient slack to make proper connections.

- F. Install and terminate all wire in accordance with manufacturer's recommendations.
- G. Neatly arrange and lace conductors:
 - 1. Do not lace wires in gutter or panel channel.
 - 2. Install all wire ties with a flush cutting wire tie installation tool:
 - a. Use a tool with an adjustable tension setting.
- H. Splices:
 - 1. Provide continuous circuits from origin to termination whenever possible:
 - a. Obtain Engineer's approval prior to making any splices.
 - 2. Where splices are necessary because of extremely long wire or cable lengths that exceed standard manufactured lengths:
 - a. Splice box NEMA rating requirements as specified in Section 16050.
 - b. Make splices in labeled junction boxes for power conductors.
 - c. Make splices for control and instrument conductors in terminal boxes:
 - 1) Provide terminal boards with setscrew pressure connectors, with spade or ring lug connectors.
 - 3. Power and control conductors routed in common raceways may be spliced in common junction boxes.
 - 4. Clearly label junction and terminal boxes containing splices with the word "SPlice LOCATED WITHIN".
 - 5. Leave sufficient slack at junction boxes and termination boxes to make proper splices and connections. Do not pull splices into conduits.
 - 6. Install splices with compression type butt splices and insulate using a heat-shrink sleeve:
 - a. In NEMA Type 4 or NEMA Type 4X areas, provide heat-shrink sleeves that are listed for submersible applications.
 - 7. Splices in below grade pull boxes, in any box subject to flooding, and in wet areas shall be made waterproof using:
 - a. A heat shrink insulating system listed for submersible applications.
 - b. Or an epoxy resin splicing kit.
- I. Apply wire markers to all wires at each end after being installed in the conduit and before meg-ohm testing and termination.
- J. Instrumentation class cable:
 - 1. Install instrumentation class cables in separate raceway systems from power cables:
 - a. Install instrument cable in metallic conduit within non-dedicated manholes or pull boxes.
 - b. Install cable without splices between instruments or between field devices and instrument enclosures or panels.
 - 2. Do not make intermediate terminations, except in designated terminal boxes as indicated on the Drawings.
 - 3. Shield grounding requirements as specified in Section 16060.
- K. Wiring allowances:
 - 1. Equipment locations may vary slightly from the drawings. Include an allowance for necessary conductors and terminations for motorized equipment, electrical outlets, fixtures, communication outlets, instruments, and devices within 10 linear feet of locations indicated on the Drawings.

2. Locations for pull boxes, manholes, and duct banks may vary slightly from the drawings. Include an allowance for necessary conductors and related materials to provide conductors to all pull boxes, manholes and duct banks within 20 linear feet of locations indicated on the Drawings.

3.04 ERECTION, INSTALLATION, APPLICATION, CONSTRUCTION (NOT USED)

3.05 REPAIR/RESTORATION (NOT USED)

3.06 RE-INSTALLATION (NOT USED)

3.07 COMMISSIONING

- A. As specified in Section 01756.

3.08 FIELD QUALITY CONTROL

- A. As specified in Section 16050.
- B. Grounding:
 1. As specified in Section 16060.

3.09 ADJUSTING (NOT USED)

3.10 CLEANING (NOT USED)

3.11 PROTECTION

- A. As specified in Section 16050.

3.12 SCHEDULES (NOT USED)

END OF SECTION

SECTION 16130

CONDUITS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Metallic conduits.
 - 2. Nonmetallic conduits.
 - 3. Conduit bodies.
 - 4. Conduit fittings and accessories.
 - 5. Conduit installation.

- B. Related sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 01756 - Testing, Training, and Facility Start-up.
 - 3. Section 16050 - Common Work Results for Electrical.
 - 4. Section 16070 - Hangers and Supports.
 - 5. Section 16075 - Identification for Electrical Systems.
 - 6. Section 16133 - Duct Banks.

1.02 REFERENCES

- A. As specified in Section 16050.

- B. American National Standards Institute (ANSI):
 - 1. C80.1 - Electrical Rigid Steel Conduit.
 - 2. C80.3 - Steel Electrical Metallic Tubing.
 - 3. C80.5 - Electrical Rigid Aluminum Conduit.
 - 4. C80.6 - Electrical Intermediate Metal Conduit.

- C. National Electrical Manufacturer's Association (NEMA):
 - 1. RN-1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Steel Conduit.
 - 2. TC2 - Electrical Polyvinyl Chloride (PVC) Conduit.
 - 3. TC3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
 - 4. TC7 - Smooth-Wall Coilable Electrical Polyethylene Conduit.
 - 5. TC13 - Electrical Nonmetallic Tubing.
 - 6. TC14 - Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

- D. Underwriters Laboratories (UL):
 - 1. 1 - Standard for Flexible Metal Conduit.
 - 2. 6 - Standard for Electrical Rigid Metal Conduit - Steel.
 - 3. 6A - Standard for Electrical Rigid Metal Conduit - Aluminum, Red Brass, and Stainless Steel.
 - 4. 360 - Standard for Liquidtight Flexible Steel Conduit.
 - 5. 651 - Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings.

6. 651B - Standard for Continuous Length HDPE Conduit.
7. 797 - Standard for Electrical Metallic Tubing - Steel.
8. 1242 - Standard for Electrical Intermediate Metal Conduit - Steel.
9. 1653 - Standard for Electrical Nonmetallic Tubing.
10. 1660 - Standard for Liquidtight Flexible Nonmetallic Conduit.
11. 1684 - Standard for Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

1.03 DEFINITIONS

- A. As specified in Section 16050.
- B. Specific definitions and abbreviations:
 1. Conduit bodies: A separate portion of a conduit system that provides access through a removable cover to the interior of the system at a junction of 2 or more conduit sections. Includes, but not limited to, Shapes C, E, LB, T, X, etc.
 2. Conduit fitting: An accessory that primarily serves a mechanical purpose. Includes, but not limited to, bushings, locknuts, hubs, couplings, reducers, etc.
 3. GRC: Galvanized rigid steel conduit.
 4. PCS: Polyvinyl chloride (PVC) coated rigid steel conduit.
 5. PVC: Polyvinyl chloride rigid nonmetallic conduit.
 6. SLT: Sealtight-liquidtight flexible conduit.
 7. NPT: National pipe thread.

1.04 SYSTEM DESCRIPTION

- A. Provide conduits, conduit bodies, fittings, junction boxes, and all necessary components, whether or not indicated on the Drawings, as required, to install a complete electrical raceway system.

1.05 SUBMITTALS

- A. Furnish submittals as specified in Sections 01330 and 16050.
- B. Product data:
 1. Furnish complete manufacturer's catalog sheets for every type and size of conduit, fitting, conduit body, and accessories to be used on the Project.
 2. Furnish complete manufacturer's recommended special tools to be used for installation if required.
- C. Certifications:
 1. Furnish PVC-coated conduit manufacturer's certification for each installer.
- D. Record Documents:
 1. Incorporate all changes in conduit routing on electrical plan drawings.
 2. Dimension underground and concealed conduits from building lines.
 3. Furnish hard copy drawings and electronic files in V8.

1.06 QUALITY ASSURANCE

- A. As specified in Section 16050.
- B. All conduits, conduit bodies, and fittings shall be UL listed and labeled.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. As specified in Section 16050.
- B. Do not expose Type PVC, FRD, NFC, and ENT to direct sunlight.
- C. Do not store conduit in direct contact with the ground.

1.08 PROJECT OR SITE CONDITIONS

- A. As specified in Section 16050.

1.09 SEQUENCING

- A. Before installing any conduit or locating any device box:
 - 1. Examine the complete set of Drawings and Specifications, and all applicable shop drawings.
 - 2. Verify all dimensions and space requirements and make any minor adjustments to the conduit system as required to avoid conflicts with the building structure, other equipment, or the work of other trades.

1.10 SCHEDULING (NOT USED)

1.11 WARRANTY

- A. As specified in Section 16050.

1.12 SYSTEM START-UP

- A. As specified in Section 16050.

1.13 OWNER'S INSTRUCTIONS (NOT USED)

1.14 MAINTENANCE (NOT USED)

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Galvanized rigid steel conduit:
 - 1. One of the following or equal:
 - a. Western Tube and Conduit.
 - b. Allied Tube and Conduit.
 - c. Wheatland Tube Co.
- B. PVC-coated rigid steel conduit:
 - 1. One of the following or equal:
 - a. Robroy Industries.
 - b. Ocal, Inc.
 - c. Calbond.

- C. Sealtight-liquidtight flexible conduit:
 - 1. One of the following or equal:
 - a. Southwire.
 - b. AFC Cable Systems.
 - c. Electri-Flex Company.
 - d. Anaconda.

- D. Rigid nonmetallic PVC conduit:
 - 1. One of the following or equal:
 - a. Carlon.
 - b. Cantex.
 - c. Triangle Conduit and Cable.

- E. Conduit bodies:
 - 1. One of the following or equal:
 - a. Crouse-Hinds.
 - b. Appleton.
 - c. O-Z/Gedney.
 - d. Ocal, Inc.
 - e. Robroy Industries.
 - f. Calbond.
 - g. Carlon.

- F. Joint compound:
 - 1. Thomas and Betts.

- G. Galvanized rigid steel conduit expansion fittings:
 - 1. One of the following or equal:
 - a. Crouse-Hinds.
 - b. Appleton.
 - c. O-Z/Gedney.

- H. Conduit hangers and supports:
 - 1. As specified in Section 16070.

2.02 EXISTING PRODUCTS (NOT USED)

2.03 MATERIALS (NOT USED)

2.04 MANUFACTURED UNITS (NOT USED)

2.05 EQUIPMENT (NOT USED)

2.06 COMPONENTS

- A. GRC:
 - 1. All threads: NPT standard conduit threads with a 3/4-inch taper per foot:
 - a. Running conduit threads are not acceptable.
 - 2. Hot-dip galvanized inside and out:
 - a. Ensures complete coverage and heats the zinc and steel to a temperature that ensures the zinc alloys with the steel over the entire surface.
 - b. Electro-galvanizing is not acceptable.

3. Manufactured in accordance with:
 - a. UL-6.
 - b. ANSI C80.1.
- B. PCS:
 1. The steel conduit, before PVC coating, shall be new, unused, hot-dip galvanized material, conforming to the requirements for Type GRC.
 2. Coated conduit NEMA Standard RN-1:
 - a. The galvanized coating may not be disturbed or reduced in thickness during the cleaning and preparatory process.
 3. Factory-bonded PVC jacket:
 - a. The exterior galvanized surfaces shall be coated with primer before PVC coating to ensure a bond between the zinc substrate and the PVC coating.
 - b. Nominal thickness of the exterior PVC coating shall be 0.040 inch except where part configuration or application of the piece dictates otherwise.
 - c. PVC coating on conduits and associated fittings shall have no sags, blisters, lumps, or other surface defects and shall be free of holes and holidays.
 - d. The PVC adhesive bond on conduits and fittings shall be greater than the tensile strength of the PVC plastic coating:
 - 1) Confirm bond with certified test results.
 4. A urethane coating shall be uniformly and consistently applied to the interior of all conduits and fittings:
 - a. Nominal thickness of 0.002 inch.
 - b. Conduits having areas with thin or no coating are not acceptable.
 - c. All threads shall be coated with urethane.
 5. The PVC exterior and urethane interior coatings applied to the conduits shall afford sufficient flexibility to permit field bending without cracking or flaking at temperature above 30 degrees Fahrenheit (-1 degree Celsius).
 6. PCS conduit bodies and fittings:
 - a. Malleable iron.
 - b. The conduit body, before PVC coating, shall be new, unused material and shall conform to appropriate UL standards.
 - c. The PVC coating on the outside of conduit bodies shall be 0.040-inch thick and have a series of longitudinal ribs to protect the coating from tool damage during installation.
 - d. 0.002-inch interior urethane coating.
 - e. Utilize the PVC coating as an integral part of the gasket design.
 - f. Stainless steel cover screw heads shall be encapsulated with plastic to ensure corrosion protection.
 - g. A PVC sleeve extending 1 conduit diameter or 2 inches, whichever is less, shall be formed at each female conduit opening:
 - 1) The inside diameter of the sleeve shall be the same as the outside diameter of the conduit to be used.
 - 2) The sleeve shall provide a vapor- and moisture-tight seal at every connection.

- C. SLT:
 - 1. Temperature rated for use in the ambient temperature at the installed location but not less than the following:
 - a. General purpose:
 - 1) Temperature range: -20 degrees Celsius to +80 degrees Celsius.
 - b. Oil-resistant:
 - 1) Temperature range: -20 degrees Celsius to +60 degrees Celsius.
 - 2. Sunlight-resistant, weatherproof, and watertight.
 - 3. Manufactured from single strip steel, hot-dip galvanized on all 4 sides before conduit fabrication.
 - 4. Strip steel spiral wound resulting in an interior that is smooth and clean for easy wire pulling.
 - 5. Overall PVC jacket.
 - 6. With integral copper ground wire, built in the core, in conduit trade sizes 1/2 inch through 1-1/4 inch.
- D. PVC:
 - 1. Extruded from virgin PVC compound:
 - a. Schedule 40 unless otherwise specified.
 - b. Schedule 80 extra-heavy wall where specified.
 - 2. Rated for 90 degrees Celsius conductors or cable.
 - 3. Rated for use in direct sunlight.
- E. Conduit bodies:
 - 1. Material consistent with conduit type:
 - a. Malleable iron bodies and covers when used with Type GRC.
 - b. Cast aluminum bodies and covers when used with Type RAC.
 - c. PVC bodies and covers when used with Type PVC.
 - d. PVC-coated malleable iron bodies and covers when used with Type PCS.
 - e. PVC-coated copper-free cast aluminum bodies and covers when used with Type PCA.
 - f. Malleable iron or aluminum bodies with pressed steel or aluminum covers when used with Type EMT.
 - 2. Conduit bodies to conform to Form 8, Mark 9, or Mogul design:
 - a. Mogul design conforming to NEC requirements for bending space for large conductors for conduit trade sizes of 1 inch and larger with conductors #4 AWG and larger, or where required for wire-bending space.
 - 3. Gasketed covers attached to bodies with stainless steel screws secured to threaded holes in conduit body.

2.07 ACCESSORIES

- A. Connectors and fittings:
 - 1. Manufactured with compatible materials to the corresponding conduit.
- B. Insulated throat metallic bushings:
 - 1. Construction:
 - a. Malleable iron or zinc-plated steel when used with steel conduit.
 - b. Aluminum when used with aluminum conduit.
 - c. Positive metallic conduit end stop.

- d. Integrally molded non-combustible phenolic-insulated surfaces rated at 150 degrees Celsius.
 - e. Use fully insulated bushings on nonmetallic conduit system made of high-impact 150 degrees Celsius rated non-combustible thermosetting phenolic.
- C. Insulated grounding bushings:
- 1. Construction:
 - a. Malleable iron or steel, zinc-plated, with a positive metallic end stop.
 - b. Integrally molded non-combustible phenolic-insulated surfaces rated at 150 degrees Celsius.
 - c. Tin-plated copper grounding saddle for use with copper or aluminum conductors.
- D. Electrical unions (Erickson Couplings):
- 1. Construction:
 - a. Malleable iron for use with steel conduit.
 - b. Aluminum for use with aluminum conduit.
 - c. Concrete tight, 3-piece construction.
 - d. Rated for Class I Division 1 Group D in hazardous areas.
- E. SLT fittings:
- 1. Construction:
 - a. Malleable iron.
 - b. Furnished with locknut and sealing ring.
 - c. Liquidtight, rain-tight, oil-tight.
 - d. Insulated throat.
 - e. Furnish as straight, 45-degree elbows, and 90-degree elbows.
 - f. Designed to prevent sleeving:
 - 1) Verify complete bonding of the raceway jacket to the plastic gasket seal.
 - g. Equipped with grounding device to provide ground continuity irrespective of raceway core construction. Grounding device, if inserted into raceway and directly in contact with conductors, shall have rolled-over edges for sizes under 5 inches.
 - h. Where terminated into a threadless opening using a threaded hub fitting, a suitable moisture-resistant/oil-resistant synthetic rubber gasket shall be provided between the outside of the box or enclosure and the fitting shoulder. Gasket shall be adequately protected by and permanently bonded to a metallic retainer.
 - 2. Corrosion-resistant and outdoor SLT fittings:
 - a. Construction:
 - 1) PVC-coated liquidtight fittings with a bonded 0.040-inch thick PVC coating on the metal connector to form a seal around the SLT conduit.
 - 2) Insulated throat and an integral sealing ring.
- F. Hubs for threaded attachment of steel conduit to sheet metal enclosures:
- 1. Construction:
 - a. Insulated throat.
 - b. PVC-coated when used in corrosive areas.
 - c. Bonding locknut.

- d. Recessed neoprene O-ring to ensure watertight and dust-tight connector.
 - e. One half (1/2)-inch through 1-1/4-inch steel zinc electroplated.
 - f. One and one half (1-1/2)-inch through 6-inch malleable iron zinc plated.
 - g. Aluminum with aluminum conduit.
2. Usage:
- a. All conduits in damp, wet, outdoor, and corrosive areas shall use threaded hubs for connections to sheet metal enclosures.

G. PVC fittings:

- 1. Materials:
 - a. All devices shall be made of PVC, using the same materials as used for Type PVC conduit.
 - b. All metal hardware shall be stainless steel.

H. Expansion/deflection couplings:

- 1. Use to compensate for movement in any directions between 2 conduit ends where they connect.
- 2. Shall allow movement of 3/4 inch from the normal in all directions.
- 3. Shall allow angular movement for a deflection of 30 degrees from normal in any direction.
- 4. Constructed to maintain electrical continuity of the conduit system.
- 5. Materials:
 - a. End couplings: Bronze or galvanized ductile iron.
 - b. Sleeve: Neoprene.
 - c. Bands: Stainless steel.
 - d. Bonding jumper: Tinned copper braid.

I. Conduit markers:

- 1. As specified in Section 16075.

2.08 MIXES (NOT USED)

2.09 FABRICATION (NOT USED)

2.10 FINISHES (NOT USED)

2.11 SOURCE QUALITY CONTROL

- A. As specified in Section 16050.

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

- A. As specified in Section 16050.
- B. General:
 - 1. Conduit routing:
 - a. The electrical drawings are diagrammatic in nature:
 - 1) Install conduit runs as specified with schematic representation indicated on the Drawings and as specified.
 - 2) Modify conduit runs to suit field conditions, as accepted by the Engineer:
 - a) Make changes in conduit locations that are consistent with the design intent but are dimensionally different, or routing to bypass obstructions.
 - b) Make changes in conduit routing due to the relocation of equipment.
 - 3) The electrical drawings do not indicate all required junction boxes and pull boxes:
 - a) Provide junction boxes and pull boxes to facilitate wire pulling as required:
 - (1) To meet cable manufacturer's pulling tension requirements.
 - (2) To limit total conduit bends between pull locations.
 - b) Install junction boxes and pull boxes at locations acceptable to the Engineer.
 - b. The Contractor is responsible for any deviations in general location, conduit size, routing, or changes to the conduit schedule without the express written approval or direction by the Engineer:
 - 1) The Engineer is the sole source in determining whether the change is constituted as a deviation.
 - 2) Perform any changes resulting in additional conduits, or extra work from such deviations.
 - 3) Incorporate any deviations on the Record Documents.
 - 2. Use only tools recommended by the conduit manufacturer for assembling the conduit system.
 - 3. Do not install 1-inch or larger conduits in or through structural members unless approved by the Engineer.
 - 4. Run conduits exposed to view parallel with or at right angles to structural members, walls, or lines of the building:
 - a. Install straight and true conduit runs with uniform and symmetrical elbows, offsets, and bends.
 - b. Make changes in direction with long radius bends or with conduit bodies.
 - 5. Install conduits with total conduit bends between pull locations less than or equal to 270 degrees.
 - 6. Route all exposed conduits to preserve headroom, access space and work space, and to prevent tripping hazards and clearance problems:
 - a. Install conduit runs so that runs do not interfere with proper and safe operation of equipment and do not block or interfere with ingress or egress, including equipment-removal hatches.
 - b. Route conduits to avoid drains or other gravity lines. Where conflicts occur, relocate the conduit as required.

7. When installing conduits through existing slabs or walls, make provisions for locating any possible conflicting items where the conduit is to penetrate. Use tone signal or X-ray methods to make certain that no penetrations will be made into the existing conduits, piping, cables, post-tensioning cables, etc.
8. Plug conduits brought into pull boxes, manholes, handholes, and other openings until used to prevent entrance of moisture.
9. For existing and new 2-inch and larger conduit runs, snake conduits with a conduit cleaner equipped with a cylindrical mandrel of a diameter not less than 85 percent of nominal diameter of the conduit:
 - a. Remove and replace conduits through which mandrel will not pass.
10. Provide all sleeves and openings required for the passage of electrical raceways or cables even when these openings or sleeves are not specifically indicated on the Drawings.
11. Install complete conduit systems before conductors are installed.
12. Underground conduits:
 - a. Install underground conduits, including conduit runs below slabs-on-grade in concrete-reinforced duct bank construction:
 - 1) As specified in Section 16133.
 - b. Make underground conduit size transitions at handholes and manholes.
 - c. Install spare conduits in underground duct banks towards top center of runs to allow for ease of installation of future cables as conduits enter underground manholes and handholes.
 - d. Seal around conduit penetrations of below grade walls with a mechanical seal.

C. Conduit usage:

1. Exposed conduits:
 - a. Rigid conduit:
 - 1) Install the rigid conduit type for each location as specified in Section 16050.
 - 2) Minimum size: 3/4-inch.
 - b. Flexible conduit:
 - 1) Use flexible conduit for final connections between rigid conduit and motors, vibrating equipment, instruments, control equipment, or where required for equipment servicing:
 - a) Use Type SLT with rigid metallic conduit.
 - 2) Minimum size: 3/4-inch:
 - a) 1/2 when required for connection to instruments.
 - 3) Maximum length:
 - a) Fixed equipment:

Conduit Trade Size	Flexible Conduit Length (inch)
3/4	18
1	18
1-1/4	18
1-1/2	18
2	36
2-1/2	36
3	36
3-1/2	38
4	40

- b) Removable instruments or hinged equipment:
 - (1) As required to allow complete removal or full movement without disconnecting or stressing the conduit.
 - 2. Concrete-encased and embedded conduits:
 - a. Type PVC Schedule 40 and PVC-coated rigid metallic conduit as specified below:
 - 1) Use Type PCS in underground and embedded installation as follows:
 - a) Stub-up and risers to grade floor or equipment from nonmetallic conduits.
 - b) Entering and exiting underground or embedded conduit runs a minimum 12 inches above and below grade of finished floor.
 - c) For any and all bends where the total deflection is greater than 45 degrees.
 - b. Minimum size:
 - 1) 2-inch in duct banks unless otherwise indicated on the Drawings.
 - 2) 1-inch for in-slab conduits unless otherwise indicated on the Drawings.
 - 3. PVC-coated rigid metallic conduit:
 - a. Use specifically manufactured or machined threading dies to manufacturer's specifications to accommodate the PVC jacket.
 - 4. GRC:
 - a. Conduit shall be cut square and reamed before threading.
 - 5. PVC:
 - a. Conduit terminations shall be via threaded adapters into threaded hubs on the junction boxes or conduit bodies.
 - b. Conduit terminations into boxes without threaded hubs shall utilize a threaded adapter and a flat neoprene washer on the outside of the box:
 - 1) Use a locknut on the inside of the box to tighten the adapter to the box.
 - c. Route conduit to afford it the maximum physical protection:
 - 1) If necessary, cover conduit to afford additional protection when it cannot be shielded by the structure or machinery frames:
 - a) Use Schedule 80 where exposed runs may be subject to physical damage.
- D. Conduit joints and bends:
 - 1. General:
 - a. Where conduit is underground, under slabs on grade, exposed to the weather, or in NEMA Type 4 or NEMA Type 4X locations, make joints liquidtight.
 - b. Keep bends and offsets in conduit runs to an absolute minimum.
 - c. All bends shall be symmetrical.
 - d. The following conduit systems shall use large-radius sweep elbows:
 - 1) Underground conduits.
 - e. Provide large-radius factory-made bends for 1-1/4-inch trade size or larger.
 - f. Make field bends with a radius of not less than the requirements found in the NEC:
 - 1) The minimum bending radius of the cable must be less than the radius of the conduit bend.

- 2) Make all field bends with power bending equipment or manual benders specifically intended for the purpose:
 - a) Make bends so that the conduit is not damaged and the internal diameter is not effectively reduced.
 - b) For the serving utilities, make bends to meet their requirements.
 - g. Replace all deformed, flattened, or kinked conduit.
 - 2. Threaded conduit:
 - a. Cut threads on rigid metallic conduit with a standard conduit-cutting die that provides a 3/4-inch per foot taper and to a length such that all bare metal exposed by the threading operation is completely covered by the couplings or fittings used. In addition, cut the lengths of the thread such that all joints become secure and wrench-tight just preceding the point where the conduit ends would butt together in couplings or where conduit ends would butt into the ends or shoulders of other fittings.
 - b. Thoroughly ream conduit after threads have been cut to remove burrs.
 - c. Use bushings or conduit fittings at conduit terminations.
 - d. On exposed conduits, repair scratches and other defects with galvanizing repair stick, Enterprise Galvanizing "Galvabar," or CRC "Zinc It."
 - e. Coat conduit threads with an approved electrically conductive sealant and corrosion inhibitor that is not harmful to the conductor insulation:
 - 1) Apply to the male threads and tighten joints securely.
 - 2) Clean excess sealant from exposed threads after assembly.
 - f. Securely tighten all threaded connections.
 - g. Any exposed threaded surfaces must be cleaned and coated with a galvanizing solution so that all exposed surfaces have a galvanized protective coating.
 - 3. PVC:
 - a. Use approved solvent-weld cement specifically manufactured for the purpose. Spray-type cement is not allowed.
 - b. Apply heat for bends so that conduit does not distort or discolor. Use a spring mandrel as required to ensure full inside diameter at all bends:
 - 1) Utilize a heater specifically for PVC conduit as recommended by the conduit manufacturer.
- E. Conduit sealing and drainage:
- 1. Conduit drainage and sealing other than required for hazardous and classified areas:
 - a. Provide sealing and drainage in vertical drops of long (in excess of 20 feet), exterior, above-grade conduit runs at the points at which the conduit enters buildings, switchgear, control panels, lighting panelboards, and other similar enclosures.
 - b. Provide seal fittings with drains in vertical drops directly above grade for exterior and above-grade conduit runs that are extended below grade.
 - c. Provide conduit seals with drains in areas of high humidity and rapidly changing temperatures:
 - 1) Where portions of an interior raceway pass through walls, ceilings, or floors that separate adjacent areas having widely different temperatures.
 - d. Seal one end only of all underground conduits at highest point with O-Z/Gedney sealing (non-hazardous) filling, or equal.

- F. Conduit supports:
 - 1. General:
 - a. Provide appropriate hangers, supports, fasteners, and seismic restraints to suit applications:
 - 1) As specified in Section 16070.
 - 2) Provide support materials consistent with the type of conduit being installed as specified in Section 16050.
 - b. Support conduit at the intervals required by the NEC.
 - c. Perforated strap and plumbers tape are not acceptable for conduit supports.
 - 2. Conduit on concrete or masonry:
 - a. Use 1-hole malleable iron straps with metallic or plastic expansion anchors and screws or support from preset inserts.
 - b. Use preset inserts in concrete when possible.
 - c. Use pipe spacers (clamp backs) in wet locations.
 - d. On plaster or stucco, use 1-hole malleable iron straps with toggle bolts.
 - 3. Suspended conduit:
 - a. Use malleable-iron factory-made split-hinged pipe rings with threaded suspension rods sized for the weight to be carried (minimum 3/8-inch diameter), Kindorf, or equal.
 - b. For grouped conduits, construct racks with threaded rods and tiered angle iron or preformed channel cross members. Clamp each conduit individually to a cross member. Where rods are more than 2-feet long, provide rigid sway bracing.
 - 4. Supports at structural steel members:
 - a. Use beam clamps.
 - b. Drilling or welding may be used only as specified or with approval of the Engineer.
 - 5. PVC-coated rigid metal systems:
 - a. Provide right-angle beam clamps and "U" bolts specially formed and sized to snugly fit the outside diameter of the coated conduit. Provide "U" bolts with PVC-encapsulated nuts that cover the exposed portions of the threads.
 - b. Securely fasten exposed conduits with Type 316 stainless steel clamps or straps.
- G. Expansion or expansion/deflection fittings:
 - 1. General:
 - a. Align expansion coupling with the conduit run to prevent binding.
 - b. Follow manufacturer's instructions to set the piston opening.
 - c. Install expansion fittings across concrete expansion joints and at other locations where necessary to compensate for thermal or mechanical expansion and contraction.
 - d. Furnish fittings of the same material as the conduit system.
 - 2. For metallic conduit, provide expansion or expansion/deflection couplings, as appropriate, where:
 - a. Install expansion fittings a minimum of every 200 feet in straight conduit runs.
- H. Empty conduits:
 - 1. Provide a polyethylene rope rated at 250 pounds tensile strength in each empty conduit more than 10 feet in length.

2. Seal ends of all conduits with approved, manufactured conduit seals, caps, or plugs immediately after installation:
 - a. Keep ends sealed until immediately before pulling conductors.
- I. Miscellaneous:
 1. Provide electrical unions at all points of union between ends of rigid conduit systems that cannot otherwise be coupled:
 - a. Running threads and threadless couplings are not allowed.
 2. Replace any conduits installed that the Engineer determines do not meet the requirements of this Specification.

3.04 ERECTION, INSTALLATION, APPLICATIONS, CONSTRUCTION (NOT USED)

3.05 REPAIR/RESTORATION (NOT USED)

3.06 RE-INSTALLATION (NOT USED)

3.07 COMMISSIONING

- A. As specified in Section 01756.

3.08 FIELD QUALITY CONTROL

- A. As specified in Section 16050.

3.09 ADJUSTING (NOT USED)

3.10 CLEANING (NOT USED)

3.11 PROTECTION

- A. As specified in Section 16050.

3.12 SCHEDULES (NOT USED)

END OF SECTION

SECTION 16133

DUCT BANKS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Electrical underground duct banks.
 - 2. Duct bank installation requirements.

- B. Related sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 01756 - Testing, Training, and Facility Start-up.
 - 3. Section 02318 - Trenching.
 - 4. Section 02952 - Pavement Restoration and Rehabilitation.
 - 5. Section 03200 - Concrete Reinforcing.
 - 6. Section 03300 - Cast-In-Place Concrete.
 - 7. Section 16130 - Conduits.
 - 8. Section 16050 - Common Work Results for Electrical.

1.02 REFERENCES

- A. As specified in Section 16050.

1.03 DEFINITIONS

- A. As specified in Section 16050.

1.04 SYSTEM DESCRIPTION

- A. Provide trenching, forming, rebar, spacers, conduit, concrete, backfill, and compaction necessary for the complete installation of the duct banks.

- B. Provide reinforced concrete duct banks for all conduits installed below grade, on the site, below structures, or in contact with the earth, unless otherwise indicated on the Drawings.

1.05 SUBMITTALS

- A. Furnish submittals as specified in Sections 01330 and 16050.

- B. Product data:
 - 1. PVC conduit spacers.
 - 2. Detectable underground marking tape.
 - 3. Pull line.

- C. Provide applicable submittal documents as specified in:
 - 1. Section 02318.
 - 2. Section 03200.
 - 3. Section 03300.

- D. Shop drawings:
 - 1. Submit site plan drawings of duct banks including underground profiles indicating all underground utilities.

1.06 QUALITY ASSURANCE

- A. As specified in Section 16050.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. As specified in Section 16050.

1.08 PROJECT OR SITE CONDITIONS

- A. As specified in Section 16050.

1.09 SEQUENCING (NOT USED)

1.10 SCHEDULING (NOT USED)

1.11 WARRANTY

- A. As specified in Section 16050.

1.12 SYSTEM START-UP

- A. As specified in Section 16050.

1.13 OWNER'S INSTRUCTIONS (NOT USED)

1.14 MAINTENANCE (NOT USED)

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Conduit spacers:
 - 1. One of the following or equal:
 - a. Carlon Snap-Loc.
 - b. Cantex.
 - c. Osburn Associates, Inc.

- B. Detectable underground marking tape:
 - 1. One of the following or equal:
 - a. Blackburn Manufacturing Company.
 - b. Pro-Line Safety Products.
 - c. Panduit.

- C. Pull line:
 - 1. One of the following or equal:
 - a. Arnco.
 - b. Greenlee.
 - c. Osburn Associates, Inc.

2.02 EXISTING PRODUCTS (NOT USED)

2.03 MATERIALS

- A. Provide conduit as specified in Section 16130:
 - 1. Use duct suitable for use with 90-degree Celsius rated conductors.
- B. Provide reinforcing steel as specified in Section 03200:
 - 1. Provide minimum Number 4 reinforcing steel.

2.04 MANUFACTURED UNITS

- A. Conduit spacers:
 - 1. Provide conduit spacers recommended by the conduit manufacturer or specified above.
 - 2. Saddle type.
 - 3. Non-metallic, non-corrosive, non-conductive.
 - 4. Interlocking type:
 - a. Vertical interlocking.
 - b. Horizontal interlocking.
 - 5. Suitable for concrete encasement.
 - 6. Molded-in rebar holder.
 - 7. Accommodates 2-inch through 6-inch conduit sizes.
 - 8. Relieves the conduit from both horizontal and vertical stresses.
- B. Pull line:
 - 1. Minimum 1/4-inch wide, flat design.
 - 2. Polyester.
 - 3. Minimum pulling strength 1,200 pounds.
- C. Detectable marking tape:
 - 1. Provide a detectable tape, locatable by a cable or metal detector from above the undisturbed grade.
 - 2. Aluminum core laminated between polyethylene film.
 - 3. Six-inch wide red tape imprinted with black lettering "CAUTION - BURIED ELECTRIC UTILITIES."

2.05 EQUIPMENT (NOT USED)

2.06 COMPONENTS (NOT USED)

2.07 ACCESSORIES (NOT USED)

2.08 MIXES

- A. Concrete mix requirements as specified in Section 03300.
- B. Provide a red-oxide conduit encasement coloring agent as specified in Section 03300.

2.09 FABRICATION (NOT USED)

2.10 FINISHES (NOT USED)

2.11 SOURCE QUALITY CONTROL (NOT USED)

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

- A. As specified in Section 16050.
- B. Duct banks:
 - 1. Install duct banks encased in concrete at least 24 inches below finish grade, unless otherwise indicated on the Drawings.
 - 2. Damage minimization:
 - a. Conduit should not be left exposed in an open trench longer than is necessary.
 - b. Protect all underground duct banks against damage during pouring of concrete or backfilling.
 - 3. All plastic conduit fittings to be joined should be exposed to the same temperature conditions for a reasonable length of time before assembly.
 - 4. Provide No. 4/0 American Wire Gauge bare copper ground wire the entire length of duct bank and bond to the grounding system **as** indicated on the Drawings.
 - 5. Install underground ducts to be self-draining:
 - a. Slope duct banks away from buildings to handholes.
 - b. Slope duct banks uniformly from handholes to handholes or both ways from high points between handholes.
 - c. Slope a minimum of 1/2 inch per 10 feet.
 - 6. Where new duct banks join to existing handholes make the proper fittings and fabricate the concrete envelopes to ensure smooth durable transitions, as indicated on the Drawings.
 - 7. Install pull line in spare conduits:
 - a. Provide adequate pull line at both ends of conduits to facilitate conductor pulling.
 - b. Cap above ground spare conduit risers at each end with screw-on conduit caps.

- C. Trenching:
 - 1. Perform trenching as specified in Section 02318.
 - 2. Trench must be uniformly graded with the bottom, rock free and covered with select material.
 - 3. Whenever possible, use the walls of the trench as forms for concrete encasement:
 - a. Forms are required where the soil is not self-supporting.
 - 4. Avoid damaging existing ducts, conduits, cables, and other utilities.

- D. Duct spacing:
 - 1. Separate conduits with manufactured plastic spacers using a minimum space between the outside surfaces of adjacent conduits of 2 inches, unless otherwise indicated on the Drawings.
 - 2. Install spacers to maintain uniform spacing of duct assembly a minimum of 4 inches above the bottom of the trench during concrete pour. Install spacers on 8-foot maximum intervals:
 - a. Due to some distortion of conduit from heat, and other means, it may be necessary to install extra spacers within the duct bank:
 - 1) Install the intermediate set of spacers within normal required spacing to maintain the proper horizontal clearance:
 - a) Clearance is required to allow the proper amount of concrete to infiltrate vertically among the duct to ensure proper protection.
 - 3. Spacers shall not be located at the center of a bend:
 - a. Locate spacer in the tangent, free of the coupling on fabricated bends.
 - b. Locate spacers midway between the tangent and the center bend on trench formed sweeps.

- E. Terminating:
 - 1. Use bell ends in duct at entrances into cable vaults.
 - 2. Make conduit entrances into cable vaults tangential to walls of cable vault.
 - 3. Form trapezoidal transitions between duct bank and cable vaults as needed in order to ensure adequate cable bending radius for the duct bank-to-vault transition.

- F. Concrete:
 - 1. Install concrete as specified in Section 03300.
 - 2. Provide nonferrous tie wires to prevent displacement of the conduits during pouring of concrete:
 - a. Tie wire shall not act as a substitute for spacers.
 - 3. Install minimum 3-inch cover around conduit and rebar.
 - 4. Consolidation of encasement concrete around duct banks shall be by hand puddling, with no mechanical vibration.
 - 5. Conduit is subject to temperature rise. As concrete cures, allow the free end to expand by pouring the concrete from the center of the run or from one tie in point.

- G. Marking tape:
 - 1. Install a detectable marking tape 12 inches above the duct bank the entire length of the duct bank.

- H. For conduit installations beneath concrete slabs:
 - 1. Install steel reinforced concrete duct banks under all building slabs as indicated on the Drawings:
 - a. Concrete for encasement under building slabs need not be colored red.
 - b. For duct banks crossing under building footers or foundations, install the top of the duct bank a minimum of 6 inches below the footer.
 - c. Where duct banks terminate with conduit risers entering building walls, install an expansion/deflection fitting or a flat-wise elbow (elbow parallel to building wall) in order to accommodate differential movement between the conduits and structure.
- I. Restore all surfaces to their original condition as specified in Section 02952, unless otherwise specified.

3.04 ERECTION, INSTALLATION, APPLICATION, CONSTRUCTION (NOT USED)

3.05 REPAIR/RESTORATION (NOT USED)

3.06 RE-INSTALLATION (NOT USED)

3.07 COMMISSIONING

- A. As specified in Section 01756.

3.08 FIELD QUALITY CONTROL

- A. As specified in Section 16050.

3.09 ADJUSTING (NOT USED)

3.10 CLEANING

- A. Clean conduits of dirt and debris by use of an appropriately sized steel mandrel no less than 1/2 inch smaller than the inside diameter of the conduit.

3.11 PROTECTION

- A. As specified in Section 16050.
- B. Provide shoring and pumping to protect the excavation and safety of workers.
- C. Protect excavations with barricades as required by applicable safety regulations.

3.12 SCHEDULES (NOT USED)

END OF SECTION

SECTION 16150

LOW VOLTAGE WIRE CONNECTIONS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Wire connecting devices.
 - 2. Terminations.
 - 3. Splices.
- B. Related sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 01756 - Testing, Training, and Facility Start-up.
 - 3. Section 16050 - Common Work Results for Electrical.
 - 4. Section 16123 - 600-Volt or Less Wires and Cables.

1.02 REFERENCES

- A. As specified in Section 16050.
- B. ASTM International (ASTM):
 - 1. D3005 – Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape.
- C. CSA International (CSA):
 - 1. C22.2 - No.197-M1983 (R2208) - PVC Insulating Tape.
- D. Underwriters Laboratories, Inc. (UL):
 - 1. 510 - Standard for Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape.

1.03 DEFINITIONS

- A. As specified in Section 16050.

1.04 SYSTEM DESCRIPTION

- A. Provide a complete system of wiring connectors, terminators, fittings, etc. for a complete wiring system suitable for the cables and conductors used.

1.05 SUBMITTALS

- A. Furnish submittals as specified in Sections 01330 and 16050.
- B. Product data:
 - 1. Catalog cut sheets.
 - 2. Installation instructions.

1.06 QUALITY ASSURANCE

- A. As specified in Section 16050.
- B. All materials shall be UL listed.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. As specified in Section 16050.

1.08 PROJECT OR SITE CONDITIONS

- A. As specified in Section 16050.

1.09 SEQUENCING (NOT USED)

1.10 SCHEDULING (NOT USED)

1.11 WARRANTY

- A. As specified in Section 16050.

1.12 SYSTEM START-UP

- A. As specified in Section 16050.

1.13 OWNER'S INSTRUCTIONS (NOT USED)

1.14 MAINTENANCE (NOT USED)

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers for each type of technology are specified with the equipment in this Section.

2.02 EXISTING PRODUCTS (NOT USED)

2.03 MATERIALS (NOT USED)

2.04 MANUFACTURED UNITS (NOT USED)

2.05 EQUIPMENT

- A. Control connections:
 - 1. Use insulated ring type wire terminators for connections to all screw terminals:
 - a. With chamfered/funneled terminal barrel entry.
 - b. Deep internal serrations.
 - c. Long barrel design to reduce electrical resistance and increased insulator-barrel surface area to ensure that the insulator remains in contact with the barrel.

- d. Electroplated-tin copper conductor.
- e. Manufacturer: The following or equal:
 - 1) Thomas and Betts, Stakon.
- 2. For process equipment connections work from manufacturer's drawings.

B. Joints, splices, taps, and connections:

- 1. 600-volt conductors:
 - a. Use solderless connectors.
 - b. Use only plated copper alloy connectors or lugs:
 - 1) Aluminum connectors or lugs are not acceptable for copper conductors.
 - c. Under those specific conditions where aluminum conductors have been allowed or are specified then the connectors for aluminum conductors shall be specifically designed for that purpose.
 - d. For wire Number 10 AWG and smaller use compression splice caps, with insulating caps:
 - 1) Manufacturer: The following or equal:
 - a) Buchanan 2006S or 2011S, with 2007 or 2014 insulating caps.
 - e. For wire Number 8 AWG and larger, use heavy duty copper compression connectors:
 - 1) Manufacturer: One of the following or equal:
 - a) Burndy.
 - b) Thomas and Betts.
 - f. Heat shrink tubing:
 - 1) Suitable for indoors, outdoors, overhead, direct burial or submerged applications.
 - 2) Minimum shrink ratio: 4 to 1.
 - 3) Continuous operating temperature: -55 degrees Celsius to 110 degrees Celsius.
 - 4) Internally applied adhesive sealant.
 - 5) Cross-linked polyolefin:
 - a) Manufacturers, one of the following or equal:
 - (1) 3M ITCSN.
 - (2) Thomas & Betts Shrink-Kon.
- 2. Instrumentation class cable splices:
 - a. Suitable for indoor, outdoors, weather exposed, direct buried, or submersed applications.
 - b. Utilizing an epoxy, polyurethane, and re-enterable compounds.
 - c. For use with shielded or unshielded plastic- and rubber-jacketed, signal, control, and power cables rated up to 1 kilovolt.
 - d. Two-part mold body with tongue and groove seams and built in spacer webbing.
 - e. Manufacturer: The following or equal:
 - 1) 3M - Scotchcast 72-N.

C. Insulating tape:

- 1. General purpose insulating tape:
 - a. Minimum 7 mil vinyl tape.
 - b. Suitable for application in an ambient of -18 degrees Celsius (0 degrees Fahrenheit).
 - c. Operating range up to 105 degrees Celsius (220 degrees Fahrenheit).

- d. Flame retardant, hot- and cold- weather resistant, UV resistant.
 - e. For use as a primary insulation for wire cable splices up to 600 VAC.
 - f. Meeting and complying with:
 - 1) ASTM D3005 Type I.
 - 2) UL 510.
 - 3) CSA C22.2.
 - g. Manufacturer: The following or equal:
 - 1) 3M - Scotch Number Super 33+.
2. General-purpose color-coding tape:
- a. Minimum 7 mil vinyl tape.
 - b. Suitable for application on PVC and polyethylene jacketed cables.
 - c. For use indoors and outdoors in weather protected enclosures.
 - d. Available with the following colors:
 - 1) Red.
 - 2) Yellow.
 - 3) Blue.
 - 4) Brown.
 - 5) Gray.
 - 6) White.
 - 7) Green.
 - 8) Orange.
 - 9) Violet.
 - e. For use as phase identification, marking, insulating, and harnessing.
 - f. Meeting and complying with:
 - 1) UL 510.
 - 2) CSA C22.2.
 - g. Manufacturer the following or equal:
 - 1) 3M - Scotch Number 35.

2.06 COMPONENTS (NOT USED)

2.07 ACCESSORIES (NOT USED)

2.08 MIXES (NOT USED)

2.09 FABRICATION (NOT USED)

2.10 FINISHES (NOT USED)

2.11 SOURCE QUALITY CONTROL (NOT USED)

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

- A. As specified in Section 16050.
- B. Load connections:
 - 1. Connect loads to the circuits as indicated. Color-code all branch circuits as specified in Section 16123.
- C. Zero to 600-volt systems:
 - 1. Make all connections with the proper tool and die as specified by the device manufacturer.
 - 2. Use only tooling and dies manufactured by the device manufacturer.
 - 3. Insulate all connections and splices with Scotch 33+ tape and Scotchfill, or pre-molded plastic covers, or heat shrink tubing and caps.
 - 4. Number all power and control wires before termination.
- D. Motor connections (600 volts and below):
 - 1. Terminate wires with compression type ring lugs at motors.
 - 2. Connection at both the motor leads and the machine wires shall have ring type compression lugs.
 - 3. Cover bolted connectors with a heat shrinkable, cross-linked polyolefin material formed as a single opening boot:
 - a. In damp and wet locations, use a complete kit containing mastic that shall seal out moisture and contamination.
 - b. Shrink cap with low heat as recommended by manufacturer.
 - 4. Wire markers shall be readable after boot installation.
 - 5. Manufacturer: The following or equal:
 - a. Raychem MCK.

3.04 ERECTION, INSTALLATION, APPLICATION, CONSTRUCTION (NOT USED)

3.05 REPAIR/RESTORATION (NOT USED)

3.06 RE-INSTALLATION (NOT USED)

3.07 COMMISSIONING

- A. As specified in Section 01756.

3.08 FIELD QUALITY CONTROL

- A. As specified in Section 16050.

3.09 ADJUSTING (NOT USED)

3.10 CLEANING (NOT USED)

3.11 PROTECTION

- A. As specified in Section 16050.

3.12 SCHEDULES (NOT USED)

END OF SECTION

SECTION 16222

LOW VOLTAGE MOTORS UP TO 500 HORSEPOWER

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Low voltage motors up to 500 horsepower.
- B. Related sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 01756 - Testing, Training, and Facility Start-up.
 - 3. Section 16050 - Common Work Results for Electrical.
 - 4. Section 16950 - Field Electrical Acceptance Tests.

1.02 REFERENCES

- A. As specified in Section 16050.
- B. American Bearing Manufacturers Association (ABMA):
 - 1. 9 - Load Ratings and Fatigue Life for Ball Bearings.
 - 2. 11 - Load Ratings and Fatigue Life for Roller Bearings.
- C. American Petroleum Institute (API):
 - 1. 670 - Vibration, Axial Position, and Bearing Temperature Monitoring Systems.
- D. ASTM International (ASTM):
 - 1. B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
- E. Institute of Electrical and Electronic Engineers (IEEE):
 - 1. 43 - IEEE Recommended Practice for Testing Insulation Resistance of Rotating Machinery.
 - 2. 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators.
 - 3. 114 - Standard Test Procedure for Single-Phase Induction Motors.
 - 4. 303 - Recommended Practice for Auxiliary Devices for Rotating Electrical Machines in Class I, Division 2 and Zone 2 Locations.
 - 5. 841 - Standard for Petroleum and Chemical Industry-Premium-Efficiency, Severe Duty, Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors - Up to and Including 370 kW (500 hp).
 - 6. 1349 - Guide for Application of Electric Motors in Class I, Division 2 Hazardous (Classified) Locations.
- F. National Electrical Manufacturers' Association (NEMA):
 - 1. MG-1 - Motors and Generators.
 - 2. MG-2 - Safety Standard for Construction and Guide for Selection, Installation, and Use of Electric Motors and Generators.

- G. Underwriters Laboratories Inc. (UL):
 - 1. 674 - Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations.

1.03 DEFINITIONS

- A. As specified in Section 16050.

1.04 SYSTEM DESCRIPTION

- A. Furnish and install electric motors and accessories as specified in this Section and the Sections specifying driven equipment to provide a complete and operable installation.

1.05 SUBMITTALS

- A. Furnish submittals as specified in Sections 01330 and 16050.
- B. Submit completed motor data sheets for each motor supplied:
 - 1. Conform to data sheet in the appendix of this Section.
 - 2. Manufacturer's or other data sheets are not acceptable.
- C. Product data:
 - 1. Descriptive bulletins.
 - 2. Machine tag and loop number as indicated on the Drawings and in the specification section number of the driven machine.
 - 3. Complete electrical data.
 - 4. Torque, current, and power factor vs. speed curves:
 - a. At 100 percent rated voltage for all full voltage started and VFD driven motors.
 - b. For motors on reduced voltage start at 70, 80, 90 and 100 percent rated voltage.
 - c. Motor winding heaters:
 - 1) Voltage.
 - 2) Watts.
 - d. Winding temperature detectors:
 - 1) Type.
 - 2) Rating.
 - e. Moisture detectors.
 - 5. Mechanical data:
 - a. Bearing design and bearing life calculations.
 - b. Resonant frequencies for all VFD-driven motors 50 horsepower or greater.
- D. Shop drawings:
 - 1. Motor weight.
 - 2. Frame size.
 - 3. Conduit box(es), size(s), and location(s).
 - 4. Outline drawings with dimensions.
 - 5. Installation details for the project seismic criteria.

- E. Test reports:
 - 1. Factory test reports with test reference standard identified.
- F. Certification:
 - 1. When motors are driven by variable speed drive systems, submit certification that selected motor:
 - a. Is capable of satisfactory performance under the intended load.
 - b. Meets the requirements of the latest edition of NEMA MG-1 Part 31.
- G. Calculations:
 - 1. Where site conditions specified in Section 16050 exceed manufacturer's ratings, provide derating calculations for each motor.

1.06 QUALITY ASSURANCE

- A. As specified in Section 16050.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. As specified in Section 16050.
- B. Motors 200 hp and larger:
 - 1. Rotate shaft 90 degrees once per month.

1.08 PROJECT OR SITE CONDITIONS

- A. As specified in Section 16050.

1.09 SEQUENCING (NOT USED)

1.10 SCHEDULING (NOT USED)

1.11 WARRANTY

- A. As specified in Section 16050.

1.12 SYSTEM START-UP

- A. As specified in Section 16050.

1.13 OWNER'S INSTRUCTION (NOT USED)

1.14 MAINTENANCE (NOT USED)

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. One of the following or equal:
 - 1. US Motors.
 - 2. General Electric.

3. Reliance.
4. Toshiba.
5. Baldor.

2.02 EXISTING PRODUCTS (NOT USED)

2.03 MATERIALS (NOT USED)

2.04 MANUFACTURED UNITS (NOT USED)

2.05 EQUIPMENT

- A. 3-phase induction motors - general:
 1. Voltage:
 - a. All motors 1/2 hp and larger shall be rated 460 V, 3 phase unless otherwise indicated on the Drawings.
 - b. Dual voltage motors rated 230/460 V, 3 phase are acceptable provided all leads are brought to the conduit box.
 2. Motors driving identical machines shall be identical.
 3. All motors greater than 1 hp and up to 500 hp shall meet the "NEMA Premium Efficiency" percent listed in NEMA MG-1.
 4. Horsepower as indicated on the Drawings:
 - a. Horsepower ratings indicated on the Drawings are based on vendor's estimates. Provide motors sized for the load of the actual equipment furnished without operating in the service factor.
 5. Service factor:
 - a. 1.15 service factor on sine wave power.
 - b. 1.0 when driven by VFD.
 6. Torque:
 - a. Provide motors that develop sufficient torque for acceleration to full speed at voltage 10 percent less than motor nameplate rating.
 - b. When started using reduced voltage starters:
 - 1) Provide motors that develop sufficient torque for acceleration to full speed.
 - c. NEMA Design B except where driven load characteristics require other than normal starting torque:
 - 1) In no case shall starting torque or breakdown torque be less than the values specified in NEMA MG-1.
 7. Enclosures:
 - a. As specified in the individual equipment Specifications or in this Section.
 - b. Totally enclosed fan cooled:
 - 1) Cast iron conduit box.
 - 2) Tapped drain holes with Type 316 stainless steel plugs for frames 286 and smaller, and automatic breather and drain devices for frames 324 and larger.
 - c. Explosion-proof:
 - 1) Tapped drain holes with corrosion resistant plugs for frames 286 and smaller and automatic breather and drain devices for frames 324 and larger.
 - d. Lifting devices: All motors weighing 265 pounds (120 kilograms) or more shall have suitable lifting devices for installation and removal.

8. Manufactured with cast iron frames in accordance with NEMA MG-1 or manufacturer's standard material for the specified rating.
9. Nameplates:
 - a. Provide all motors with a permanent, stainless steel nameplate indelibly stamped or engraved with:
 - 1) NEMA standard motor data:
 - a) Indicate compliance with NEMA MG-1 Part 31 for inverter duty motors.
 - 2) AFBMA bearing numbers and lubrication instructions.
10. Hardware:
 - a. Type 316 stainless steel.
11. Conduit boxes:
 - a. Cast iron or stamped steel.
 - b. Split from top to bottom.
 - c. Provide gaskets at the following interfaces:
 - 1) Frames and conduit boxes.
 - 2) Conduit boxes and box covers.
 - d. Rotatable through 360 degrees in 90-degree increments:
 - 1) Where available based on the size of the conduit box.
 - e. Exceeding the dimensions defined in NEMA MG-1.
 - f. Provide grounding lugs inside conduit boxes for motor frame grounding.
12. Motor bearings:
 - a. Antifriction.
 - b. Regreasable and initially filled with grease for horizontal motors, vertical motors per manufacturer's standard design.
 - c. Bearings and lubrication suitable for ambient temperature and temperature rise.
 - d. Suitable for intended application and have ABMA L-10 rating life of 60,000 hours or more.
 - e. Fit bearings with easily accessible grease supply, flush, drain, and relief fittings using extension tubes where necessary.
 - f. Where specified in the equipment Specifications, provide split-sleeve type hydrodynamic radial bearings. Provide a bearing isolator to protect bearings from contaminants.
13. Insulation systems:
 - a. Motors installed in ambient temperatures 40 degrees Celsius or less:
 - 1) Provide Class F insulation.
 - 2) Design temperature rise consistent with Class B insulation.
 - 3) Rated to operate at an ambient temperature of 40 degrees Celsius at the altitude where the motor will be installed.
 - b. Motors installed in ambient temperatures between 40 degrees Celsius and 50 degrees Celsius:
 - 1) Provide Class F insulation.
 - 2) Design temperature rise consistent with Class B insulation.
 - 3) Rated to operate at an ambient temperature of 50 degrees Celsius at the altitude where the motor will be installed.
 - c. Motors installed in ambient temperatures between 50 degrees Celsius and 65 degrees Celsius:
 - 1) Provide Class H insulation.
 - 2) Design temperature rise consistent with Class F insulation.
 - 3) Rated to operate at an ambient temperature of 65 degrees Celsius at the altitude where the motors will be installed.

14. Motor leads:
 - a. Insulated leads with non-wicking, non-hydroscopic material. Class F insulation.
 15. Noise:
 - a. Maximum operating noise level in accordance with NEMA MG-1.
- B. Vertical motors:
1. Enclosures:
 - a. Totally enclosed fan cooled (TEFC) for motors 200 horsepower and less installed outdoors.
 2. Thrust bearings:
 - a. Selected for combined rotor and driven equipment loads.
 - b. Coordinate with driven equipment supplier for maximum vertical thrust of driven equipment.
 3. Anti-reverse ratchet.

2.06 COMPONENTS (NOT USED)

2.07 ACCESSORIES

- A. Motor winding heaters:
1. Provide all 3 phase motors with belted or cartridge space heaters mounted within the motor enclosure.
 2. Space heater rating shall be 120 volts, single-phase, unless otherwise indicated on the Drawings.
 3. Power leads for heaters wired into conduit box.
 4. Installed within motor enclosure adjacent to core iron.
- B. Winding temperature detectors:
1. Provide factory installed winding temperature detector with leads terminating in the conduit box:
 - a. Where required by the driven equipment Specification or as indicated on the Drawings.
 - b. RTD type, 2 per phase, 100 ohm platinum.
 2. Temperature switches with normally closed contacts as indicated on the Drawings.

2.08 MIXES (NOT USED)

2.09 FABRICATION (NOT USED)

2.10 FINISHES (NOT USED)

2.11 SOURCE QUALITY CONTROL (NOT USED)

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

- A. As specified in Section 16050.
- B. Install motors in accordance with manufacturer's instructions.
- C. Install shaft grounding ring on VFD driven motors in accordance with the manufacturer's instructions.

3.04 ERECTION, INSTALLATION, APPLICATION, CONSTRUCTION (NOT USED)

3.05 REPAIR/RESTORATION (NOT USED)

3.06 RE-INSTALLATION (NOT USED)

3.07 COMMISSIONING AND PROCESS START-UP

- A. As specified in Section 01756.
- B. Factory testing:
 - 1. Motors less than 250 horsepower:
 - a. Perform manufacturer's standard production tests including but not limited to:
 - 1) No load current.
 - 2) High potential test.
 - 3) Winding resistance.
 - b. Furnish copies of standard test reports on prototype or identical units.

3.08 FIELD QUALITY CONTROL

- A. As specified in Section 16050.
- B. Before start-up, perform insulation resistance test on each motor furnished or installed on this project:
 - 1. Windings energized to 1,000 volts DC for 1 minute.
 - 2. Resistance measured at the end of the test, recorded, and submitted to the Engineer for review.
 - 3. Inform the Engineer of any unusual or unacceptable test results.
 - 4. This test is in addition to the acceptance tests in Section 16950.

3.09 ADJUSTING (NOT USED)

3.10 CLEANING (NOT USED)

3.11 PROTECTION

- A. As specified in Section 16050.

END OF SECTION

MOTOR DATA SHEET

MOTOR/ EQUIPMENT TAG _____ MOTOR NUMBER _____
SPECIFICATION NUMBER OF DRIVEN MACHINE _____

MOTOR NAMEPLATE DATA

MANUFACTURER _____ MODEL/SERIES _____ MODEL NO. _____
FRAME _____ ENCLOSURE _____ NEMA DESIGN _____
HP _____ SERVICE FACTOR _____ RPM _____
INSULATION CLASS _____ VOLTS _____ FULL LOAD AMPS _____
AMBIENT TEMP _____ PHASE _____ NO LOAD AMPS _____
DESIGN TEMP _____ HERTZ _____ LOCK ROTOR AMPS _____
INRUSH CODE LETTER _____

100% LOAD 75% LOAD 50% LOAD
GUARANTEED MINIMUM EFFICIENCIES: _____
GUARANTEED MINIMUM POWER FACTOR: _____
MAXIMUM SIZE OF POWER FACTOR CORRECTION CAPACITOR: _____ KVAR

ACCESSORIES

MOTOR WINDING HEATER _____ VOLTS _____ WATTS
WINDING THERMAL PROTECTION _____
WINDING TEMP SWITCHES (YES/NO) _____
RTD:
TYPE _____ QUANTITY PER PHASE _____ # OF WIRES _____
NOMINAL RESISTANCE _____ NOMINAL TEMP _____ COEFFICIENT _____
RECOMMENDED DEGREES RECOMMENDED DEGREES
ALARM _____ CELSIUS TRIP _____ CELSIUS

SPECIAL APPLICATIONS

INVERTER DUTY* (YES/NO) _____ PART WINDING (YES/NO) _____ WYE - DELTA (YES/NO) _____
2 SPEED, 1 WINDING (YES/NO) _____ 2 SPEED, 2 WINDING (YES/NO) _____
AREA CLASSIFICATION:
CLASS _____ DIVISION _____ GROUP _____ TEMP CODE _____

* Conforms to NEMA MG-1 Part 31.

SECTION 16305

ELECTRICAL SYSTEM STUDIES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Short-circuit fault analysis study.
 - 2. Protective device coordination study.
 - 3. Arc-flash hazard study.
- B. Related sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 01756 - Commissioning.
 - 3. Section 16050 - Common Work Results for Electrical.

1.02 REFERENCES

- A. As specified in Section 16050.
- B. Institute of Electrical and Electronics Engineers (IEEE):
 - 1. 141 - IEEE Recommended Practice for Electric Power Distribution for Industrial Plants (Red Book).
 - 2. 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems (Buff Book).
 - 3. 315 - IEEE Standards Electrical and Electronics Graphic and Letter Symbols and Reference Designations.
 - 4. 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis (Brown Book).
 - 5. 902 - IEEE Guide for Maintenance, Operation and Safety on Industrial and Commercial Power Systems (Yellow Book).
 - 6. 1015 - IEEE Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems - Corrigendum 1 (Blue Book).
 - 7. 1584 - IEEE Guide for Performing Arc Flash Hazard Calculations.
- C. National Fire Protection Association (NFPA):
 - 1. 70E - Standard for Electrical Safety in the Workplace.

1.03 DEFINITIONS

- A. As specified in Section 16050.

1.04 SYSTEM DESCRIPTION

- A. General study requirements:
1. Scope:
 - a. The short-circuit fault analysis, protective device coordination, and arc-flash hazard studies shall include all equipment in the power distribution system as indicated on the Drawings including, but not limited to:
 - 1) Utility equipment.
 - 2) Switchboards.
 - 3) Generators.
 - 4) Transformers:
 - a) Including all dry-type transformers.
 - 5) Motor control centers.
 - 6) Motors.
 - 7) Panelboards:
 - a) Including all 240- and 208-volt systems.
 - 8) Vendor control panels.
 - 9) HVAC equipment.
 - b. Study scenarios:
 - 1) The studies shall include all possible electrical system configurations, for example:
 - a) Operation on normal (utility) source.
 - b) Operation on generator source.
 2. Obtain, for all equipment, the required data for preparation of the study including, but not limited to:
 - a. Transformer kilovolt-ampere (kVA) and impedances.
 - b. Generator impedances.
 - c. Generator decrement curves.
 - d. Bus withstand ratings.
 - e. Cable and bus data.
 - f. Protective device taps, time dials, instantaneous pickups, and time-delay settings.
 3. Obtain the Electric Utility information on the minimum and maximum available fault current, minimum and maximum utility impedances, utility protective device settings including manufacturer and model number, interrupting ratings, X/R ratios, and model information one level above the point of connection:
 - a. Utility tolerances and voltage variations.
 4. The individual performing the studies shall visit the site and collect all necessary field data in order to perform and complete comprehensive electrical system studies.
 5. Bus and conductor data:
 - a. Use impedances of the actual installed or specified conductors, unless otherwise indicated.
 - b. Use cable and bus impedances calculated at 25 degrees Celsius, unless otherwise indicated.
 - c. Use 600-volt cable reactance based on typical dimensions of actual installed or specified conductors, unless otherwise indicated.
 - d. Use bus withstand values for all equipment having buses.
 - e. Use medium-voltage cable reactances based on typical dimensions of shielded cables with 133-percent insulation levels, unless otherwise indicated.

6. Motors:
 - a. Each motor shall be individually modeled:
 - 1) Grouping of motors for fault contribution current is not acceptable.
 - b. Motors with variable frequency drives may be assumed to have no contribution to fault current.
7. Use the equipment, bus, and device designations as indicated on the Drawings for all studies.

B. Short-circuit fault analysis study additional requirements:

1. The short-circuit fault analysis shall be performed and submitted in 2 phases:
 - a. Initial short-circuit fault analysis:
 - 1) Based on the Contract Documents and Electric Utility information.
 - 2) The initial short-circuit fault analysis study shall indicate the estimated available short-circuit current at the line side terminals of each piece of equipment covered by the scope of the study.
 - 3) Provide a list of assumptions used in the initial study.
 - b. Final short-circuit fault analysis:
 - 1) The final short-circuit fault analysis shall modify the initial analysis as follows:
 - a) Utilize the actual equipment provided on the project.
 - b) Utilize conductor lengths based on installation.
2. Calculate 3-phase bolted fault, line-to-line fault, line-to-ground fault, double line-to-ground fault, short-circuit 1/2 cycle momentary symmetrical and asymmetrical RMS, 1-1/2 to 4 cycle interrupting symmetrical RMS, and 30-cycle steady-state short-circuit current values at each piece of equipment in the distribution system.
3. Evaluate bus bracing, short-circuit ratings, fuse interrupting capacity and circuit-breaker-adjusted interrupting capacities against the fault currents, and calculate X/R values:
 - a. Identify and document all devices and equipment as either inadequate or acceptable.
4. Calculate line-to-ground and double line-to-ground momentary short-circuit values at all buses having ground-fault devices.
5. Provide calculation methods, assumptions, one-line diagrams, and source impedance data, including utility X/R ratios, typical values, recommendations, and areas of concern.

C. Protective device coordination study additional requirements:

1. Furnish protective device settings for all functions indicated on the Drawings including, but not limited to:
 - a. Current.
 - b. Voltage:
 - 1) Provide settings for all voltage relays based upon actual utility and generator tolerances and specifications.
 - c. Frequency:
 - 1) Provide settings for all frequency relays based upon actual utility and generator tolerances and specifications.
 - d. Negative sequence.
 - e. Reverse power.
 - f. Machine protection functions:
 - 1) Provide settings for all motor and generator protective relays based on the manufacturer's recommended protection requirements.

2. Provide log-log form time-current curves (TCCs) graphically indicating the coordination proposed for the system:
 - a. Include with each TCC a complete title and one-line diagram with legend identifying the specific portion of the system covered by the particular TCC:
 - 1) Typical TCCs for identical portions of the system, such as motor circuits, are acceptable as allowed by the Engineer.
 - b. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics:
 - 1) These details can be included on the TCC.
 - c. Include a detailed description of each protective device tap, time dial, pickup, instantaneous, and time delay settings:
 - 1) These details can be included on the TCC.
 3. TCCs shall include all equipment in the power distribution system where required to demonstrate coordination. Include utility relay and fuse characteristics, medium-voltage equipment protective relay and fuse characteristics, low-voltage equipment circuit breaker trip device characteristics, transformer characteristics, motor and generator characteristics, and characteristics of other system load protective devices:
 - a. Include all devices down to the largest branch circuit and largest feeder circuit breaker in each motor control center, main breaker in branch panelboards, and fused disconnect switches.
 - b. Provide ground fault TCCs with all adjustable settings for ground fault protective devices.
 - c. Include manufacturing tolerances and damage bands in plotted fuse and circuit breaker characteristics.
 - d. On the TCCs, show transformer full load currents, transformer magnetizing inrush, ANSI transformer withstand parameters, and transformer damage curves.
 - e. Cable damage curves.
 - f. Terminate device characteristic curves at a point reflecting the maximum symmetrical or asymmetrical fault current to which the device is exposed based on the short-circuit fault analysis study.
 - g. Coordinate time interval medium-voltage relay characteristics with upstream and downstream devices to avoid nuisance tripping.
 4. Site generation: When site generation (including cogeneration, standby, and emergency generators) is part of the electrical system, include phase and ground coordination of the generator protective devices:
 - a. Show the generator decrement curve and damage curve along with the operating characteristic of the protective devices.
 5. Suggest modifications or additions to equipment rating or settings in a tabulated form.
- D. Arc-flash hazard study additional requirements:
1. Include the calculated arc-flash boundary and incident energy (calories/square centimeter) at each piece of equipment in the distribution system:
 - a. Perform study with 15 percent arcing fault variation as defined by IEEE 1584.
 - b. Perform arc-flash calculations at minimum and maximum utility and generator fault contributions.

- c. Perform arc-flash calculations for both the line side and load side of the switchgear, switchboard, motor control center, and panelboard main breakers.
 - d. Perform arc-flash calculations for all short-circuit scenarios with all motors on for 3 to 5 cycles and with all motors off.
 - e. Protective device clearing time shall be limited to 2 seconds, maximum.
 - 2. Provide executive summary of the study results:
 - a. Provide summary based upon worst case results.
 - 3. Provide a detailed written discussion and explanation of the tabulated outputs:
 - a. Include all scenarios.
 - 4. Provide alternative device settings to allow the Owner to select the desired functionality of the system:
 - a. Minimize the arc-flash energy by selective trip and time settings for equipment maintenance purposes.
 - b. Identify the arc-flash energy based upon the criteria of maintaining coordination and selectivity of the protective devices.
- E. Electrical system study meetings:
- 1. The individual conducting the short-circuit fault analysis, protective device coordination, and the arc-flash hazard studies shall meet with the Owner and Engineer 2 times.
 - 2. The purpose of the 2 meetings is as follows:
 - a. Preliminary results meeting:
 - 1) This meeting will be held after the studies have been completed, reviewed, and accepted by the Engineer.
 - 2) The purpose of this meeting is to inform the Owner of the results of the study and impacts on normal operation and maintenance including:
 - a) Protective device coordination problems and recommended solutions.
 - b) Explanation of the arc-flash hazard study results and its potential impact on operations.
 - c) Recommendations for reduction of arc-flash category levels including reduction of protective device settings or changes in operational practices.
 - b. Final meeting:
 - 1) Discuss changes to the studies based on the previous meeting.
 - 2) Discuss with the Owner how changes to the electrical system may change the arc-flash hazard category.
 - 3) Deliver the final electrical system studies report.
 - 3. The meetings will be at the Owner's facility:
 - a. Provide a minimum of 3-weeks' notice to the Owner and Engineer in advance of the projected meeting date.
 - b. Submit a draft of the meeting agenda when each meeting is requested.
 - 4. Meeting materials:
 - a. Prepare and provide the following materials:
 - 1) Meeting agenda. Include, at a minimum, the scope of the meeting, estimated time length for the meeting, and meeting goals.
 - 2) 4 copies of the submitted studies.

- F. By virtue of the fact that this is a professional study, the Owner reserves the right to modify the requirements of the study to comply with its operational requirements. The protective device coordination study and the arc-flash hazard study shall be modified based on the results of the meetings with the Owner.

1.05 SUBMITTALS

- A. Furnish submittals as specified in Sections 01330 and 16050.
- B. Final studies and reports:
1. Format and quantity:
 - a. Provide 6 bound copies of all final reports.
 - b. Provide 3 complete sets of electronic files on CD or DVD media, including the electrical system model(s), configuration files, custom libraries, and any other files used to perform the studies and produce the reports. Also provide an electronic version of the bound reports in PDF format.
 - c. Provide the number of copies specified in Section 01330.
 2. Include the sections below in the final report:
 - a. Copies of correspondence and data obtained from the electric utility company.
 - b. Letter certifying the inspection and verification of existing equipment.
 - c. One-line diagrams:
 - 1) The following information shall be included at a minimum:
 - a) Motor horsepower.
 - b) Transformer data:
 - (1) kVA.
 - (2) Configuration.
 - c) Cable data:
 - (1) Insulation.
 - (2) Size.
 - (3) Length.
 - 2) One-line diagrams shall be fully legible at 11-inch by 17-inch size.
 - d. Include in the short-circuit fault analysis study:
 - 1) Descriptions, purpose, basis, assumptions, recommendations, and scope of the study.
 - 2) Normal system connections and those that result in maximum fault conditions.
 - 3) Tabulation of circuit breaker, fuse, and other protective device ratings compared to maximum calculated short-circuit duties.
 - 4) Fault current calculations for the cases run including a definition of terms and guide for interpretation of computer software printouts.
 - e. Protective device coordination study shall include:
 - 1) Descriptions, purpose, basis, assumptions, recommendations, and scope of the study.
 - 2) List all requirements used in the selection and setting criteria for any protective devices.
 - 3) TCCs graphically indicating the coordination proposed for the system on log-log graphs.
 - a) All copies shall be in color.
 - 4) Tabulation of relay, fuse, circuit breaker, and other protective devices in graphical form with a one-line diagram to display area coordination.

- 5) Where coordination could not be achieved, an explanation shall be included in the report to support the statement along with recommendations to improve coordination. Recommended equipment modifications or settings shall be in a tabulated form.
- f. Include in the arc-flash hazard study:
 - 1) Descriptions, purpose, basis, assumptions, recommendations, and scope of the study.
 - 2) Normal system connections and those that result in maximum arc-flash conditions.
 - 3) Arc-flash raw data, calculations, and assumptions.
 - 4) Arc-flash label data:
 - a) Identifying the content of each label.
 - b) Identifying the location of each label.
- C. Certification:
 1. Submit written certification, sealed and signed by the professional engineer conducting the study, equipment supplier, and electrical subcontractor stating that the data used in the study is correct.
- D. Submit the credentials of the individual(s) performing the study and the individual in responsible charge of the study.
- E. The Engineer will review all studies and reports. After review, the Engineer will make recommendations and/or require changes to be made to the short-circuit fault analysis, protective device coordination, or arc-flash hazard studies. These changes shall be provided as part of the scope of work.
- F. Submit course outline for Owner's training.

1.06 QUALITY ASSURANCE

- A. As specified in Section 16050.
- B. Qualifications of the entity responsible for electrical system studies:
 1. The studies shall be performed, stamped, and signed by a professional engineer registered in the state where the project is located.
 2. A minimum of 5 years of experience in power system analysis is required for the individual in responsible charge of the studies.
 3. The short-circuit fault analysis, protective device coordination, and arc-flash hazard studies shall be performed with the aid of a digital computer program:
 - a. Point-to-point calculations are not acceptable.
- C. The study shall be performed Professional Engineer licensed in the State of California.

1.07 DELIVERY, STORAGE, AND HANDLING (NOT USED)

1.08 PROJECT/SITE CONDITIONS (NOT USED)

1.09 SEQUENCING

- A. Site visit to gather data on the existing facility systems for all studies:
 - 1. Make multiple trips as required to obtain all data for the short-circuit fault analysis, protection device coordination, and arc flash hazard studies.
- B. Submit the preliminary short-circuit fault analysis, protective device coordination, and arc-flash hazard studies.
- C. Electrical system study meeting for preliminary results.
- D. Final arc-flash meeting and final short-circuit fault analysis, protective device coordination, and arc-flash hazard studies.
- E. Label equipment with approved arc-flash labels.
- F. Owner's training.

1.10 SCHEDULING (NOT USED)

1.11 WARRANTY (NOT USED)

1.12 SYSTEM START-UP (NOT USED)

1.13 OWNER'S INSTRUCTIONS (NOT USED)

1.14 MAINTENANCE (NOT USED)

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Electrical system study software: One of the following or equal:
 - 1. ETAP by Operation Technology Inc.
 - 2. Powertools by SKM Systems Analysis.
 - 3. Paladin DesignBase by Power Analytics Corporation.

2.02 EXISTING PRODUCTS (NOT USED)

2.03 MATERIALS (NOT USED)

2.04 MANUFACTURED UNITS (NOT USED)

2.05 EQUIPMENT (NOT USED)

2.06 COMPONENTS

- A. Arc-flash hazard labels:
 - 1. Dimensions:
 - a. Minimum 5 inches by 3.5 inches.

2. Materials:
 - a. Polyester with polyvinyl polymer over-laminate.
 - b. Self-adhesive.
 - c. Resistant to:
 - 1) UV.
 - 2) Chemicals and common cleaning solvents.
 - 3) Scuffing.
 - 4) Wide temperature changes.
3. Contents:
 - a. Short-circuit bus identification.
 - b. Calculated incident energy (calories/square centimeter) range:
 - 1) Based on worst-case study results.
 - c. Arc-flash protection boundary.
 - d. Shock hazard boundary:
 - 1) The Contractor may provide separate labels for indication of the shock hazard boundary.
 - e. Description of the combined level of personnel protective equipment.
4. Color scheme:
 - a. For locations above 40 calories/square centimeter:
 - 1) White label with red "DANGER" strip across the top.
 - 2) Black lettering.
 - b. For locations below 40 calories/square centimeter:
 - 1) White label with orange "WARNING" strip across the top.
 - 2) Black lettering.

2.07 ACCESSORIES (NOT USED)

2.08 MIXES (NOT USED)

2.09 FABRICATION (NOT USED)

2.10 FINISHES (NOT USED)

2.11 SOURCE QUALITY CONTROL (NOT USED)

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

- A. As specified in Section 16050.
- B. After review and acceptance of the arc-flash hazard study by the Engineer, install all arc-flash hazard labels:
 1. Install labels at all locations required by NFPA, ANSI, or IEEE standards.
 2. At a minimum, install labels in the following locations:
 - a. The front of each main or incoming service compartment.
 - b. The front of each accessible auxiliary or conductor compartment.

- c. Each motor control center vertical section.
 - d. Each panelboard covered by the study.
 - e. Other equipment covered by the scope of the study.
- C. After review and acceptance of the arc-flash hazard study and protective device coordination study by the Engineer, adjust protective device settings per final study prior to equipment energization:
- 1. Devices that require power for configuration may be set during energization, but before any subfed loads are energized.
 - 2. Ensure that settings for upstream equipment are set prior to energizing downstream devices.

3.04 ERECTION, INSTALLATION, APPLICATION, AND CONSTRUCTION (NOT USED)

3.05 REPAIR/RESTORATION (NOT USED)

3.06 RE-INSTALLATION (NOT USED)

3.07 COMMISSIONING

- A. As specified in Section 01756.

3.08 FIELD QUALITY CONTROL

- A. As specified in Section 16050.
- B. The individual performing the arc-flash hazard study shall direct the installation of the arc-flash hazard labels:
 - 1. Remove and replace any improperly applied labels.
 - 2. Repair the equipment finish damaged by removal of any label.
 - 3. Install labels level or plumb across the entire dimension of the label.

3.09 ADJUSTING (NOT USED)

3.10 CLEANING (NOT USED)

3.11 PROTECTION (NOT USED)

3.12 SCHEDULES (NOT USED)

END OF SECTION

SECTION 16412

LOW VOLTAGE MOLDED CASE CIRCUIT BREAKERS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Low voltage molded case circuit breakers.
- B. Related sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 01756 - Testing, Training, and, Facility Start-up.
 - 3. Section 16050 - Common Work Results for Electrical.

1.02 REFERENCES

- A. As specified in Section 16050.
- B. National Electrical Manufacturers Association (NEMA):
 - 1. AB 3. - Molded Case Circuit Breakers and Their Application.
- C. Underwriter's Laboratories (UL):
 - 1. 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
 - 2. 943 - Ground Fault Circuit Interrupters.

1.03 DEFINITIONS

- A. As specified in Section 16050.
- B. In accordance with UL 489.

1.04 SYSTEM DESCRIPTION

- A. Molded case thermal magnetic or motor circuit protector type circuit breakers as indicated on the Drawings and connected to form a completed system.

1.05 SUBMITTALS

- A. Furnish submittals as specified in Sections 01330 and 16050.
- B. Product data:
 - 1. Catalog cut sheets.
 - 2. Manufacturer's time-current curves for all molded case circuit breakers furnished.

1.06 QUALITY ASSURANCE

- A. As specified in Section 16050.
- B. Low voltage molded case circuit breakers shall be UL listed and labeled.

1.07 DELIVERY, STORAGE AND HANDLING

- A. As specified in Section 16050.

1.08 PROJECT OR SITE CONDITIONS

- A. As specified in Section 16050.

1.09 SEQUENCING (NOT USED)

1.10 SCHEDULING (NOT USED)

1.11 WARRANTY

- A. As specified in Section 16050.

1.12 SYSTEM START-UP

- A. As specified in Section 16050.

1.13 OWNER'S INSTRUCTIONS (NOT USED)

1.14 MAINTENANCE (NOT USED)

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Schneider Electric/Square D Company to match existing.

2.02 EXISTING PRODUCTS

- A. Circuit breaker to be installed in an existing Square D Model 6 Motor Control Center.

2.03 MATERIALS (NOT USED)

2.04 MANUFACTURED UNITS

- A. General:
 - 1. Conforming to UL 489.
 - 2. Operating mechanism:
 - a. Quick-make, quick-break, non-welding silver alloy contacts.
 - b. Common Trip, OPEN and CLOSE for multi-pole breakers such that all poles open and close simultaneously.
 - c. Mechanically trip free from the handle.

- d. Trip indicating handle - automatically assumes a position midway between the manual ON and OFF positions to clearly indicate the circuit breaker has tripped.
- e. Lockable in the "OFF" position.
- 3. Arc extinction:
 - a. In arc chutes.
- 4. Voltage and current ratings:
 - a. Minimum ratings as indicated on the Drawings.
 - b. Minimum frame size 100A.
- 5. Interrupting ratings:
 - a. Minimum ratings as indicated on the Drawings.
 - b. Modify as required to meet requirements of the short circuit fault analysis - as specified in Section 16305.
 - c. Not less than the rating of the assembly (panelboard, switchboard, motor control center, etc.)

B. Motor circuit protectors:

- 1. Instantaneous only circuit breaker as part of a listed combination motor controller.
- 2. Each pole continuously adjustable in a linear scale with 'LO' and 'HI' settings factory calibrated.

2.05 EQUIPMENT (NOT USED)

2.06 COMPONENTS

A. Terminals:

- 1. Line and load terminals suitable for the conductor type, size, and number of conductors in accordance with UL 489.

B. Case:

- 1. Molded polyester glass reinforced.
- 2. Ratings clearly marked.

C. Trip units:

- 1. Thermal magnetic:
 - a. Instantaneous short circuit protection.
 - b. Inverse time delay overload.
 - c. Ambient or enclosure compensated by means of a bimetallic element.

2.07 ACCESSORIES (NOT USED)

2.08 MIXES (NOT USED)

2.09 FABRICATION (NOT USED)

2.10 FINISHES (NOT USED)

2.11 SOURCE QUALITY CONTROL

A. Test breakers in accordance with:

- 1. UL 489.
- 2. Manufacturer's standard testing procedures.

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

- A. Install breakers to correspond to the accepted shop drawings.

3.04 ERECTION, INSTALLATION, APPLICATION, CONSTRUCTION (NOT USED)

3.05 REPAIR/RESTORATION (NOT USED)

3.06 RE-INSTALLATION (NOT USED)

3.07 COMMISSIONING

- A. As specified in Section 01756.

3.08 FIELD QUALITY CONTROL

- A. As specified in Section 16050.

3.09 ADJUSTING

- A. Adjust trip settings in accordance with Protective Device Coordination Study as accepted by the Engineer and in accordance with manufacturer's recommendations.
- B. Adjust motor circuit protectors in accordance with NEC and the manufacturer's recommendation based on the nameplate values of the installed motor.

3.10 CLEANING (NOT USED)

3.11 PROTECTION

- A. As specified in Section 16050.

3.12 SCHEDULES (NOT USED)

END OF SECTION

SECTION 16422

MOTOR STARTERS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Motor starters and contactors.

- B. Related sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 01756 - Testing, Training, and Facility Start-up.
 - 3. Section 16050 - Common Work Results for Electrical.
 - 4. Section 16070 - Hangers and Supports.
 - 5. Section 16075 - Identification for Electrical Systems.
 - 6. Section 16123 - 600-Volt or Less Wires and Cables.
 - 7. Section 16412 - Low Voltage Molded Case Circuit Breakers.

1.02 REFERENCES

- A. As specified in Section 16050.

- B. International Electrotechnical Commission (IEC):
 - 1. 60 947-4 - Low-Voltage Switchgear and Control Gear.
 - 2. 801-1 - Electromagnetic Compatibility for Industrial-Process Measurement and Control Equipment - Part 1: General Information.

- C. National Electrical Manufacturer's Association (NEMA):
 - 1. ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 V.

- D. Underwriters Laboratories (UL):
 - 1. 508 - Standard for Industrial Control Equipment.
 - 2. 508A - Standard for Industrial Control Panels.

1.03 DEFINITIONS

- A. As specified in Section 16050.

- B. Specific definitions and abbreviations:
 - 1. FVNR: Full voltage non-reversing.
 - 2. Overload relay class: A classification of an overload relay time current characteristic by means of a number which designates the maximum time in seconds at which it will operate when carrying a current equal to 600 percent of its current rating.

1.04 SYSTEM DESCRIPTION

- A. General requirements:
 - 1. Starters for motor control centers, individual enclosed starters, or control panels.

1.05 SUBMITTALS

- A. Furnish submittals as specified in Sections 01330 and 16050:
 - 1. Submit motor starter data with equipment submittal.

- B. Product data:
 - 1. Manufacturer.
 - 2. Catalog cut sheets.
 - 3. Technical information.
 - 4. Complete nameplate schedule.
 - 5. Complete bill of material.
 - 6. List of recommended spare parts.
 - 7. Confirmation that the overload relay class for each starter meets the requirements of the equipment and motor supplier.
 - 8. Electrical ratings:
 - a. Phase.
 - b. Wire.
 - c. Voltage.
 - d. Ampacity.
 - e. Horsepower.
 - 9. Furnish circuit breaker submittals as specified in Section 16412.

- C. Shop drawings:
 - 1. Elementary and schematic diagrams:
 - a. Provide 1 diagram for every starter and contactor.
 - b. Indicate wire numbers for all control wires on the diagrams:
 - 1) Wire numbering as specified in Section 16075.
 - c. Indicate interfaces with other equipment on the drawings.

- D. Operation and maintenance manuals:
 - 1. Submit complete operating and maintenance instructions presenting full details for care and maintenance of equipment furnished or installed under this Section. Including but not limited to:
 - a. Electrical ratings:
 - 1) Phase.
 - 2) Wire.
 - 3) Voltage.
 - 4) Ampacity.
 - b. Complete bill of material.
 - c. Manufacturer's operating and maintenance instructions starter and/or contactor component parts, including:
 - 1) Protective devices (fuses, breakers, overload relays, heater elements, etc.).
 - 2) Pilot devices.
 - d. Complete renewal parts list.

- e. As-built drawings:
 - 1) Furnish as-built drawings for each starter and contactor indicating final:
 - a) Wire numbers.
 - b) Interfaces with other equipment.
 - 2) 11-inch by 17-inch format.

1.06 QUALITY ASSURANCE

- A. As specified in Section 16050.
- B. Regulatory requirements:
 - 1. All starters and components shall be UL listed and labeled:
 - a. UL 508 - Industrial Control Equipment.
 - b. UL 508A - Industrial Control Panels.
 - 2. NEMA ICS 2 - Industrial Control and System Controllers; Contactors and Overload Relays Rated: 600 Volts.
 - 3. Combination starters shall be UL listed and labeled.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. As specified in Section 16050.

1.08 PROJECT OR SITE CONDITIONS

- A. As specified in Section 16050.

1.09 SEQUENCING (NOT USED)

1.10 SCHEDULING

1.11 WARRANTY

- A. As specified in Section 16050.

1.12 SYSTEM START-UP

- A. As specified in Section 16050.

1.13 OWNER'S INSTRUCTIONS (NOT USED)

1.14 MAINTENANCE

- A. Spare parts:
 - 1. Provide the following spare parts, suitably packaged and labeled with the corresponding equipment number:
 - a. One spare fuse of each size and type per starter.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. The following to match existing:
 - 1. NEMA starters and contactors:
 - a. Schneider Electric/Square D.

2.02 EXISTING PRODUCTS

- A. Motor starter to be installed in an existing Square D Model 6 motor control center.

2.03 MATERIALS (NOT USED)

2.04 MANUFACTURED UNITS

- A. General:
 - 1. Provide combination type starters with motor circuit protector or thermal-magnetic circuit breaker and control power transformer with ratings as indicated on the Drawings.
 - 2. NEMA size, design, and rated:
 - a. NEMA Size 1 minimum.
 - 3. Coordinate motor circuit protector, thermal magnetic circuit breaker, or fusible disconnect, and overload trip ratings with nameplate horsepower and current ratings of the installed motor:
 - a. If motors provided are different in horsepower rating than those specified or indicated on the Drawings, provide starters coordinated to the actual motors furnished.
 - 4. Mount extended overload reset buttons to be accessible for operation without opening starter enclosure door.
- B. Full voltage starters (FVNR):
 - 1. Across-the-line full voltage magnetic starters.
 - 2. Rated for 600 volts.
 - 3. Electrical characteristics as indicated on the Drawings.
 - 4. Provide positive, quick-make, quick-break mechanisms, pad lockable enclosure doors.
 - 5. Furnish starter with bi-metallic overload relays.
 - 6. Double-break silver alloy contacts.

2.05 EQUIPMENT (NOT USED)

2.06 COMPONENTS

- A. Molded case circuit breakers:
 - 1. Circuit breaker type and ratings as indicated on the Drawings.
 - 2. Provide as specified in Section 16412.
- B. Contactors:
 - 1. NEMA size as indicated on the Drawings.
 - 2. Electrically held.
 - 3. Factory adjusted and chatter free.

4. Auxiliary contacts:
 - a. Contact ratings as per NEMA A 600 rating:
 - 1) Auxiliary contacts rated 10 amps at 600 volts.
 - b. Provide all contacts indicated on the Drawings, and any additional contacts required for proper operation.
 - c. Provide at least 1 normally open and 1 normally closed spare auxiliary contact.
 5. Constructed in accordance with the following standards:
 - a. UL 508.
 - b. IEC 947-4:
 - 1) Type 1 coordination when protected by a circuit breaker.
 - 2) Type 2 coordination when protected by a suitable UL listed fuse.
 - c. IEC 801-1 parts 2 through 6.
- C. Overloads:
1. Bi-metallic overload relay:
 - a. Class 20 protection.
 - b. Ambient compensated.
 - c. Interchangeable heater pack:
 - 1) One heater per phase.
 - 2) Coordinate with installed motor full load amps and service factor.
 - d. Visible trip indicator.
 - e. Push-to-trip test.
 - f. Isolated normally open alarm contact.
 - g. Normally closed trip contacts.
 - h. Manual reset.
- D. Control power transformer:
1. Furnish integral control power transformer capacity to power:
 - a. All motor controls; Motor and starter accessories indicated on the Drawings or specified.
 2. Primary and secondary fusing as indicated on the Drawings:
 - a. Fusing sized by the manufacturer for the rating of the transformer furnished.
 3. Control power transformer secondary voltage:
 - a. As indicated on the Drawings.

2.07 ACCESSORIES

- A. Lugs and terminals:
1. For all external connections of No. 6 AWG and larger.
 2. UL listed for either copper or aluminum conductors.
- B. Surge protective devices:
1. Furnish surge protection devices across the coil of each starter, contactor, and relay.
- C. Pilot devices:
1. Provide pilot lights, switches, elapsed time meters, and other devices as specified or as indicated on the Drawings.
 2. As specified in Section 17710.

- D. Nameplates and wire markers:
 - 1. As specified in Section 16075.

2.08 MIXES (NOT USED)

2.09 FABRICATION (NOT USED)

2.10 FINISHES (NOT USED)

2.11 SOURCE QUALITY CONTROL

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

- A. As specified in Section 16050.
- B. Install the equipment in accordance with the accepted installation instructions and anchorage details to meet the seismic and wind load requirements at the Project site.
- C. Starters in motor control centers:
 - 1. Install starters in existing motor control center.

3.04 ERECTION, INSTALLATION, APPLICATION, CONSTRUCTION (NOT USED)

3.05 REPAIR/RESTORATION (NOT USED)

3.06 RE-INSTALLATION (NOT USED)

3.07 COMMISSIONING

- A. As specified in Section 01756.

3.08 FIELD QUALITY CONTROL

- A. As specified in Section 16050.

3.09 ADJUSTING

- A. Make all adjustments as necessary and recommended by the manufacturer, Engineer, or testing firm.
- B. Set all overloads and motor circuit protectors based on the nameplate values of the installed motor.

3.10 CLEANING

A. As specified in Section 16050.

3.11 PROTECTION

A. As specified in Section 16050.

3.12 SCHEDULES (NOT USED)

END OF SECTION

SECTION 16640

CATHODIC PROTECTION – WATER RESERVOIR INTERIOR

PART 1 GENERAL

1.01 SUMMARY

- A. The Contractor shall furnish all materials, install all equipment, and provide all labor necessary to complete the work shown on the drawings and/or listed below and all other work and miscellaneous items not specifically mentioned but reasonably inferred, including all accessories and appurtenances required for a complete system. The intent of the specification is to provide for a complete, functional cathodic protection system for the submerged interior surfaces of the steel reservoir.
- B. The Contractor shall furnish all materials, install all equipment and provide all labor necessary to complete the work shown on the drawings and/or listed below and all other work and miscellaneous items not specifically mentioned but reasonably inferred, including all accessories and appurtenances required for a complete system. The intent of the specification is to provide for a complete, functional cathodic protection system for the submerged interior surfaces of the 2.0 million gallon steel reservoir, Blackhorse Recycled Water Reservoir, Marina, California.

1.02 WORK INCLUDED

- A. Work included in this section consists of all components of the cathodic protection system for the steel reservoir including auto-potential controlled rectifier, anodes, access hole covers, cables, reference electrodes and any other work necessary to complete the installation:
 - 1. Impressed current cathodic protection of the submerged portion of the tank interior surfaces.
 - 2. Installation of an auto-potential controlled rectifier, anodes, anode suspension system, cables, and reference electrode, with associated wiring.
 - 3. Material submittals.
 - 4. Coatings for conduit, top of hand-hole covers, and touch-up work.
 - 5. Anodes, anode lead wires, header cables and conduit lengths shown on the plans are approximate only. Actual lengths are the responsibility of the contractor and are based on installation requirements.
 - 6. Correction of all deficiencies.

1.03 CODE REQUIREMENTS

- A. All materials, workmanship, and installation shall conform to all requirements of the legally constituted authority having jurisdiction. These authorities include, but are not limited to, the latest revision of the State of California, Department of Industrial Relations, Division of Industrial Safety Orders of the Industrial Accident Commission; and all other applicable State, County, or City codes and regulations. Nothing in the drawings or specifications is to be construed to permit work not conforming to these regulations and codes. Where larger size or better grade

materials than required by these regulations and codes are specified, the specifications and drawings shall have precedence.

1.04 REFERENCE SPECIFICATIONS

- A. ASTM - American Society for Testing and Materials.
- B. IEEE - Institute of Electrical and Electronic Engineers.
- C. NEMA - National Electrical Manufacturers' Association.
- D. NACE - National Association of Corrosion Engineers.
- E. OSHA - Occupational Safety and Health Administration.
- F. AWWA - American Water Works Association.

1.05 QUALITY ASSURANCE

- A. All work shall be performed to the satisfaction of the Owner's Engineer.
- B. Use only new, highest quality cathodic protection components, and standard products from a manufacturer regularly engaged in the production of such material or equipment.
- C. All materials in contact with the water or exposed to the interior of the tank shall be classified in accordance with ANSI/NSF 61 "Drinking Water Systems Components."
- D. Cathodic protection components shall be subject to testing by the Owner's Engineer to ensure proper installation and operation. The Contractor shall be responsible for correction of all deficiencies identified by the testing and all costs incurred for retesting prior to final acceptance.
- E. The system warranty shall be no less than one year after system activation and shall include all costs for repair, parts and labor.

1.06 DATA TO BE FURNISHED BY THE CONTRACTOR

- A. Contractor shall submit for approval by the Owner's Engineer two (2) copies of the following items:
 - 1. A complete list of cathodic protection equipment and materials, including name and manufacturer, catalog number, size, and any other pertinent data necessary for proper identification and to determine conformance with specifications.
 - 2. System warranty pursuant with Paragraph 1.04.E.
 - 3. Coating manufacturer's data sheet for each product to be used along with instructions and recommendations for surface preparation and coating application for galvanized steel surfaces as well as for touchup of steel surfaces.
 - 4. Material safety data sheet for each field applied coating product used.
 - 5. Sanitization procedure for all items entering the inside of the tank.
 - 6. Proposed installation schedule.

- B. Contractor shall receive written approval of submittals, prior to beginning installation.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver cathodic protection and coating materials to the Site in original, sealed containers.
- B. Replace all damaged anodes, panels and all damaged lead wires.

PART 2 MATERIALS

2.01 GENERAL

- A. All materials shall conform to the requirements set forth herein or as designated on the drawings, unless otherwise specified. All materials must be new, free from defects, and shall be of the best commercial quality for the purpose specified. All necessary items and accessories not shown on the drawings or specified herein, but which are required to fully carry out the specified intent of the work, shall be furnished by the Contractor without additional cost to the owner.

2.02 T.A.S.C. RECTIFIER

- A. Rectifier shall be the product of a concern currently engaged in the manufacture of cathodic protection equipment and shall conform in all respects to NEMA Standards. The rectifier shall be silicon full-wave bridge, dual voltage 120V AC, 60-cycle, single-phase, air-cooled as indicated on the drawings, designed for continuous operation at 45° C ambient temperature and shall include the following features:
 1. Output rating: 24 Volts-6 Amp DC.
 2. "IR" drop free, potential controlled using a permanent copper sulfate reference electrode. It should be capable of maintaining the polarized structure potential to within a few millivolts of the set potential. Minimum input impedance of the measuring circuit should be 10 Mega-Ohms.
 3. Thermal magnetic circuit breaker, plastic encased, for overload protection or primary and secondary.
 4. Transient protection for AC and DC circuit.
 5. Lightning protection for primary circuit.
 6. Separate meters for current and voltage output with 2-percent accuracy.
 7. Nickel plated connectors and adjustment terminals. Hardware used in electrical connections including bolts, studs, nuts, washers and lock washers shall be of brass for electrical conductivity and for resistance to atmospheric corrosion. All electrical and mechanical connections shall be tightly secured with lock washers, or other positive locking devices.
 8. DC output terminals shall be solderless lug type and shall be mounted on the main rectifier panel. Terminal panels shall be clearly and permanently identified as to their polarity by engraving the panel or by other permanent marking. In addition the rectifier units shall be supplied with two spare sets of fuses and an O& M manual.

9. The following data shall be permanently attached to the rectifier and included in the O&M Manual:
 - a. Manufacturer.
 - b. Model Number.
 - c. Serial Number.
 - d. AC Input Volts.
 - e. AC Input amps.
 - f. Line Frequency.
 - g. Number of Phases.
 - h. DC Output Volts.
 - i. DC Output Amps.
 - j. Ambient Temperature Rating.
 - k. Equipped for wall mounting to Unistrut or steel wall panel.
 10. Air-Cooled Rectifier Enclosure: Housing shall be weatherproof, air-cooled type, NEMA 3R enclosure constructed of 11 gage galvanized steel, with two coats of white paint, free of warps and wrinkles, and shall be equipped with padlock hasp. The enclosure shall be adequately sized to include all components as indicated herein.
- B. Subject to Compliance with the Contract Documents the following Manufacturers are acceptable:
1. Corpro Companies, Inc.
 2. Universal Rectifiers, Inc.
 3. Farwest Corrosion/Network Technologies Group Inc.
 4. Or approved equal.

2.03 ANODES

- A. Mixed Metal Oxide Wire Anode Option:
1. The anodes shall consist of 0.062 inch (1.5 mm) diameter, copper titanium wire with a mixed metal oxide coating. The anode wires shall be spliced to anode lead wire:
 - a. Anode Type "1.5 mm STD" as manufactured by Industrie De Nora.
 - b. Approved equal.
- B. Anode Lead Wire: #10 AWG/HMWPE crimped and soldered to the anode, making a mechanically secure connection.
- C. Soldered Connection and Core: Seal entirely with 2 half lapped layers of rubber tape, and a heat shrink sleeve.
- D. The porcelain weights shall be approximately 1 pound in weight and less than 4-inches in diameter:
1. Guy Insulator (502), ANSI Class 54-1, Catalog No. ST54-1, as manufactured by Austin Insulators Inc.
 2. Approved equal.

2.04 CABLES

- A. Anode cable: Stranded single conductor copper, #10 AWG/HMWPE.
- B. Anode header cable: Stranded single conductor copper, # 8 AWG/HMWPE.

- C. Reference Electrode Lead Wire: Stranded single conductor copper, No. 12 AWG/HMWPE color as indicated on Drawings.
- D. Control cable and reference electrode header cable: Stranded, shielded, (twisted pair), dual conductor, copper #12 AWG/THHN.

2.05 REFERENCE ELECTRODE

- A. The permanent reference electrode used to measure the tank-to-water potential shall be designed to remain stable in a continuous immersion in the water for a minimum of 10 years with only minimal maintenance as recommended by the manufacturer. The reference electrode shall be a copper/copper-sulfate type of reference electrode and shall have a potential drift of less than 10 mV:
 - 1. The permanent reference electrode shall be equipped with a 4-inch diameter plastic bumper.
 - 2. STAPERM, Model CU-2-FW as manufactured by GMC.
 - 3. Permacell Model 801, as manufactured by Corpro Companies Inc.
 - 4. Approved equal.

2.06 GALVANIZED STEEL CONDUIT AND FITTINGS

- A. Conduit and fittings shall be hot-dipped galvanized steel and shall conform to ANSI Specification C80.1 for Rigid Metallic Conduit.
- B. Coat conduit per Specifications Section 099610.

2.07 ANODE SUSPENSION SYSTEM

- A. The anodes shall be suspended vertically from the roof of the tank as shown on the drawings.
- B. Hand holes and mounting devices shall be provided so the anodes may be replaced or inspected without entering the tank. The anode hand-hole assemblies shall consist of 5-inch diameter holes and 6-inch diameter stainless steel cover plates with neoprene gaskets and stainless steel clamping bars held in place by stainless steel bolts. One additional handhole assembly is required for the reference electrode to be installed near the roof hatch.
- C. Clevis pins shall have a porcelain insulator and a stainless steel cotter pin. The clevis pins shall be sized as shown on the drawings. Stainless steel 3/8-inch 16 bolts, nuts and washers shall be used to fasten the clevis pin to the roof.

2.08 COATING FOR EXTERNAL TANK REPAIR

- A. For coating repairs of the external tank see Coating Specifications.

2.09 CABLE-TO-TANK-CHIME CONNECTION

- A. All cable connections to the ductile iron pipe, spool pieces or fittings and steel pipelines, except for force balanced expansion devices, shall be accomplished utilizing an exothermic welding process such as "Cadweld" by Erico Products, Inc., "Thermoweld" by Continental Industries, Inc., or approved equal. Each cable shall be fitted with a copper sleeve for accomplishing the weld and cartridge, sleeves and

molds for each weld shall be furnished by the same manufacturer. All materials for welding shall be sized and in accordance with recommendations in manufacturers' literature. Exothermic welds for the ductile iron fittings shall be made using the weld metal for cast iron pipe.

2.10 CABLE-TO-CHIME COATING MATERIAL

- A. Epoxy used for sealing the cable to steel tank chime connections shall be Aquatapoxy® A-6, manufactured by Cohesant Materials, Durcon-164, manufactured by the Duriron Company; Scotchcast Resin No. 4, manufactured by 3-M Company; or CC-1 Potting Compound, manufactured by PSI Products.

PART 3 EXECUTION

3.01 GENERAL

- A. All materials, workmanship and installation shall conform to all requirements of the legally constituted authority having jurisdiction. These authorities include, but are not limited to, the latest revision of the State of California, Department of Industrial Relations, Division of Industrial Safety, Electrical Orders; The National Electric Code, General Construction Safety Orders of the Industrial Accident Commission; and all other applicable State, County, or City codes and regulations. Nothing in the drawings or specifications is to be construed to permit work not conforming to these regulations and codes. Where larger size or better grade materials than required by these regulations and codes are specified, the specifications and drawings shall have precedence.

3.02 STORAGE OF MATERIALS

- A. All materials and equipment to be used in construction shall be stored in such a manner to be protected from detrimental effects from the elements. If warehouse storage cannot be provided, materials and equipment shall be stacked well above ground level and protected from the elements with plastic sheeting or as appropriate.

3.03 ANODES

- A. The anodes shall be suspended vertically from the tank roof as shown in the drawings. The anode lead wire shall be secured to a porcelain spool insulator with stainless steel clevis type bracket bolted to the interior of the tank roof near the hand-holes.
- B. The hand-holes shall be cut into the tank roof using a saw. A cutting torch shall not be used to cut the hand-holes. After cutting the holes in the roof, burrs and sharp edges of the hole shall be removed by grinding. Care shall be taken to prevent paint chips and metal filings from dropping into the tank. Care shall also be taken to minimize damage to the tank coating system. The cut edges of the roof holes shall be coated prior to installation of the hand-hole covers.

3.04 ANODE HEADER CABLES

- A. The #8 AWG HMWPE anode header cable shall be installed for the outer ring without cutting any strands of copper and shall run from each hand-hole completing a full 360 degree circle. Minimize the splices when running the inner ring.
- B. The anode header cable shall be supported at each anode access hand-hole by an individual porcelain clevis pin type insulator.

3.05 ANODE & HEADER CABLE SPLICES

- A. Anode to header cable splices shall be with a proper sized Thomas & Betts C tap crimp connector or two copper split bolts. The connections shall be double half wrapped with rubber filler tape and then wrapped with not less than a double half wrap of quality electrical tape. The splices shall be made in such a way as to insure against moisture intrusion. All splices shall be located above the high water line.

3.06 REFERENCE ELECTRODE

- A. The reference electrode shall be suspended vertically from the tank roof as shown in the drawings. The reference electrode wire shall be secured to a porcelain spool insulator with stainless steel clevis type bracket bolted to the interior of the tank roof near the hand-hole.
- B. An access hand-hole in the roof shall be cut into the tank roof for the reference electrode, and an access hole cover provided.
- C. The installer shall coordinate with the coatings contractor, and cut the hand-hole before the tank is coated. After cutting the hole in the roof, burrs and sharp edges of the hole shall be removed by grinding. Care shall be taken to minimize damage to the coating. The cut edges of the roof holes shall be repaired prior to installation of the hand-hole covers.
- D. The reference electrode shall be installed with its tip 3 inches above the floor of the tank.

3.07 3.07 AUTOPOTENTIAL CONTROLLED RECTIFIER

- A. Install a 30A service switch, and route AC conduit with cables to the Reservoir Control Panel.
- B. Route structure (drain) cable and its conduit to the tank chime.
- C. Route conduit for the anode header cable, and for the shielded, dual conductor cable for the control circuit and the reference electrode.
- D. The "IR" drop free, auto-potential controlled rectifier shall be installed as shown in the drawings. The structure cable from the tank shall be connected to the negative terminal, the control cable shall be terminated in the structure terminal of the controller circuit, the reference electrode cable shall be terminated in the reference electrode terminal in the controller circuit and the anode header cable shall be terminated at the positive terminal of the rectifier.

3.08 CABLE-TO-TANK-CHIME CONNECTION

- A. Cable-to-tank-chime connection shall be installed in the manner and at the locations shown on the drawings. Coating materials shall be removed from the pipe surface over an area just sufficient to make the connections. The surface shall be cleaned to white metal by grinding or filing prior to welding the conductor. Grinding with resin-impregnated wheels shall not be allowed. The conductor shall be welded to the pipe by the exothermic process with a copper sleeve fitted over the conductor, and only sufficient insulation shall be removed from the conductor to allow placing in welding mold. After the weld has cooled, all slag shall be removed and the weld shall be tested with a sharp blow from a 22-ounce hammer to assure proper metallurgical bond. All defective welds shall be removed and replaced. All exposed surfaces of copper and steel shall be covered with a minimum thickness of ¼ in. of insulating materials as shown on the drawings. The cable to chime connection shall be tested with a low resistance ohmmeter by the Contractor and approved by the Owner's Engineer prior to acceptance.

3.09 ENERGIZING AND TESTING

- A. After installation of the cathodic protection system, the system shall be energized and tested by the Owner's Engineer to assure conformance with the drawings and specifications and to ensure adequate protection of the tank internals per relevant NACE standards. Any and all deficiencies shall be corrected by the Contractor at no expense to the Owner.

3.10 CLEAN-UP

- A. The Contractor shall be responsible for clean-up and removal of all debris, extra material, and equipment utilized for installation of the cathodic protection system.

END OF SECTION

SECTION 16950

FIELD ELECTRICAL ACCEPTANCE TESTS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Responsibilities for testing the electrical installation.
 - 2. Adjusting and calibration.
 - 3. Acceptance tests.

- B. Related sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 01756 - Commissioning.
 - 3. Section 16050 - Common Work Results for Electrical.
 - 4. Section 16060 - Grounding and Bonding.

- C. Copyright information:
 - 1. Some portions of this Section are copyrighted by the InterNational Electrical Testing Association, Inc. (NETA). See NETA publication ATS for details.

1.02 REFERENCES

- A. As specified in Section 16050.

- B. American National Standards Institute (ANSI).

- C. Institute of Electrical and Electronics Engineers (IEEE):
 - 1. 43 - IEEE Recommended Practice for Testing Insulation Resistance of Rotating Machinery.
 - 2. 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System.
 - 3. 95 - IEEE Recommended Practice for Insulation Testing of AC Electric Machinery (2300 V and Above) With High Direct Voltage.
 - 4. 421.3 - IEEE Standard for High-Potential Test Requirement for Excitation Systems for Synchronous Machines.
 - 5. 450 - IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications.
 - 6. 1106 - IEEE Recommended Practice for Installation, Maintenance, Testing, and Replacement of Vented Nickel-Cadmium Batteries for Stationary Applications.
 - 7. 1188 - IEEE Recommended Practice for Maintenance, Testing, and Replacement of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Applications.
 - 8. C57.13 - IEEE Standard Requirements for Instrument Transformers.
 - 9. C57.13.1 – IEEE Guide for Field Testing of Relaying Current Transformers.

- 10. C57.13.3 - IEEE Guide for Grounding of Instrument Transformer Secondary Circuits and Cases.
 - 11. C57.104 - IEEE Guide for the Interpretation of Gases Generated in Oil-Immersed Transformers.
- D. Insulated Cable Engineer's Association (ICEA).
 - E. InterNational Electrical Testing Association (NETA):
 - 1. ATS-2009 Standard for Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems.
 - F. International Electrotechnical Commission (IEC).
 - G. Manufacturer's testing recommendations and instruction manuals.
 - H. National Fire Protection Association (NFPA):
 - 1. 70 – National Electrical Code (NEC).
 - 2. 110 - Standard for Emergency and Standby Power Systems.
 - I. National Institute of Standards and Technology (NIST).
 - J. Specification sections for the electrical equipment being tested.
 - K. Shop drawings.

1.03 DEFINITIONS

- A. As specified in Sections 01756 and 16050.
- B. Specific definitions:
 - 1. Testing laboratory: The organization performing acceptance tests.

1.04 SYSTEM DESCRIPTION

- A. Testing of all electrical equipment installed under this Contract in accordance with the manufacturer's requirements and as specified in this Section.
- B. Conduct all tests in the presence of the Engineer or the Engineer's representative:
 - 1. Engineer will witness all visual, mechanical and electrical tests, and inspections.
- C. The testing and inspections shall verify that the equipment is operational within the tolerances required and expected by the manufacturer, and these Specifications.
- D. Responsibilities:
 - 1. Contractor responsibilities:
 - a. Ensure that all resources are made available for testing, and that all testing requirements are met.
 - 2. Electrical subcontractor responsibilities:
 - a. Perform routine tests during installation.
 - b. Demonstrate operation of electrical equipment.
 - c. Commission the electrical installation.

- d. Provide the necessary services during testing, and provide these services to the testing laboratory, Contractor, and other subcontractors, including but not limited to:
 - 1) Providing electrical power as required.
 - 2) Operating of electrical equipment in conjunction with testing of other equipment.
 - 3) Activating and shutting down electrical circuits.
 - 4) Making and recording electrical measurements.
 - 5) Replacing blown fuses.
 - 6) Installing temporary jumpers.
 - 3. Testing laboratory responsibilities:
 - a. Perform all acceptance tests specified in this Section.
 - b. Provide all required equipment, materials, labor, and technical support during acceptance tests.
- E. Upon completion of testing or calibration, attach a label to all serviced devices:
- 1. The label shall indicate the date serviced and the company that performed the service.

1.05 SUBMITTALS

- A. Furnish submittals as specified in Sections 01330 and 16050.
- B. Manufacturers' testing procedures:
 - 1. Submit manufacturers' recommended testing procedures and acceptable test results for review by the Engineer.
- C. Test report:
 - 1. Include the following:
 - a. Summary of Project.
 - b. Description of equipment tested.
 - c. Description of tests performed.
 - d. Test results.
 - e. Conclusions and recommendations.
 - f. Completed test forms.
 - g. List of test equipment used and calibration dates.
 - h. LAN cable test reports.
- D. Testing laboratory qualifications:
 - 1. Submit a complete resume and statement of qualifications from the proposed testing laboratory detailing their experiences in performing the tests specified:
 - a. This statement will be used to determine whether the laboratory is acceptable, and shall include:
 - 1) Corporate history and references.
 - 2) Resume of individual performing test.
 - 3) Equipment list and test calibration data.
- E. Division of responsibilities:
 - 1. Submit a list identifying who is responsible for performing each portion of the testing.

1.06 QUALITY ASSURANCE

- A. As specified in Section 16050.
- B. Testing laboratory qualifications:
 - 1. The testing laboratory may be qualified testing personnel from the electrical subcontractor's staff or an independent testing company.
 - 2. Selection of the testing laboratory and testing personnel is subject to approval by the Engineer based on testing experience and certifications of the individuals and testing capabilities of the organization.

1.07 DELIVERY, STORAGE, AND PROTECTION (NOT USED)

1.08 PROJECT OR SITE CONDITIONS

- A. As specified in Section 16050.

1.09 SEQUENCING

- A. At least 30 days before commencement of the acceptance tests, submit the manufacturer's complete field testing procedures to the Engineer and to the testing laboratory, complete with expected test results and tolerances for all equipment to be tested.
- B. Perform testing in the following sequence:
 - 1. Perform routine tests as the equipment is installed including:
 - a. Insulation-resistance tests.
 - b. Continuity tests.
 - c. Rotational tests.
 - 2. Adjusting and preliminary calibration.
 - 3. Acceptance tests.
 - 4. Demonstration.
 - 5. Commissioning and plant start-up.

1.10 SCHEDULING (NOT USED)

1.11 WARRANTY

- A. As specified in Section 16050.

1.12 SYSTEM START-UP (NOT USED)

1.13 OWNER'S INSTRUCTIONS (NOT USED)

1.14 MAINTENANCE (NOT USED)

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION

- A. Test instrument calibration:
 - 1. Utilize a testing laboratory with a calibration program which maintains all applicable test instrumentation within rated accuracy.
 - 2. The accuracy shall be traceable to the NIST in an unbroken chain.
 - 3. Calibrate instruments in accordance with the following frequency schedule:
 - a. Field instruments: 6 months maximum.
 - b. Laboratory instruments: 12 months maximum.
 - c. Leased specialty equipment where the accuracy is guaranteed by the lessor (such as Doble): 12 months maximum.
 - 4. Dated calibration labels shall be visible on all test equipment.
 - 5. Maintain an up-to-date instrument calibration record for each test instrument:
 - a. The records shall show the date and results of each calibration or test.
 - 6. Maintain an up-to-date instrument calibration instruction and procedure for each test instrument.

- B. Do not begin testing until the following conditions have been met:
 - 1. All instruments required are available and in proper operating condition.
 - 2. All required dispensable materials such as solvents, rags, and brushes are available.
 - 3. All equipment handling devices such as cranes, vehicles, chain falls and other lifting equipment are available or scheduled.
 - 4. All instruction books, calibration curves, or other printed material to cover the electrical devices are available.
 - 5. Data sheets to record all test results are available.

3.03 INSTALLATION (NOT USED)

3.04 ERECTION, INSTALLATION, APPLICATION, CONSTRUCTION (NOT USED)

3.05 REPAIR/RESTORATION (NOT USED)

3.06 RE-INSTALLATION (NOT USED)

3.07 COMMISSIONING

- A. As specified in Section 01756.

3.08 FIELD QUALITY CONTROL

- A. Low voltage cables, 600 volt maximum:
 - 1. Visual and mechanical inspection:
 - a. Compare cable data with the Drawings and Specifications.
 - b. Inspect exposed sections of cable for physical damage and correct connection as indicated on the Drawings.
 - c. Inspect bolted electrical connections for high resistance by 1 of the following methods:
 - 1) Use of low-resistance ohmmeter.

- 2) Verify tightness of accessible bolted electrical connections by the calibrated torque wrench method:
 - a) Refer to manufacturer's instructions for proper foot-pound levels or NETA ATS tables.
 - d. Inspect compression applied connectors for correct cable match and indentation.
 - e. Inspect for correct identification and arrangement.
 - f. Inspect cable jacket insulation and condition.
 - 2. Electrical tests:
 - a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter.
 - b. Perform insulation resistance test on each conductor with respect to ground and adjacent conductors:
 - 1) Applied potential shall be 500 volts dc for 300 volt rated cable and 1,000 volts dc for 600 volt rated cable.
 - 2) Test duration shall be 1 minute.
 - c. Perform continuity tests to insure correct cable connection.
 - d. Verify uniform resistance of parallel conductors.
 - 3. Test values:
 - a. Compare bolted connection resistance values to values of similar connections:
 - 1) Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - b. Insulation-resistance values shall be in accordance with manufacturer's published data:
 - 1) Refer to NETA ATS tables in the absence of manufacturer's published data.
 - 2) Investigate values of insulation-resistance less than the allowable minimum.
 - c. Cable shall exhibit continuity.
 - d. Investigate deviations in resistance between parallel conductors.
- B. Low voltage molded case and insulated case circuit breakers:
- 1. Visual and mechanical inspection:
 - a. Compare equipment nameplate data with the Contract Documents.
 - b. Inspect physical and mechanical condition.
 - c. Inspect anchorage and alignment.
 - d. Verify that all maintenance devices are available for servicing and operating the breaker.
 - e. Verify the unit is clean.
 - f. Verify the arc chutes are intact.
 - g. Inspect moving and stationary contacts for condition and alignment.
 - h. Verify that primary and secondary contact wipe and other dimensions vital to satisfactory operation of the breaker are correct.
 - i. Perform all mechanical operator and contact alignment tests on both the breaker and its operating mechanism in accordance with manufacturers published data.
 - j. Operate circuit breaker to ensure smooth operation.

- k. Inspect bolted electrical connections for high resistance by one of the following methods:
 - 1) Use of low-resistance ohmmeter.
 - 2) Verify tightness of accessible bolted electrical connections by the calibrated torque wrench method:
 - a) Refer to manufacturer's instructions for proper foot-pound levels or NETA ATS tables.
 - l. Inspect operating mechanism, contacts, and arc chutes in unsealed units.
 - m. Verify cell fit and element alignment.
 - n. Verify racking mechanism operation.
 - o. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
 - p. Perform adjustments for final protective device settings in accordance with the coordination study.
 - q. Record as-found and as-left operation counter readings.
2. Electrical tests:
- a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter.
 - b. Perform insulation-resistance tests for 1 minute on each pole, phase-to-phase and phase-to-ground with the circuit breaker closed and across each open pole:
 - 1) Apply voltage in accordance with manufacturer's published data.
 - 2) Refer to NETA ATS tables in the absence of manufacturer's published data.
 - c. Perform a contact/pole-resistance test.
 - d. Determine long-time pickup and delay by primary current injection.
 - e. Determine short-time pickup and delay by primary current injection.
 - f. Determine ground-fault pickup and delay by primary current injection.
 - g. Determine instantaneous pickup value by primary current injection.
 - h. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data.
 - i. Verify correct operation of any auxiliary features such as trip and pickup indicators, zone interlocking, electrical close and trip operation, trip-free, anti-pump function and trip unit battery condition:
 - 1) Reset all trip logs and indicators.
 - j. Verify operation of charging mechanism.
3. Test values:
- a. Compare bolted connection resistance values to values of similar connections:
 - 1) Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - b. Bolt-torque levels shall be in accordance with manufacturer's published data:
 - 1) Refer to NETA ATS tables in the absence of manufacturer's published data.
 - c. Insulation-resistance values shall be in accordance with manufacturer's published data:
 - 1) Refer to NETA ATS tables in the absence of manufacturer's published data.
 - 2) Investigate values of insulation-resistance less than the allowable minimum.

- d. Microhm or dc millivolt drop values shall not exceed the high levels of the normal range as indicated in the manufacturer's published data:
 - 1) If manufacturer's data is not available, investigate any values which deviate from adjacent poles or similar breakers by more than 50 percent of the lowest value.
- e. Long-time pickup values shall be as specified, and the trip characteristic shall not exceed manufacturer's published time-current characteristic tolerance band including adjustment factors:
 - 1) If manufacturer's curves are not available, trip times shall not exceed the value shown in NETA ATS tables.
- f. Short-time pickup values shall be as specified, and the trip characteristic shall not exceed manufacturer's published time-current tolerance band.
- g. Ground fault pickup values shall be as specified, and the trip characteristic shall not exceed manufacturer's published time-current tolerance band.
- h. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances:
 - 1) Refer to NETA ATS tables in the absence of manufacturer's published data.
- i. Pickup values and trip characteristics shall be within manufacturer's published tolerances.
- j. Minimum pickup voltage of the shunt trip and close coils shall conform to the manufacturer's published data:
 - 1) Refer to NETA ATS tables in the absence of manufacturer's published data.
- k. Breaker open, close, trip, trip-free, anti-pump, and auxiliary features shall function as designed.
- l. The charging mechanism shall operate in accordance with manufacturer's published data.

C. Grounding systems:

- 1. Visual and mechanical inspection:
 - a. Inspect ground system for compliance with that indicated on the Drawings, specified in Specifications, and in the NEC.
 - b. Inspect physical and mechanical condition.
 - c. Inspect bolted electrical connections for high resistance using one of the following methods:
 - 1) Use of low-resistance ohmmeter.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque wrench method:
 - a) Refer to manufacturer's instructions for proper foot-pound levels or NETA ATS tables.
 - d. Inspect anchorage.
- 2. Electrical tests:
 - a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter.
 - b. Perform fall of potential test or alternative test in accordance with IEEE 81 on the main grounding electrode or system.
 - c. Perform point-to-point tests to determine the resistance between the main grounding system and all major electrical equipment frames, the system neutral and any derived neutral points.

3. Test values:
 - a. Grounding system electrical and mechanical connections shall be free of corrosion.
 - b. Compare bolted connection resistance values to values of similar connections:
 - 1) Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - c. Bolt-torque levels shall be in accordance with manufacturer's published data:
 - 1) Refer to NETA ATS tables in the absence of manufacturer's published data.
 - d. The resistance between the main grounding electrode and ground shall be as specified in Section 16060. Investigate point-to-point resistance values that exceed 0.5 ohm.

D. Rotating machinery:

1. Visual and mechanical inspection:
 - a. Compare equipment nameplate information with the Contract Documents.
 - b. Inspect physical and mechanical condition.
 - c. Inspect anchorage, alignment, and grounding.
 - d. Inspect air baffles, filter media, cooling fans, slip rings, brushes, brush rigging, and shaft current discharge devices.
 - e. Inspect bolted electrical connections for high resistance using one of the following methods:
 - 1) Use of low-resistance ohmmeter.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque wrench method:
 - a) Refer to manufacturer's instructions for proper foot-pound levels or NETA ATS tables.
 - f. Perform special tests such as gap spacing and machine alignment if applicable.
 - g. Manually rotate the rotor and check for problems with the bearings or shaft.
 - h. Rotate the shaft and measure and record the shaft extension runout.
 - i. Verify correct application of appropriate lubrication and lubrication systems.
2. Electrical tests:
 - a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter.
 - b. Perform insulation-resistance test in accordance with IEEE 43:
 - 1) On motors 200 horsepower and smaller, test duration shall be 1 minute. Calculate dielectric absorption ratio.
 - 2) On motors larger than 200 horsepower, test duration shall be 10 minutes. Calculate polarization index.
 - c. Perform dc dielectric withstand voltage tests on machines rated at 2,300 volts and greater in accordance with IEEE 95:
 - 1) IEEE 95 for dc dielectric withstand voltage tests.
 - 2) NEMA MG1 for ac dielectric withstand voltage tests.
 - d. Perform phase-to-phase stator resistance test on machines rated at 2,300 volts and greater.
 - e. Perform insulation-resistance test on insulated bearings in accordance with manufacturer's published data.

- f. Test surge protection devices as specified in this Section.
 - g. Test motor starter as specified in this Section.
 - h. Perform resistance tests on resistance temperature detector (RTD) circuits.
 - i. Verify operation of motor space heater.
 - j. Perform a rotation test to ensure correct shaft rotation.
 - k. Measure running current and evaluate relative to load conditions and nameplate full-load amperes.
3. Test values:
- a. Inspection:
 - 1) Air baffles shall be clean and installed in accordance with the manufacturer's published data.
 - 2) Filter media shall be clean and installed in accordance with the manufacturer's published data.
 - 3) Cooling fans shall operate.
 - 4) Slip ring alignment shall be within manufacturer's published tolerances.
 - 5) Brush alignment shall be within manufacturer's published tolerances.
 - 6) Brush rigging shall be within manufacturer's published tolerances.
 - b. Compare bolted connection resistance values to values of similar connections:
 - 1) Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - c. Bolt-torque levels shall be in accordance with manufacturer's published data:
 - 1) Refer to NETA ATS tables in the absence of manufacturer's published data.
 - d. Air-gap spacing and machine alignment shall be in accordance with manufacturer's published data.
 - e. The recommended minimum insulation-resistance ($IR_{1 \text{ min}}$) test results in megohms shall be as specified in this Section:
 - 1) The polarization index value shall not be less than 2.0.
 - 2) The dielectric absorption ratio shall not be less than 1.4.
 - f. If no evidence of distress or insulation failure is observed by the end of the total time of voltage application during the dielectric withstand test, the test specimen is considered to have passed the test.
 - g. Investigate phase-to-phase stator resistance values that deviate by more than 10 percent.
 - h. Power factor or dissipation factor values shall be compared to manufacturer's published data:
 - 1) In the absence of manufacturer's published data compare values of similar machines.
 - i. Tip-up values shall indicate no significant increase in power factor.
 - j. If no evidence of distress, insulation failure, or waveform nesting is observed by the end of the total time of voltage application during the surge comparison test, the test specimen is considered to have passed the test.
 - k. Bearing insulation-resistance measurements shall be within manufacturer's published tolerances:
 - 1) In the absence of manufacturer's published data compare values of similar machines.

- l. Test results of surge protection devices shall be as specified in this Section.
 - m. Test results of motor starter equipment shall be as specified in this Section.
 - n. Heaters shall be operational.
 - o. Vibration amplitudes shall not exceed values in NETA ATS tables:
 - 1) If values exceed those in the NETA ATS tables, perform a complete vibration analysis.
 - p. Machine rotation should match required rotation of connected load.
 - q. Running phase-to-phase voltages should be within 1.0 percent. Running currents shall be balanced and proportional to load condition and nameplate data.
- E. Motor starters, low voltage:
- 1. Visual and mechanical inspection:
 - a. Compare equipment nameplate information with the Contract Documents.
 - b. Inspect physical and mechanical condition.
 - c. Inspect anchorage, alignment, and grounding.
 - d. Verify the unit is clean.
 - e. Inspect contactors:
 - 1) Verify mechanical operation.
 - 2) Verify contact gap, wipe, alignment, and pressure are in accordance with manufacturer's published data.
 - f. Motor-running protection:
 - 1) Verify overload element rating is correct for its application.
 - 2) If motor running protection is provided by fuses, verify correct fuse rating.
 - g. Inspect bolted electrical connections for high resistance using one of the following methods:
 - 1) Use of low-resistance ohmmeter.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque wrench method:
 - a) Refer to manufacturer's instructions for proper foot-pound levels or NETA ATS tables.
 - h. Lubrication requirements:
 - 1) Verify appropriate lubrication on moving current-carrying parts.
 - 2) Verify appropriate lubrication on moving and sliding surfaces.
 - 2. Electrical tests:
 - a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter.
 - b. Perform insulation-resistance tests for 1 minute on each pole, phase-to-phase and phase to ground with the starter closed, and across each open pole for 1 minute:
 - 1) Test voltage shall be in accordance with manufacturer's published data.
 - 2) Refer to NETA ATS tables in the absence of manufacturer's published data.
 - c. Test motor protection devices in accordance with manufacturer's published data.
 - d. Test circuit breakers as specified in this Section.
 - e. Perform operational tests by initiating control devices.

3. Test values:
 - a. Compare bolted connection resistance values to values of similar connections:
 - 1) Investigate values which deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - b. Bolt-torque levels shall be in accordance with manufacturer's published data:
 - 1) Refer to NETA ATS tables in the absence of manufacturer's published data.
 - c. Insulation-resistance values shall be in accordance with manufacturer's published data:
 - 1) Refer to NETA ATS tables in the absence of manufacturer's published data.
 - 2) Investigate values of insulation-resistance less than the allowable minimum.
 - d. Motor protection parameters shall be in accordance with manufacturer's published data.
 - e. Circuit breaker test results shall as specified in this Section.
 - f. Control devices shall perform in accordance with system design requirements.

3.09 ADJUSTING (NOT USED)

3.10 CLEANING

- A. As specified in Section 16050.
- B. After the acceptance tests have been completed, dispose of all testing expendables, vacuum all cabinets, and sweep clean all surrounding areas.

3.11 PROTECTION

- A. As specified in Section 16050.

3.12 SCHEDULES (NOT USED)

END OF SECTION

SECTION 17050

COMMON WORK RESULTS FOR PROCESS CONTROL AND INSTRUMENTATION SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. General requirements applicable to all Process Control and Instrumentation Work.
 - 2. General requirements for process control and instrumentation submittals.

- B. Related sections:
 - 1. Document 00700 - General Conditions.
 - 2. Document 00800 - Supplementary Conditions.
 - 3. Section 01110 - Summary of Work.
 - 4. Section 01140 - Work Restrictions.
 - 5. Section 01292 - Schedule of Values.
 - 6. Section 01312 - Project Meetings.
 - 7. Section 01324A - Progress Schedules and Reports.
 - 8. Section 01329 - Safety Plan.
 - 9. Section 01330 - Submittal Procedures.
 - 10. Section 01410 - Regulatory Requirements.
 - 11. Section 01450 - Quality Control.
 - 12. Section 01600 - Product Requirements.
 - 13. Section 01612 - Seismic Design Criteria.
 - 14. Section 01614 - Wind Design Criteria.
 - 15. Section 01756 - Testing, Training and Facility Start Up.
 - 16. Section 01770 - Closeout Procedures.
 - 17. Section 01782 - Operation and Maintenance Data.
 - 18. Section 16050 - Common Work Results for Electrical.
 - 19. Section 16075 - Identification for Electrical Systems.
 - 20. Section 17100 - Control Strategies.
 - 21. Section 17101 - Specific Control Strategies.
 - 22. Section 17950 - Testing, Calibration, and Commissioning.

- C. Interfaces to equipment, instruments, and other components:
 - 1. Drawings, Specifications, and overall design are based on preliminary information furnished by various equipment manufacturers, which identify a minimum scope of supply from the manufacturers. This information pertains to, but is not limited to, instruments, control devices, electrical equipment, packaged mechanical systems, and control equipment provided with mechanical systems.
 - 2. Provide all material and labor needed to install the actual equipment furnished, include all costs to add any additional instruments, wiring, control system inputs/outputs, controls, interlocks, electrical hardware etc., which may be

- necessary to make a complete, functional installation based on the actual equipment furnished:
- a. Make all changes necessary to meet the manufacturer's wiring requirements.
 3. Submit all such changes and additions to the Engineer for acceptance as specified in Document 00700.
 4. Review the complete set of Drawings and Specifications in order to ensure that all items related to the instrumentation and control systems are completely accounted for. Include any items indicated on the Drawings or in Specifications from another discipline in the scope of Work:
 - a. If a conflict between Drawings and Specifications is discovered, refer conflict to the Engineer as soon as possible for resolution.
 5. Loop drawings:
 - a. Provide complete loop drawings for all systems.
 - b. The Owner and Engineer are not responsible for providing detailed loop diagrams for Contractor furnished equipment.
- D. All instrumentation, and control equipment and systems for the entire project to comply with the requirements specified in the Instrumentation and Control Specifications, whether referenced in the individual Equipment Specifications or not:
1. The Owner is not responsible for any additional costs due to the failure of the Contractor to notify all subcontractors and suppliers of the Instrumentation and Control Specifications' requirements.
- E. Contract Documents:
1. General:
 - a. The drawings and specifications are complementary and are to be used together in order to fully describe the Work.
 2. Specifications:
 - a. Documents 00700 and 00800 of the Contract Documents govern the Work.
 - b. These requirements are in addition to all General Requirements.
 3. Contract drawings:
 - a. The Instrumentation and Control Drawings show in a diagrammatic manner, the desired locations, and arrangements of the components of the Instrumentation Work. Follow the drawings as closely as possible, use professional judgment and coordinate with the other trades to secure the best possible installation, use the entire drawing set for construction purposes.
 - b. Locations of equipment is approximate only, exercise professional judgment in executing the Work to ensure the best possible installation:
 - 1) The equipment locations and dimensions indicated on the Drawings and elevations are approximate. Use the shop drawings to determine the proper layout. Coordinate with all subcontractors to ensure that all instrumentation and control equipment is compatible with other equipment and space requirements. Make changes required to accommodate differences in equipment dimensions.
 - c. Installation details:
 - 1) The Contract Drawings include installation details showing means and methods for installing instrumentation and control equipment. For cases where typical details are not provided or compatible with an installed location, develop installation details that are necessary

for completing the Work, and submit these details for review by the Engineer.

- d. Schematic diagrams:
 - 1) All controls are shown de-energized.
 - 2) Schematic diagrams show control function only. Incorporate other necessary functions for proper operation and protection of the system.
 - 3) Add slave relays, where required, to provide all necessary contacts for the control system or where needed to function as interposing relays for control voltage coordination, equipment coordination, or control system voltage drop considerations.
 - 4) Mount all devices shown on motor controller schematic diagrams in the controller compartment enclosure, unless otherwise noted or indicated.
 - 5) Control schematics are to be used as a guide in conjunction with the descriptive operating sequences indicated on the Drawings or in the Specifications. Combine all information and furnish a coordinated and fully functional control system.

F. Alternates/Alternatives:

- 1. Substitute item provisions as specified in Document 00700.

G. Changes and change orders:

- 1. As specified in Document 00700.

1.02 REFERENCES

A. Code compliance:

- 1. As specified in Section 01410:
 - a. The publications are referred to in the text by basic designation only. The latest edition accepted by the Authority Having Jurisdiction of referenced publications in effect at the time of Bid governs.
- 2. The following codes and standards are hereby incorporated into this Section:
 - a. American National Standards Institute (ANSI).
 - b. American Petroleum Institute (API):
 - 1) RP 550 - Manual on Installation of Refinery Instruments and Control Systems; Part II-Process Stream Analyzers; Section 5-Oxygen Analyzers.
 - 2) RP 551 - Process Measurement Instrumentation.
 - c. International Organization for Standardization (ISO):
 - 1) 9001 - Quality Management Systems - Requirements.
 - d. International Society of Automation (ISA):
 - 1) 5.1 - Instrumentation Symbols and Identification.
 - 2) 5.4 - Instrument Loop Diagrams.
 - 3) 20 - Specification Forms for Process Measurement and Control Instruments, Primary Elements, and Control Valves.
 - e. National Electrical Manufacturers Association (NEMA):
 - 1) 250 - Enclosures for Electrical Equipment (1000 V Maximum).
 - f. National Fire Protection Association (NFPA).
 - g. National Institute of Standards and Technology (NIST).

- h. Underwriters Laboratories, Inc. (UL):
 - 1) 508 - Standard of Safety for Industrial Control Equipment.
 - 2) 508A - Standard of Safety for Industrial Control Panels.

- B. Compliance with Laws and Regulations:
 - 1. As specified in Document 00700.

1.03 DEFINITIONS

- A. Definitions of terms and other electrical and instrumentation considerations in accordance with:
 - 1. Factory Mutual (FM).
 - 2. International Electrotechnical Commission (IEC).
 - 3. Institute of Electrical and Electronics Engineers (IEEE).
 - 4. International Society of Automation (ISA).
 - 5. International Organization for Standardization (ISO).
 - 6. National Electrical Code (NEC).
 - 7. National Electrical Manufacturers Association (NEMA).
 - 8. InterNational Electrical Testing Association (NETA).
 - 9. National Fire Protection Association (NFPA).
 - 10. National Institute of Standards and Technology (NIST).
 - 11. Underwriters Laboratories (UL).
- B. Specific definitions:
 - 1. Control circuit: Any circuit operating at 120 volts alternating current (VAC) or direct current (VDC) or less, whose principal purpose is the conveyance of information (including performing logic) and not the conveyance of energy for the operation of an electrically powered device.
 - 2. Panel: An instrument support system that may be a flat surface, a partial enclosure, or a complete enclosure for instruments and other devices used in process control systems.
 - 3. Power circuit: Any circuit operating at 90 volts (AC or DC) or more, whose principal purpose is the conveyance of energy for the operation of an electrically powered device.
 - 4. Signal circuit: Any circuit operating at less than 50 VAC or VDC, which conveys analog information or digital communications information.
 - 5. 2-Wire transmitter (loop powered): A transmitter that derives its operating power supply from the signal transmission circuit and requires no separate power supply connections. As used in this Section, 2-wire transmitter refers to a transmitter that provides a signal such as 4 to 20 mA 24VDC regulation of a signal in a series circuit with an external 24 VDC driving potential:
 - a. Fieldbus communications signal or both.
 - 6. Powered transmitters: A transmitter that requires a separate power source (120 VAC, 240 VAC, etc.) in order for the transmitter to develop its signal. As used in this Section, the produced signal may be a 4 to 20 mA 24VDC signal, a digital bus communications signal, or both.
 - 7. Modifications: Changing, extending, interfacing to, removing, or altering an existing circuit.
- C. Acronym definitions:
 - 1. CCS: The PCS central computer system (CCS) consisting of computers and software. The personal computer-based hardware and software system that

- includes the operator interface, data storage, data retrieval, archiving, alarming, historian, reports, trending, and other higher level control system software and functions.
2. DPDT: Double-pole, double-throw.
 3. ES: Enterprise system: Computer based communications or data sharing system utilized for non-process control functions such as E-mail, sharing files, creating documents, etc.
 4. FAT: Factory acceptance test also known as Source Test.
 5. HART: Highway addressable remote transducer.
 6. HOA: Hand-Off-Auto control function that is totally PLC based. In the Hand mode, equipment is started or stopped, valves are opened or closed through operator direction under the control of the PLC software. In the Auto mode, equipment is started or stopped and valves are opened or closed through a control algorithm within the PLC software. In the Off mode, the equipment is prohibited from responding from the PLC control.
 7. HMI: Human machine interface is a software application that presents information to an operator or user about the state of a process, and to accept and implement the operators control instructions. Typically information is displayed in a graphical format.
 8. ICSC: Instrumentation and control system contractor: Subcontractor who specializes in the design, construction, fabrication, software development, installation, testing, and commissioning of industrial instrumentation and control systems.
 9. IJB: Instrument junction boxes: A panel designed with cord sets to easily remove, replace, or relocate instrument signals.
 10. I/O: Input/Output.
 11. IP: Internet protocol or ingress protection.
 12. LCP: Local control panel: Operator interface panel that may contain an HMI, pilot type control devices, operator interface devices, control relays, etc. and does not contain a PLC or RIO.
 13. LAN: Local area network: A control or communications network that is limited to the physical boundaries of the facility.
 14. LOI: Local Operator Interface is an operator interface device consisting of an alphanumeric or graphic display with operator input functionality. The LOI is typically a flat panel type of display mounted on the front of an enclosure with either a touch screen or tactile button interface.
 15. LOR: Local-Off-Remote control function. In the Remote mode, equipment is started or stopped, and valves are opened or closed through the PLC based upon the selection of the HOA. In the Local mode, equipment is started or stopped, valves are opened or closed based upon hardwired control circuits completely independent of the PLC with minimum interlocks and permissive conditions. In the Off mode, the equipment is prohibited from responding to any control commands.
 16. NJB: Network junction box. An enclosure that contains multiple access points to various networks within the facility. Networks could be Ethernet, Ethernet/IP, Fieldbus, RIO, etc.
 17. P&ID: Process and instrumentation diagram.
 18. PC: Personal computer.
 19. PCIS: Process control and instrumentation system: Includes the entire instrumentation system, the entire control system, and all of the Work specified in the Instrumentation and Control Specifications and depicted on the Instrumentation Drawings. This includes all the PCS and instruments and

- networking components as well as the various servers, workstations, thin clients, etc.
20. PCM: Process control module: An enclosure containing any of the following devices: PLC, RTU, or RIO.
 21. PCS: Process Control System: A general name for the computerized system that gathers and processes data from equipment and sensors and applies operational controls to the process equipment. It includes the PLCs and/or RIOs, LOIs, HMIs, both LCPs, VCPs and all data management systems accessible to staff.
 22. PJB: Power junction box: An enclosure with terminal blocks that distribute power to multiple instruments.
 23. PLC: Programmable logic controller.
 24. RIO: Remote I/O device for the PLC consisting of remote I/O racks, or remote I/O blocks.
 25. RTU: Remote telemetry unit: A controller typically consisting of a PLC, and a means for remote communications. The remote communications devices typically are radios, modems, etc.
 26. SCADA: Supervisory control and data acquisition system: A general name for the computerized system that gathers and processes data from sensors and equipment located outside of the facility, such as wells, lift stations, metering stations, etc.
 27. SPDT: Single-pole, double-throw.
 28. SPST: Single-pole, single-throw.
 29. UPS: Uninterruptible power supply.
 30. VCP: Vendor control panel: Control panels that are furnished with particular equipment by a vendor other than the ICSC. These panels may contain PLCs, RIO, LOI, HMI, etc.
 31. WAN: Wide area network: A control or communications network that extends beyond the physical boundaries of the facility.

1.04 SYSTEM DESCRIPTION

- A. General requirements:
 1. The Work includes everything necessary for and incidental to executing and completing the instrumentation and control system work indicated on the Drawings and specified in the Specifications and reasonably inferable there from including but not limited to:
 - a. Preparing hardware submittals for field instrumentation.
 - b. Design, develop, and draft loop drawings, and all other drawing submittals specified in the Instrumentation and Control Specifications.
 - c. Prepare the test plan, the training plan, and the spare parts submittals.
 - d. Procure all hardware.
 - e. Perform bench calibration and verify calibration after installation.
 - f. Oversee, document, and certify loop testing.
 - g. Oversee, document, and certify system.
 - h. Installation Testing.
 - i. Oversee and document Functional Testing.
 - j. Conduct the Process Operational Period and the Instrumentation and Controls Process Performance Testing.
 - k. Prepare operation and maintenance manuals.
 - l. Conduct training classes.

- m. Provide Record Drawings and Loop Drawings associated with Instruments and equipment:
 - 1) As specified in the Contract Documents.
 - 2) For interfaces with existing equipment.
 - n. Resolve signal, power, or functional incompatibilities between the PCS and interfacing devices.
 - o. Perform all required corrective and preventative maintenance.
 - 2. It is the intent of these Specifications that the entire electrical power, instrumentation, and control system for the potable water pump be complete and operable. Provide all necessary material and labor for the complete system from source of power to final utilization equipment, including all connections, testing, calibration of all equipment furnished by others, as well as equipment furnished by the Contractor, whether or not specifically mentioned but which are necessary for successful operation.
 - 3. Coordinate all aspects of the Work between Contractor and all subcontractors before bidding to ensure that all costs associated with a complete installation are included. The Owner is not responsible for any change orders due to lack of coordination of the Work between the Contractor, the ICSC, the other subcontractors, or suppliers.
 - 4. Furnish detailed, complete, and thorough operations and maintenance documentation, including but not limited to operations manuals, maintenance manuals, as-built wiring drawings, training manuals, as-built software documentation, and all other documentation required to operate, modify, and maintain all parts of the PCS.
 - 5. Portions of this Project involve installation in existing facilities and interfaces to existing circuits, power systems, controls, and equipment:
 - a. Perform and document comprehensive and detailed field investigations of existing conditions (circuits, power systems, controls, equipment, etc.) before performing any Work.
 - b. Provide and document interface with, modifications to, upgrade, or replacement of existing circuits, power systems, controls, and equipment.
 - 6. Revise in a manner as directed by the Engineer all I/O and addressing that the Engineer determines to be unacceptable as a result of a lack of Contractor coordination between Contract Documents and all suppliers.
 - 7. Defective Work:
 - a. As specified in Document 00700.
- B. Existing system:
 - 1. Modify the existing RTU and SCADA software to provide the required functionality for the new recycled water reservoir.
- C. New system:
 - 1. Instruments and controls for monitoring the recycled water reservoir and potable water pump.
- D. Operating facility:
 - 1. As specified in Section 01140.

2. Portions of this existing facility must remain fully functional throughout the entire construction period. In consideration of this requirement, comply with the following guidelines:
 - a. All outages must be of minimal duration and fully coordinated and agreed to by the Owner. Adjust the construction to meet the requirements of the Owner.
 - b. As weather and facility demand conditions dictate, re-adjust the construction schedule to meet the demands placed upon Owner by its users.
 - c. Where portions of the Work are in existing facilities and require interface to existing circuits, power systems, controls and equipment, perform comprehensive and detailed field investigations of existing conditions. Determine all information necessary to document, interface with, modify, upgrade, or replace existing circuits, power systems, controls, and equipment.
3. The Contractor is responsible for the integrity and measurement accuracy of all loops.

1.05 SUBMITTALS

- A. Furnish submittals as specified in Section 01330 and this Section.
- B. General:
 1. Instruct all equipment suppliers of submittals and operation and maintenance manuals of the requirements in this Section.
 2. Furnish the submittals required by each section in the Instrumentation Specifications.
 3. Adhere to the wiring numbering scheme specified in Section 16075 throughout the Project:
 - a. Uniquely number each wire.
 - b. Wire numbers must appear on all Equipment Drawings.
 4. Use equipment and instrument tags, as indicated on the Drawings, for all submittals.
- C. Submittal preparation:
 1. In these Contract Documents, some items of Work are represented schematically, and are designated for the most part by numbers, as derived from criteria in ISA-5.1:
 - a. Employ the nomenclature and numbers designated in this Section and indicated on the Drawings exclusively throughout shop drawings, data sheets, and similar submittals.
 - b. Replace any other symbols, designations, and nomenclature unique to a manufacturer's, suppliers, or subcontractor's standard methods with those identified in this Section and indicated on the Drawings.
- D. Specific submittal requirements:
 1. Shop drawings:
 - a. Required for materials and equipment listed in this and other sections.
 - b. Furnish sufficient information to evaluate the suitability of the proposed material or equipment for the intended use, and for compliance with these Specifications.

- c. Shop drawings requirements:
 - 1) Locations of conduit entrances.
 - 2) Component layout and identification.
 - 3) Schematic and wiring diagrams with wire numbers and terminal identification.
 - 4) Connection diagrams, terminal diagrams, internal wiring diagrams, conductor size, etc.
 - 5) Nameplates:
 - a) As specified in Section 16075 or as indicated on the Drawings.
 - 6) Temperature limitations, as applicable.
 - d. Use equipment and instrument tags as depicted on the P&IDs for all submittals.
 - e. Adhere to wiring numbering scheme outlined in Section 16075 throughout the Project:
 - 1) Uniquely number each wire per the Specifications.
 - f. Wire numbers must appear on all equipment drawings.
 - g. Organize the shop drawing submittals for inclusion in the Operation and Maintenance Manuals.
 - h. Include the letterhead and/or title block of the firm responsible for the preparation of all shop drawings. Include the following information in the title block, as a minimum:
 - 1) The firm's registered business name.
 - 2) Firm's physical address, email address, and phone number.
 - 3) Owner's name.
 - 4) Project name and location.
 - 5) Drawing name.
 - 6) Revision level.
 - 7) Personnel responsible for the content of the drawing.
 - 8) Date.
 - i. The work includes modifications to existing circuits:
 - 1) Clearly show all modifications to existing circuits.
 - 2) In addition, show all existing unmodified wiring to clearly depict the functionality and electrical characteristics of the complete modified circuits.
2. Product data:
- a. Submitted for non-custom manufactured material listed in this and other sections and shown on shop drawings.
 - b. Include:
 - 1) Catalog cuts.
 - 2) Bulletins.
 - 3) Brochures.
 - 4) Quality photocopies of applicable pages from these documents.
 - 5) Identify on the data sheets the Project name, applicable specification section, and paragraph.
 - 6) Identify model number and options for the actual equipment being furnished.
 - 7) Neatly cross out options that do not apply or equipment not intended to be supplied.
 - c. Use equipment and instrument tags as depicted on the P&IDs for all submittals.

3. Operation and maintenance manuals:
 - a. As specified in Section 01782.
 - b. Operational Manual:
 - 1) Prepare and provide a simplified version of the standard manufacturer's HMI software and system operations manual that includes basic instructions in the application of the system as required for operators in day-to-day operations.
 - c. Organize the operation and maintenance manuals for each process in the following manner:
 - 1) Section A - Process and Instrumentation Diagrams.
 - 2) Section B - Control Descriptions.
 - 3) Section C - Loop Drawings.
 - 4) Section D - Instrument Summary.
 - 5) Section E - Instrument Data Sheets and Brochures.
 - 6) Section F - Sizing Calculations.
 - 7) Section G - Instrumentation Installation Details.
 - 8) Section H - Test Results.
 - 9) Section I - Operational Manual.
 - 10) Section J - Spare Parts List.
4. Material and equipment schedules:
 - a. Furnish a complete schedule and/or matrix of all materials, equipment, and apparatus that are proposed for use:
 - 1) Include sizes, names of manufacturers, catalog numbers, and such other information required to identify the items.
5. Itemized instrument summary:
 - a. Submit a hard copy of the instrument summary.
 - b. List all of the key attributes of each instrument including:
 - 1) Tag number.
 - 2) Manufacturer.
 - 3) Model number.
 - 4) Service.
 - 5) Area location.
 - 6) Calibrated range.
 - 7) Loop drawing number.
6. Instrument data sheets and cut sheets:
 - a. Furnish fully completed data sheets, both electronically in Microsoft Word or Excel and in hard copy, for each instrument and component according to ISA-20 Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves. The data sheets provided with the instrument specifications are preliminary and are not complete. They are provided to assist with the completion of final instrument data sheets. Additional data sheets may be required. Include the following information on the data sheet:
 - 1) Component functional description specified in this Section and indicated on the Drawings.
 - 2) Manufacturers model number or other product designation.
 - 3) Tag number specified in this Section and indicated on the Drawings.
 - 4) System or loop of which the component is a part.
 - 5) Location or assembly at which the component is to be installed.
 - 6) Input and output characteristics.
 - 7) Scale range with units and multiplier.

- 8) Requirements for electric supply.
- 9) Requirements for air supply.
- 10) Power consumption.
- 11) Response timing.
- 12) Materials of construction and of component parts that are in contact with, or otherwise exposed to, process media, and or corrosive ambient air.
- 13) Special requirements or features, such as specifications for ambient operating conditions.
- 14) Features and options that are furnished.
- b. Provide a technical brochure or bulletin ("cut sheet") for each instrument on the project. Submit with the corresponding data sheets:
 - 1) Include a list of tag numbers for which it applies with each brochure or bulletin.
 - 2) Furnish technical product brochures that are complete enough to verify conformance with all Contract Document requirements, and to reflect only those features supplied with the device.
 - 3) Cross out models, features, options, or accessories that are not being provided.
 - 4) Clearly mark and identify special options and features.
- c. Organization: Index the data sheets and brochures in the submittal by systems or loops.
7. Installation recommendations:
 - a. Submit the manufacturer's printed recommendations for installation of instrumentation equipment.
8. Project Record documents:
 - a. Furnish as specified in Section 01770.
 - b. Record Drawing requirements:
 - 1) Provide Project Record Drawing of all Instrumentation Drawings.
 - 2) Update Record Drawings weekly.
 - 3) Record Drawings must be fully updated as a condition of the monthly progress payments.
 - 4) Clearly and neatly show all changes including the following:
 - a) All existing pipe, conduit, wire, instruments or other structures encountered or uncovered during construction.
9. Loop Drawings:
 - a. Submit loop drawings for every analog, discrete, and control circuit:
 - 1) Provide a loop drawing submittal that completely defines and documents the contents of each monitoring, alarming, interlock, and control loop on this Project.
 - 2) Provide loop drawings in the format indicated in the contract drawings. Provide all tagging in accordance with the Owner's standard.
 - b. Show every instrument and I/O point on at least one loop diagram.
 - c. Provide a complete index in the front of each bound volume:
 - 1) Index the loop drawings by systems or process areas.
 - d. Provide drawings showing definitive diagrams for every instrumentation loop system:
 - 1) Show and identify each component of each loop or system using requirements and symbols from ISA-5.4.
 - 2) Furnish a separate drawing sheet for each system or loop diagram.

- e. In addition to the ISA-5.4 requirements, show the following details:
 - 1) Functional name of each loop.
 - 2) Reference name, drawing, and loop diagram numbers for any signal continuing off the loop diagram sheet.
 - 3) Show all terminal numbers, regardless of the entity providing the equipment.
 - 4) MCC panel, circuit, and breaker numbers for all power feeds to the loops and instrumentation.
 - 5) Designation of and, if appropriate, terminal assignments associated with, every manhole, pull-box, junction box, conduit, and panel through which the loop circuits pass.
 - 6) Show, conduit, junction box, equipment and PCS terminations, termination identification, wire numbers and colors, power circuits, and ground identifications.
 - 7) If a circuit is continued on another drawing, show the name and number of the continuation drawing on the loop drawing. Provide complete references to all continuation drawings whether vendor control panels, other loop drawings, existing drawings provided by the Owner, or other drawings.
 - f. In addition to the above requirements, provide loop diagrams in accordance with the example loop diagram as indicated on the Drawings.
10. Instrument Installation Drawings:
- a. Submit, instrument installation, mounting, and anchoring details for all components and assemblies, including access requirements and conduit connection or entry details.
 - b. Furnish for each instrument a dedicated 8 1/2-inch by 11-inch installation detail that pertains to the specific instrument by tag number.
 - c. For each detail, provide certification and the hard copies, by the instrument manufacturer, that the proposed installation is in accordance with the instrument manufacturer's recommendations and is fully warrantable.
 - d. For each detail, provide, as a minimum, the following contents:
 - 1) Necessary sections and elevation views required to define instrument location by referencing tank, building or equipment names and numbers, and geographical qualities such as north, south, east, west, basement, first floor, etc.
 - 2) Ambient temperature and humidity where the instrument is to be installed.
 - 3) Corrosive qualities of the environment where the instrument is to be installed.
 - 4) Hazardous rating of the environment where the instrument is to be installed.
 - 5) Process line pipe or tank size, service and material.
 - 6) Process tap elevation and location.
 - 7) Upstream and downstream straight pipe lengths between instrument installation and pipe fittings and valves.
 - 8) Routing of tubing and identification of supports.
 - 9) Mounting brackets, stands, anchoring devices, and sun shades.
 - 10) Conduit entry size, number, location, and delineation between power and signal.
 - 11) NEMA ratings of enclosures and all components.

- 12) Clearances required for instrument servicing.
 - 13) List itemizing all manufacturer makes, model numbers, quantities, lengths required, and materials of each item required to support the implementation of the detail.
11. Control Descriptions:
 - a. For each control loop, provide a detailed functional description of the operation of the equipment, signals, and controls as shown on the P&IDs:
 - 1) Include all functions depicted or described in the Contract Documents.
 - 2) Include within the Control Description content:
 - a) All specific requirements.
 - b) All common requirements that pertain in general to all loops.
 - c) Listing all ranges, setpoints, timers, values, counter values, etc.
 12. Test Procedure Submittals:
 - a. Submit the proposed procedures to be followed during tests of the PCS and its components in 2 parts:
 - 1) Preliminary Submittal: Outline of the specific proposed tests and examples of proposed forms and checklists.
 - 2) Detailed Submittal: After successful review of the Preliminary Submittal, submit the proposed detailed test procedures, forms, and checklists. Include a statement of test objectives with the test procedures.
 13. Test reports:
 - a. As specified in Section 01330.

1.06 QUALITY ASSURANCE

- A. Manufacture instruments at facilities certified to the quality standards of ISO 9001.
- B. Furnish all equipment listed by and bearing the label of UL or of an independent testing laboratory acceptable to the Engineer and the Authority Having Jurisdiction.
- C. ICSC:
 1. The Contractor, through the use of a qualified ICSC, is responsible for the implementation of the PCIS and the integration of the system with other required instrumentation, control devices, and software.
 2. The ICSC assumes full responsibility, through the Contractor, to perform all work to select, furnish, install, [program], test, calibrate, and place into operation all instrumentation including application software, for a complete, integrated and functional PCIS system.
 3. Due to the complexities associated with the interfacing of numerous control system devices, it is the intent of these Specifications that the ICSC be responsible for the integration of the PCIS with existing devices and devices provided under the Contract Documents with the objective of providing a completely integrated control system.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. As specified in Section 01600.
- B. Special instructions:
 1. Securely attach special instructions for proper field handling, storage, and installation to each piece of equipment before packaging and shipment.

- C. Tagging:
 - 1. Tag each component and/or instrument to identify its location, instrument tag number, and function in the system.
 - 2. Firmly attach a permanent tag indelibly machine marked with the instrument tag number, as given in the tabulation, on each piece of equipment constituting the PCS.
 - 3. Tag instruments immediately upon receipt in the field.
 - 4. Prominently display identification on the outside of the package.
 - 5. Utilize the Tag and Loop Number identifications shown on the P&IDs.
- D. Delivery and inspection:
 - 1. Deliver products in undamaged condition, in manufacturer's original container or packaging with identifying labels intact and legible. Include date of manufacture on label.

1.08 PROJECT OR SITE CONDITIONS

- A. Site conditions:
 - 1. Provide equipment, raceways, and any other components required for a complete installation that meets the environmental conditions for the Site as specified in the General Requirements and below.
 - 2. Seismic classification:
 - a. Provide all equipment and construction techniques suitable for the seismic requirements for the site, as specified in Section 01612.
 - 3. Wind:
 - a. Provide all equipment and construction techniques suitable for the site wind loading criteria, as specified in Section 01614.
 - 4. Altitude, temperature and humidity:
 - a. Provide all equipment and instrumentation fully rated for continuous operation at the project altitude, temperature and humidity conditions with no additional derating factors applied.
 - 5. Area classifications:
 - a. Furnish enclosures that match the area classifications as specified in Section 16050.
 - 6. Site security:
 - a. Abide by all security and safety rules concerning the Work on the Site, as specified in Section 01329.

1.09 SEQUENCING

- A. General:
 - 1. As specified in Sections 01312 and 01756.
 - 2. Testing requirements are specified in Sections 01756, 17950 and other sections.
 - 3. General scheduling requirements are specified in Section 01324A.
 - 4. Work restrictions and other scheduling requirements are specified in Section 01140.
 - 5. Commissioning requirements as specified in Section 01756.
- B. General Field Start-Up and testing procedures:
 - 1. As specified in Section 01756.

- C. Installation testing:
 - 1. As specified in Section 01756.
 - 2. Commence after acceptance of all training, wire test, calibration tests, and loop validation tests, and all inspections have demonstrated that the PCIS complies with all Contract requirements.
 - 3. Acceptance of the PCIS Installation testing must be provided in writing by the Owner before the performance testing may begin.

- D. Training:
 - 1. As specified in Section 01756.

- E. Functional testing:
 - 1. Representatives from each of the following groups shall be in attendance during the functional Testing: Programmer, System Supplier Commence after acceptance of all training, wire test, calibration tests, and loop validation tests, and all inspections have demonstrated that the PCIS complies with all Contract requirements.
 - 2. Loop validation test.
 - 3. As specified in Section 17950:
 - a. Notify the Owner of scheduled tests a minimum of 21 days before the estimated completion date of installation and wiring of the PCIS.
 - b. Complete loop validation testing a minimum of 5 days before the pre-commissioning phase of the project.
 - c. Loop validation certifications:
 - 1) After the field device loop tests have been successfully completed as specified in Section 17950 for all individual instruments, all separate analog control networks, all valves, all VCPs, all motors, all local operator interface panels, all motor control centers, etc., submit a certified copy of all test forms signed by the Contractor, Vendor, and the Owner's representative with test data entered, together with a clear and unequivocal statement that all instrumentation, including all control and signal wiring, has been successfully calibrated, inspected, and tested:
 - a) Acceptance of the PCIS Installation Testing must be provided in writing by the Engineer before the Process Operational Period may begin.

- F. Provide all special tools and spare parts, as specified in the Maintenance paragraph of this Section, before Process Operational Period commences, suitably wrapped, and identified.

- G. Process Operational Period:
 - 1. Upon completion of the Process Operational Period, conduct an Instrumentation and Controls Process Performance Test as a condition for Project final completion.

1.10 SCHEDULING (NOT USED)

1.11 WARRANTY

- A. Provide additional warranty as specified in the individual Instrumentation and Control Specifications that extends beyond the Correction Period, as specified in Documents 00700 and 00800.

1.12 SYSTEM PROCESS START-UP

- A. Replace or modify equipment, software, and materials that do not achieve design requirements after installation in order to attain compliance with the design requirements:
 - 1. Following replacement or modification, retest the system and perform additional testing to place the complete system in satisfactory operation and obtain compliance acceptance from the Engineer.

1.13 OWNER'S INSTRUCTIONS (NOT USED)

1.14 MAINTENANCE

- A. Before Substantial Completion, perform all maintenance activities required by the Contract Documents including any calibrations, final adjustments, component replacements or other routine service required before placing equipment or systems in service.
- B. Furnish all spare parts as required by the Contract Documents.
- C. Provide additional spare parts specified in other sections of the Instrumentation and Control Specifications.
- D. Submit all special tools and spare parts, suitably wrapped and identified, before Process Operational Period commences.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide similar items from a single manufacturer throughout the PCIS portion of the Project.
- B. Allowable manufacturers are specified in individual instrument and equipment specifications.

2.02 EXISTING PRODUCTS (NOT USED)

2.03 MATERIALS

- A. Furnish all materials under this Contract that are new, free from defects, and standard products produced by manufacturers regularly engaged in the production of these devices and that bear all approvals and labels as required by the Specifications.
- B. Provide materials complying with the applicable industrial standard as specified in the Contract Documents.

2.04 MANUFACTURED UNITS (NOT USED)

2.05 EQUIPMENT (NOT USED)

2.06 COMPONENTS

- A. Furnish all meters, instruments, and other components that are the most recent field proven models marketed by their manufacturers at the time of submittal of the shop drawings unless otherwise specified to match existing equipment.
- B. Unless otherwise specified, furnish individual instruments that have a minimum accuracy of within 0.5 percent of full scale and a minimum repeatability of within 0.25 percent of full scale.
- C. Signal transmission:
 - 1. Analog signals:
 - a. Furnish analog measurements and control signals that vary in direct linear proportion to the measured variable, unless otherwise indicated.
 - b. Furnish electrical analog signals outside control panels that are 4 to 20 milliamperes 24 VDC, except as indicated.
 - c. Electrically or optically isolate all analog signals from other signals.
 - d. Furnish regulated analog signals that are not affected by changes in supply voltage or load resistance within the unit's rating.
 - e. Maintain the total 4 to 20 milliamperes loop impedance to 10 percent below the published value at the loop operating voltage.
 - f. Where necessary, reduce loop impedance by providing current-to-current (I/I) isolation amplifiers for signal re-transmission.
 - 2. Discrete input signals.
 - 3. Coordinate with the Owner for use of existing discrete input signals in the RTU
Discrete output signals:
 - a. Coordinate with the Owner for use of existing discrete output signals in the RTU.
 - 4. Signal performance and design criteria:
 - a. Stability:
 - 1) After Controls have taken corrective action, oscillation of the final control element shall not exceed 2 cycles per minute or a magnitude of motion of 0.5 percent of full travel.
 - b. Response:
 - 1) Any change in setpoint or controlled variable shall produce a corrective change in position of the final control element and stabilized within 30 seconds.
 - c. Agreement:
 - 1) Setpoint indication of controlled variable and measured indication of controlled variable shall agree within 3 percent of full scale over a 6:1 operating range.
 - d. Repeatability:
 - 1) For any repeated magnitude of control signal, from either an increasing or decreasing direction, the final control element shall take a repeated position within 0.5 percent of full travel regardless of force required to position the final element.
 - e. Sensitivity:
 - 1) Controls shall respond to a setpoint deviations and measured variable deviations within 1.0 percent of full scale.
 - f. Performance:
 - 1) All instruments and control devices shall perform in accordance with the manufacturers' specifications.

2.07 ACCESSORIES

- A. Provide flow conditioning devices or other required accessories if necessary to meet the accuracy requirements in the Contract Documents.
- B. Nameplates:
 - 1. Provide a nameplate for each instrument.
 - 2. All nameplates shall be of identical style, color, and material throughout the facility.
 - 3. All instruments shall be equipped with Type 316 stainless steel nameplate with the instrument tag stamped in 3/8-inch letters and connected to the instrument using Type 316 stainless steel wire.

2.08 MIXES (NOT USED)

2.09 FABRICATION (NOT USED)

2.10 FINISHES (NOT USED)

2.11 SOURCE QUALITY CONTROL

- A. Provide all equipment that is new, free from defects, and standard products produced by manufacturers regularly engaged in the production of these products that bear all approvals and labels as required by the Specifications.
- B. Arrange with all manufacturers of the equipment and fabricators of panels and cabinets, to allow the Owner and Engineer to inspect and witness the testing of the equipment at the site of fabrication:
 - 1. Equipment includes the cabinets, special control systems, flow measuring devices, and other pertinent systems and devices.
- C. Source Test is specified in Section 17950.

PART 3 EXECUTION

3.01 EXAMINATION

- A. The ICSC is encouraged to visit the site and examine the premises completely before bidding. It is the ICSC's responsibility to be fully familiar with the existing conditions and local requirements and regulations.
- B. Review the existing Site conditions and examine all shop drawings for the various items of equipment in order to determine exact routing and final terminations for all wiring and cables.
- C. Provide a complete instrumentation and control system:
 - 1. Install all extra conduits, cables, and interfaces as may be necessary to provide a complete and operating electrical, and process control and instrumentation system.

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

- A. Equipment locations indicated on the Drawings may change due to variations in equipment size or minor changes made by others during construction:
 - 1. Verify all dimensions as indicated on the Drawings:
 - a. Actual field conditions govern all final installed locations, distances, and levels.
 - 2. Review all information indicated on the Drawings, including architectural, structural, mechanical, instrumentation, and the accepted electrical, instrumentation, and mechanical shop drawings, and coordinate Work as necessary to adjust to all conditions that arise due to such changes.
 - 3. Make minor changes in location of equipment before rough in, as directed by the Owner or Engineer.
- B. Perform all related Electrical Work in accordance with the applicable sections of the Electrical Specifications.
- C. Field instruments installation:
 - 1. Install field instruments as specified in the Contract Documents, API RP 550 and RP 551, and the manufacturer's instructions.
 - 2. Mount field instruments so that they can be easily read, readily approached, and easily serviced, and so they do not restrict access to mechanical equipment:
 - a. Mount field instruments on a pipe stand or local panel, if they are not directly mounted, unless otherwise indicated on the Drawings.
 - b. Provide sun shields for all field electronic instruments exposed to direct sunlight.
 - 3. Make connections from rigid conduit systems to field instruments with PVC coated flexible conduit:
 - a. Type of flexible conduit required for the area classification:
 - 1) Area classification as specified in Section 16050.
 - b. Maximum length of 18 inches.
 - 4. Connect field instruments with cable as specified in the Electrical Specifications, except when the manufacturer requires the use of special cable, or otherwise specified in this Section:
 - a. Special cable applications shall be in accordance with the NEC.
 - 5. Verify the correctness of each installation:
 - a. Polarity of electric power and signal connections.
 - 6. Ensure all process connections are free of leaks.
- D. Equipment tie-downs:
 - 1. Anchor all instruments by methods that comply with seismic and wind bracing requirements, which apply to the Site.
- E. Instrument tagging:
 - 1. As specified in Section 16075.
 - 2. Provide all field-mounted instruments with nameplates:
 - a. Nameplates engraved with the instrument's full tag number as indicated on the Drawings:
 - 1) Affix tags with stainless steel wire fasteners.

- F. Cable and conductor termination:
 - 1. Terminate all cables and conductors on terminal blocks.
 - 2. Terminal block enclosures:
 - a. Suitable for the area classification as specified in Section 16050.

- G. Surge protection:
 - 1. Provide outdoor field instrument loops with voltage surge protection units installed on the instruments and the panel.
 - 2. Individually fuse each 4 to 20 milliamperes direct current loop with a 1/16 ampere fuse between power supplies and receiver surge protectors.
 - 3. Provide voltage surge protection for 4 wire transmitters and analyzers:
 - a. Protect both power source and signal loop.

3.04 ERECTION, INSTALLATION, APPLICATION, CONSTRUCTION (NOT USED)

3.05 REPAIR/RESTORATION (NOT USED)

3.06 RE-INSTALLATION (NOT USED)

3.07 COMMISSIONING

- A. As specified in Section 01756.

3.08 FIELD QUALITY CONTROL

- A. Instrument Installation Inspection:
 - 1. Provide any assistance necessary to support inspection activities.
 - 2. Inspections may include, but are not limited to, the following:
 - a. Inspect equipment and materials for physical damage.
 - b. Inspect the installed arrangement, lay lengths, orientation, piping obstructions, etc., that could affect the instruments accuracy or repeatability.
 - c. Inspect installation for compliance with Drawings and Specifications.
 - d. Inspect installation for obstructions and adequate clearances around equipment.
 - e. Inspect equipment installation for proper leveling, alignment, anchorage, and assembly.
 - f. Inspect equipment nameplate data to verify compliance with design requirements.
 - g. Inspect cable terminations.
 - h. Inspect/witness instrument calibrations/verifications.
 - 3. Inspection activities conducted during construction do not satisfy inspection requirements specified in Section 17950.
 - 4. Field acceptance testing: (Functional Testing) is specified in Section 17950. Additional general requirements are specified in Section 01756.

- B. Installation supervision:
 - 1. Ensure that the entire PCIS is installed in a proper and satisfactory manner. At a minimum, the ICSC shall provide the following services:
 - a. Installation resources:
 - 1) Coordinate with the Contractor regarding installation requirements of the Contract Documents.

- b. Provide technical assistance to installation personnel by telephone:
 - 1) Furnish installation personnel with at least one copy of the accepted submittals, including all installation details.
- c. Periodic inspections during the construction period.
- d. A complete check of the completed installation to ensure that it is in conformance with the requirements of the equipment manufacturer and the Contract Documents.
- e. Field verify accuracy and calibration of all instruments.

3.09 ADJUSTING

- A. Make all revisions necessary to the control system software, as directed by the Engineer:
 - 1. It is understood that the Contractor knows and agrees that changes will be required in the control system software during the Source Testing, Functional Testing, Process Operational Period, Process Start-Up, and during the Project Correction Period.

3.10 CLEANING

- A. As specified in Section 01770.
- B. Vacuum clean all control panels and enclosures before process start-up and again after final completion of the project.
- C. Clean all panel surfaces.
- D. Return to new condition any scratches and/or defects.
- E. Wipe all instrument faces and enclosures clean.
- F. Leave wiring in panels, manholes, boxes, and other locations in a neat, clean, and organized manner:
 - 1. Neatly coil and label all spare wiring lengths.
 - 2. Shorten, re-terminate, and re-label excessive spare wire and cable lengths, as determined by the Engineer.
- G. As specified in other sections of the Contract Documents.

3.11 PROTECTION

- A. Protect all Work from damage or degradation until date of Substantial Completion.

3.12 SCHEDULES (NOT USED)

END OF SECTION

SECTION 17101

SPECIFIC CONTROL STRATEGIES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Loop descriptions:
 - a. Specific control requirements and functional descriptions for individual control loops.
- B. Related sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 17050 - Common Work Results for Process Control and Instrumentation Systems.

1.02 REFERENCES

- A. As specified in Section 17050.

1.03 DEFINITIONS

- A. As specified in Section 17050.

1.04 SYSTEM DESCRIPTION (NOT USED)

1.05 SUBMITTALS

- A. Develop detailed loop descriptions based on the information in the Contract Documents, and submit as specified in Sections 01330 and 17050:
 - 1. For each control loop, provide a detailed functional description of the operation of the equipment, signals, and controls shown on the P&IDs:
 - a. Include all functions depicted or described in the Contract Documents.
 - b. Include the following within each loop description:
 - 1) All requirements specific to that loop.
 - 2) Common control requirements applicable to that loop.
 - 3) List of all ranges, setpoints, timers, values, counters, etc.
 - 2. Where there are similar loops with identical control, such as multiple loops for individual raw water pumps, only 1 loop description need be developed and the remaining loops may reference that loop description.
 - 3. Loop description format: As specified in this Section.
- B. Loop number and title:
 - 1. References:
 - a. List P&IDs that are specifically referenced.
 - 2. Abstract:
 - a. General description of how the loop works, what devices are involved, and how the process will be controlled.

- b. Process values, setpoints, and limits, including units and ranges:
 - 1) Show span and range values for analog inputs and outputs, and operating point and deadband for discrete inputs.
- 3. Hardwired control:
 - a. Detailed description of the control functions at the local level.
 - b. Function of local operator interfaces.
 - c. Operation of hardwired field pilot controls:
 - 1) Pushbuttons.
 - 2) Selector switches.
 - 3) Potentiometers.
 - 4) Pilot lights, indicators, and other displays.
- 4. Hardwired interlocks:
 - a. Explanation of the operation of system interlocks and hardwired permissive conditions.
- 5. PLC control:
 - a. Detailed description of the control functions that are under control of the PLC.
 - b. Operator controls and automatic controls.
 - c. Setpoints, alarms, etc.:
 - 1) Include units and ranges for analog values.
 - 2) Include span and range for analog inputs and outputs.
 - 3) Include operating point and deadband for discrete inputs, and identify conditions where contacts are open, and when they close.
 - d. Control sequences.
 - e. Software interlocks:
 - 1) Operation of system software interlocks.
- 6. PCS/LOI/HMI control:
 - a. Detailed description of the operator controls.
 - b. Setpoints, alarms, etc.
- 7. Indicators and alarms:
 - a. List any indicators and alarms specific to the loop that are not covered in the common control strategies.
- 8. Failure modes:
 - a. List any failure modes specific to the loop that are not covered in the common control strategies.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 DELIVERY, STORAGE, AND HANDLING (NOT USED)

1.08 PROJECT OR SITE CONDITIONS (NOT USED)

1.09 SEQUENCING (NOT USED)

1.10 SCHEDULING (NOT USED)

1.11 WARRANTY (NOT USED)

1.12 SYSTEM START-UP (NOT USED)

1.13 OWNER'S INSTRUCTIONS (NOT USED)

1.14 COMMISSIONING (NOT USED)

1.15 MAINTENANCE (NOT USED)

PART 2 PRODUCTS

2.01 MANUFACTURERS (NOT USED)

2.02 EXISTING PRODUCTS (NOT USED)

2.03 MATERIALS (NOT USED)

2.04 MANUFACTURED UNITS (NOT USED)

2.05 EQUIPMENT (NOT USED)

2.06 COMPONENTS (NOT USED)

2.07 ACCESSORIES (NOT USED)

2.08 MIXES (NOT USED)

2.09 FABRICATION (NOT USED)

2.10 FINISHES (NOT USED)

2.11 SOURCE QUALITY CONTROL (NOT USED)

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION (NOT USED)

3.04 ERECTION, INSTALLATION, APPLICATION, CONSTRUCTION

A. Loops 1900, 1901, 1902 - Blackhorse Reservoir Potable Water System:

1. References:

a. N-05.

2. Abstract:

a. The potable water pump is used to supplement recycled water in the Blackhorse Reservoir.

3. Hardwired control:

a. When the HAND-OFF-AUTO selector switch at the MCC is in the HAND position, the pump will run. A running feedback contact shall be sent to the PLC.

b. When the HAND-OFF-AUTO selector switch at the MCC is in the AUTO position, the PLC will control the pump.

4. Hardwired interlocks/Overload Programmed Interlocks:
 - a. In any mode of operation, the running pump shall stop if one of the following occurs:
 - 1) The HAND-OFF-AUTO selector switch at the MCC is put in the OFF position.
 - 2) High temperature is sensed at the motor.
 - d. The High Temperature Reset Pushbutton at the MCC panel shall allow the operator to reset the high temperature alarm condition provided the motor has cooled down.
5. PLC control:
 - a. Through the PLC, the operator can start and stop the pump, monitor potable water pump flow and measure Blackhorse Reservoir level.
6. PCS/LOI/HMI control:
 - a. When the HOA switch at the MCC is in the AUTO mode, the potable water pump is controlled by the PLC is either a MANUAL or AUTOMATIC mode.
 - b. In the MANUAL mode the operator can manually start and stop the potable water pump.
 - c. In the AUTOMATIC mode the PLC will start the potable water pump when the level in the Blackhorse Reservoir drops below an operator adjustable setpoint, initially set at 10 feet, provided the level in the D1 Reservoir is above and operator adjustable setpoint, initially set at 10 feet.
 - d. The potable water pump will continue to run until the Blackhorse Reservoir level reaches an operator adjustable level, initially set at 12 feet, or the level in the D1 reservoir falls below the operator adjustable level. The PLC shall automatically control the pump based on the level set points at described below:
 1. The pump shall keep running as long the level at the D1 reservoir is above 10 feet. When the D1 Reservoir reaches a low level of 10 feet, the PLC shall be programmed to stop the pump. This status shall remain till the level of the DI reservoir is below or equal to 10 feet.
 2. The pump shall keep running as long the level at the Blackhorse reservoir is below 12 feet. When the Blackhorse Reservoir reaches a high level of 12 feet, the PLC shall shutdown the pump. This status shall remain till the level of the Blackhorse reservoir is below or equal to 10 feet. When the level of the reservoir reaches a value lower than 10 feet the PLC shall start the pump.
7. Indicators and alarms:
 - a. As indicated on the Drawings.
8. Failure modes:
 - a. As indicated on the Drawings.

3.05 REPAIR/RESTORATION (NOT USED)

3.06 RE-INSTALLATION (NOT USED)

3.07 FIELD QUALITY CONTROL (NOT USED)

3.08 ADJUSTING (NOT USED)

3.09 CLEANING (NOT USED)

3.10 DEMONSTRATION AND TRAINING

A. As specified in Section 17050.

3.11 PROTECTION (NOT USED)

3.12 SCHEDULES (NOT USED)

END OF SECTION

SECTION 17206

LEVEL MEASUREMENT: ULTRASONIC

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Ultrasonic level instruments.
- B. Related sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 17050 - Common Work Results for Process Control and Instrumentation Systems.
- C. Provide all instruments identified in the Contract Documents.

1.02 REFERENCES

- A. As specified in Section 17050.

1.03 DEFINITIONS

- A. As specified in Section 17050.
- B. Specific definitions:
 - 1. FDT: Field Device Tool.
 - 2. DTM: Device Type Manager.

1.04 SUBMITTALS

- A. Furnish submittals as specified in Sections 01330 and 17050.
- B. Provide complete documentation covering the traceability of all calibration instruments.

1.05 QUALITY ASSURANCE

- A. As specified in Section 17050.
- B. Examine the complete set of Contract Documents and verify that the instruments are compatible with the installed conditions including:
 - 1. Process conditions: Fluids, pressures, temperatures, flows, materials, etc.
 - 2. Physical conditions:
 - a. Installation and mounting requirements.
 - b. Location within the process.
 - c. Accessories: Verify that all required accessories are provided and are compatible with the process conditions and physical installation.

- C. Notify the Engineer if any installation condition does not meet the instrument manufacturer's recommendations or specifications.
- D. Provide instruments manufactured at facilities certified to the quality standards of ISO 9001.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. As specified in Section 17050.

1.07 PROJECT OR SITE CONDITIONS

- A. Project environmental conditions as specified in Section 17050:
 - 1. Provide instruments suitable for the installed site conditions including, but not limited to, material compatibility, site altitude, site seismic conditions, humidity, and process and ambient temperatures.

1.08 WARRANTY

- A. As specified in Section 17050.

1.09 MAINTENANCE

- A. Furnish all parts, materials, fluids, etc. necessary for operation, maintenance, and calibration purposes throughout the warranty period. Deliver all of these supplies before project substantial completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. One of the following or equal:
 - 1. Ultrasonic level sensor with 4-wire remote transmitter:
 - a. Ametek Drexelbrook: USonic-R Series.
 - b. Endress+Hauser: Prosonic S FDU Series Sensor with FMU Series Transmitter.

2.02 MANUFACTURED UNITS

- A. Ultrasonic level measurement with 4-wire remote transmitter:
 - 1. General:
 - a. Continuous non-contact level measurement device with remote transmitter using ultrasonic echo sensing. The transducer generates an ultrasonic pulse in the range of 12 to 50 kHz and measures the time required for the pulse to travel to the process surface and return. The distance is calculated from the send and receive times. Each 4-wire level transmitter system includes, but is not limited to:
 - 1) Ultrasonic transducer.
 - 2) Signal cable.
 - 3) Transmitter.

2. Performance requirements:
 - a. Accuracy:
 - 1) 0.25 percent of range.
 - b. Repeatability:
 - 1) 0.1 percent of range.
3. Ultrasonic transducer:
 - a. Encapsulated in chemical- and corrosion-resistant material as indicated on the Instrument Data Sheet or Instrument Index.
 - b. Class I Division 1 for transducer only.
 - c. Operating temperature range: -5 to 122 degrees Fahrenheit (-20 to 50 degrees Celsius).
 - d. Operating relative humidity range: 5 to 95 percent.
 - e. Functions:
 - 1) Temperature compensation.
 - f. Mounting: As indicated in the Contract Documents.
4. Transmitter:
 - a. Level-indicating transmitter:
 - 1) Indicator: Liquid crystal display with approximately 0.50-inch display scaled to read in engineering units.
 - 2) Sensitivity: Able to ignore momentary level spikes or momentary loss of echo and indicate loss of echo condition on indicating transmitter unit.
 - 3) Ability to allow for signal profiles and echo mapping:
 - a) Provide manufacturer's software for re-mapping the signal.
 - b. Functions:
 - 1) Level measurement.
 - 2) Tank volume.
 - 3) Flow measurement.
 - c. Power supply:
 - 1) 120 VAC.
 - 2) Power consumption: 36 VA maximum.
 - d. Outputs:
 - 1) Isolated 4 to 20 milliamperes DC.
 - 2) Relay outputs:
 - a) 3 Form A or Form C contacts.
 - b) Rated 5 amps at 250 VAC.
 - c) Programmable.
 - 3) Enclosure: NEMA Type 4X.
 - 4) Mounting: As indicated in the Contract Documents.
 - 5) Operating temperature range from -5 to 122 degrees Fahrenheit (-20 to 50 degrees Celsius); relative humidity of 10 to 100 percent.

2.03 ACCESSORIES

- A. Mounting brackets: As indicated on the Drawings.
- B. Provide sunshades for outdoor installations.

2.04 SOURCE QUALITY CONTROL

- A. As specified in Section 17050.
- B. Factory calibrate each instrument with a minimum 3-point calibration or according to manufacturer's standard at a facility that is traceable to NIST:
 - 1. Submit calibration data sheets to the Engineer at least 30 days before shipment of the instruments to the project site.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine the installation location for the instrument and verify that the instrument will work properly when installed:
 - 1. Notify the Engineer promptly if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

- A. As specified in Section 17050.
- B. Coordinate the installation with all trades to ensure that the mechanical system has all necessary appurtenances including weld-o-lets, valves, etc. for proper installation of instruments.

3.04 FIELD QUALITY CONTROL

- A. As specified in Section 17050.

3.05 ADJUSTING

- A. As specified in Section 17950.
- B. Turn on turbulent surface software feature for all installations measuring surfaces lacking a placid surface. This would include but not be limited to level measurements in mixed media filters and potentially wet wells.

3.06 CLEANING

- A. As specified in Section 17050.

3.07 DEMONSTRATION AND TRAINING

- A. As specified in Section 17050.

3.08 PROTECTION

- A. As specified in Section 17050.

3.09 SCHEDULES

- A. The provided information does not necessarily include all required instruments. Provide all instruments identified in the Contract Documents:
 - 1. Instruments may be as indicated on the Drawings, specified in the Specifications, or both.

END OF SECTION

A/E: Carollo Engineers		ULTRASONIC LEVEL INSTRUMENTS				Spec. No.		Rev.	
						17206			
Contractor: Recycled Water Pipeline Final Design		No		By		Date		Revision	
Project: Marin County Water District						Contract		Date	
Customer: BlackHorse Recycled Water Reservoir						Req.		P.O.	
Plant: Marin County, CA									
Location: Marin County, CA						By		Chk	
BOM No.:								App	
File:									
G E N	1	Instrument Tag Number	LE/LIT-1902						
	2	Service	Recycle Water						
	3	P&ID	N05						
	4	Other							
P R O B E	5	Type	Ultrasonic						
	6	Housing Material	Mfr. Recommended						
	7	Measurement Range							
	8	Op. Temp. Range							
	9	Manufacturer							
E	10	Model							
	11	Model Number							
C A B L E	12	Style	Mfg. Std						
	13	Length							
	14	Other							
	15	Other							
T R A N S M I T T E R	16	Other							
	17	Type							
	18	Operating Mode							
	19	Enclosure	NEMA 4X						
	20	Mounting	Remote						
	21	Temperature Range							
	22	Voltage Requirements	120 VAC, 60 Hz						
	23	Power							
	24	Accuracy	0.25% of range						
	25	Display	Multi Character LCD						
	26	Output	4-20 mA						
	27	Calibration							
R	28	Status Relay							
	29	Manufacturer							
	30	Model No.							
	31	Elect. Entry							
	32	Other							
	33								
O P T S	34								
	35								
	36								
	36								
Notes:									

SECTION 17302

FLOW MEASUREMENT: MAGNETIC FLOWMETERS

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Full-body magnetic flowmeters.
- B. Related sections:
 - 1. Section 01330 - Submittal Procedures.
 - 2. Section 17050 - Common Work Results for Process Control and Instrumentation Systems.
- C. Provide all instruments identified in the Contract Drawings.

1.02 REFERENCES

- A. As specified in Section 17050.
- B. International Organization for Standardization (ISO):
 - 1. 9000 - Quality management systems -- Fundamentals and vocabulary.
 - 2. 17025 - General requirements for the competence of testing and calibration laboratories.
- C. National Institute of Standards and Technology (NIST).
- D. NSF International (NSF).

1.03 DEFINITIONS

- A. As specified in Section 17050.

1.04 SUBMITTALS

- A. Furnish submittals as specified in Sections 01330 and 17050.

1.05 QUALITY ASSURANCE

- A. As specified in Section 17050.
- B. Examine the complete set of Contract Documents and verify that the instruments are compatible with the installed conditions including:
 - 1. Process conditions: Fluids, pressures, temperatures, flows, materials, etc.
 - 2. Physical conditions:
 - a. Installation and mounting requirements.
 - b. Location within the process.
 - c. Accessories: Verify that all required accessories are provided and are compatible with the process conditions and physical installation.

- C. Notify the Engineer if any installation condition does not meet the instrument manufacturer's recommendations or specifications.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. As specified in Section 17050.

1.07 PROJECT OR SITE CONDITIONS

- A. As specified in Section 17050.

1.08 WARRANTY

- A. As specified in Section 17050.

1.09 MAINTENANCE

- A. As specified in Section 17050.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. The following, no equals or substitutions:
 - 1. Sparling TigerMag FM656.

2.02 MANUFACTURED UNITS

- A. Magnetic flowmeter:
 - 1. General:
 - a. Magnetic flowmeters obtain the flow velocity by measuring the changes of induced voltage of the conductive fluid passing across a controlled magnetic field.
 - b. Complete zero stability shall be an inherent characteristic of the flowmeter system.
 - c. Include for each magnetic flow metering system:
 - 1) A metering tube with electrodes (sensor).
 - 2) Signal cable.
 - 3) Transmitter integral or remote as indicated on the Drawings and called out in the data sheet at the end of this section.
 - 4) Flowmeter grounding rings.
 - 2. Performance requirements:
 - a. Accuracy:
 - 1) 0.25 percent of flow rate from 10 to 100 percent of full scale for velocities ranging between 1.9 to 10 feet per second.
 - b. Repeatability:
 - 1) 0.25 percent of rate.
 - 3. Element:
 - a. Metering tube:
 - 1) Constructed of carbon steel or Type 304 stainless steel (unless specifically noted otherwise in the instrument data sheets) with flanged connections to match with piping material.

- 2) Liner material in conformance with:
 - a) Manufacturer's recommendations for the intended service.
 - b) NSF certified for all drinking water applications.
 - c) Refer to data sheet for specific requirements.
 - 3) Electrodes type and material in conformance with:
 - a) Manufacturer's recommendations for the intended service.
 - b) Utilize a minimum of 2, self-cleaning electrodes.
 - c) Refer to data sheet for specific requirements.
 - 4) Meter terminal housing NEMA Type 4X unless specifically noted otherwise in the instrument data sheets.
 - 5) Meter coating consisting of epoxy painted finish.
 - 6) Components:
 - a) 2 grounding rings:
 - (1) Which are in conformance with the manufacturer's bore and material recommendation for the meter's intended service.
 - (2) Designed to protect and shield from abrasion of the liner's edge interface at the meter's end.
4. Transmitter:
- a. Power supply:
 - 1) 120 VAC.
 - 2) Power consumption: 60 VA maximum.
 - b. Outputs:
 - 1) As noted in the instrument data sheets.
 - 2) For all instruments with 4 to 20 mA HART or digital bus protocol, provide a Device Type Manager (DTM) certification by FDT group.
 - c. Microprocessor-based signal converter/transmitter.
 - d. Utilize DC pulse technique to drive flux-producing coils.
 - e. Contain a 6-digit display for flow rate, percent of span, and totalizer.
 - f. Operator keypad interface.
 - g. Integral zero return to provide consistent zero output signals in response to an external dry contact closure.
 - h. Integral low flow cut-off zero return.
 - i. Programmable parameters including:
 - 1) Meter size.
 - 2) Full-scale flow rate.
 - 3) Magnetic field frequency.
 - 4) Time constant.
 - j. Data retention for a minimum of 5 years without auxiliary main or battery power.
 - k. Self-diagnostics and automatic data checking.
 - l. Protected terminals and fuses in a separate compartment which isolates field connection from electronics.
 - m. Ambient operating temperature limits of -5 to 140 degrees Fahrenheit (-20 to 60 degrees Celsius).

2.03 ACCESSORIES

- A. Stainless steel tag labeled as specified in the Contract Documents.
- B. Provide sunshades for all transmitters located outdoors.

- C. Provide galvanic isolation gaskets, nylon/Teflon flange bolt insulation bushings and nylon washers on all meters installed on pipes with cathodic protection.

2.04 SOURCE QUALITY CONTROL

- A. As specified in Section 17050.
- B. Factory calibrate each flow metering system at a facility that is traceable to the NIST. ISO-17025 accredited test facility with certified accuracy traceable to NIST.
- C. Evidence of accreditation shall originate from a national verification agency such as A2LA.
- D. A real-time computer generated printout of the actual calibration date indication actual velocities and as read values of the flow tube:
 - 1. Flow calibration report of the manufacturers flow lab calibration procedure shall be shipped with the meter system.
 - 2. Minimum calibration shall be a 3 point calibration including 1, 3, and 10 feet per second velocities for every meter and transmitter system.
 - 3. Manufacturer shall archive all calibration reports for future reference.

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

- A. As specified in Section 17050.

3.04 FIELD QUALITY CONTROL

- A. As specified in Section 17050.
- B. Provide manufacturer's services to perform installation inspection.

3.05 ADJUSTING

- A. Field Verification:
 - 1. Verify factory calibration of all instruments in accordance with the manufacturer's instructions.
 - 2. The transmitter and sensor to include a method to verify flow meter performance to the original manufacturer specifications.
 - 3. Verification should be traceable to factory calibration using a third party, attested onboard system pursuant to ISO standards.
 - 4. The verification report should be compliant to common quality systems such as ISO 9000 to prove reliability of the meter specified accuracy.
 - 5. Return factory calibrated devices to the factory if they do not meet the field verification requirements for calibration.

3.06 CLEANING

- A. As specified in Section 17050.

3.07 DEMONSTRATION AND TRAINING

- A. As specified in Section 17050.
- B. Demonstrate performance of all instruments to the Engineer before commissioning.

3.08 PROTECTION

- A. As specified in Section 17050.

3.09 SCHEDULES

- A. Instrument Data Sheets included in this Section.
- B. The provided information does not necessarily include all required instruments.
- C. Provide all instruments identified in the Contract Documents:
 - 1. Instruments may be indicated on the Drawings, specified in the Specifications, or both.

END OF SECTION

A/E: Carollo Engineers		MAGNETIC FLOWMETERS				INSTRUMENT DATA SHEETS			
						Spec. No.		Rev.	
Contractor:		No	By	Date	Revision	17302			
Project: Recycled Water Pipeline Final Design						Contract		Date	
Customer: Marin County Water District						Req.		P.O.	
Plant: BlackHorse Recycled Water Reservoir						By		Chk	
Location: Marin County, CA								App	
BOM No.:									
File:									
1	Instrument Tag No.	FIT-1901							
2	Service	Recycle Water							
3	P&ID	N05							
4	C	Line Size / Schedule	8-inch						
5	O	Line Material	PW						
6	N	Connection Type/ Pressure Rating							
7	N	Connection Materials							
E	9	Tube Size	Line size						
		Tube Material							
L	10	Liner Material	Hard Rubber, NSF 61 certified						
E	11	M	Electrode Type	Mfg Standard					
M	12	E	Electrode Material						
E	13	T	Meter Casing						
N	14	E	Power Sply	Phase	120 VAC	1P			
T	15	R	Grounding Type & Matl.						
	16		Enclosure Class	NEMA 4X					
	17		Other						
	18		Fluid						
	19	F	Max Flow	1100 GPM					
	20	L	Min Velocity						
	21	U	Min Flow	Norm Flow					
	22	I	Min Temp	Max Temp					
	23	D	Min Press	Max Press					
	24		Vacuum Possibility						
	25		Conductivity						
T	26		Function						
R	27		Mounting	Integral					
A	28		Enclosure Class	NEMA 4X					
N	29		Length Signal Cable						
S	30		Type Span Adjustment						
M	31		Power Supply						
I	32		Transmitter Output	4-20 mA					
			Relay Outputs	Form C					
T	33		Accuracy	0.25%					
T	34		Calibrated Range						
E	35		Empty Pipe Detection						
R	36		Bi-Directional Flow						
	37		Display Scale Size	Range					
	38		Alarm Contact No.	Form					
	39		Manufacturer						
	40		Element (Meter) Model No.						
	41		Transmitter (Inst.) Model No.						
Notes:									

SECTION 17950

TESTING, CALIBRATION, AND COMMISSIONING

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Testing requirements that apply to process control and instrumentation systems for the entire Project.

- B. Related sections:
 - 1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
 - 2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.
 - 3. The following sections are related to the Work described in this Section. This list of related sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents:
 - a. Section 01330 - Submittal Procedures.
 - b. Section 01756 - Commissioning and Process Start-Up.
 - c. Section 17050 - Common Work Results for Process Control and Instrumentation Systems.
 - d. Section 17101 - Specific Control Strategies.

1.02 REFERENCES

- A. As specified in Section 17050.
- B. Electronics Industries Alliance (EIA).
- C. Telecommunications Industry Association (TIA).

1.03 DEFINITIONS

- A. As specified in Sections 01756 and 17050.
- B. Specific definitions:
 - 1. PTO: Profibus Trade Organization.

1.04 SYSTEM DESCRIPTION (NOT USED)

1.05 SUBMITTALS

- A. Furnish submittals as specified in Section 01330.

- B. General:
1. Reference additional detailed test submittal scheduling and prerequisite requirements as specified in the Sequencing article of Section 17050.
- C. Test procedures:
1. Develop and submit detailed test procedures to show that the integrated SCADA system hardware and software is fully operational and in compliance with the requirements specified in the Contract Documents.
 2. Provide a statement of test objectives for each test.
 3. Prepare specific procedures for each process system.
 4. Describe sequentially the steps to be followed in verifying the correct operation of each process system, including all features described in the loop descriptions, control strategies, and shown in the P&IDs. Implied or generic test procedures are not acceptable.
 5. Specify who will perform the tests, specifically what testing equipment will be used (including serial numbers and NIST-traceable calibration), and how the testing equipment will be used.
 6. Describe the expected role of the Engineer, as well as any requirements for assistance from Owner's staff.
 7. Provide the forms and checklists to be used.
- D. Test forms:
1. Provide test and calibration forms and checklists for each of the following:
 - a. Calibration.
 - b. Loop validation tests.
 - c. Installation tests.
 - d. Functional tests.
 - e. Instrumentation and Controls Performance test.
 2. Test forms shall include the detailed test procedures, or shall include clear references to separate pages containing the complete test procedure applicable to each form. If references to procedures are used, the complete procedure shall be included with each test binder.
 3. Every page of each test form shall include project name, date, time, name of person conducting the test, signature of person conducting the test, and for witnessed tests, place for signature of person (Engineer and Owner) witnessing the test.
 4. Some sample test forms are included at the end of this Section. These test forms show the minimum required test form content. They are not complete, and have not been customized for this Project. The Contractor is to develop and submit test forms customized for the Project and meeting all of the specified test and submittal requirements.
- E. Testing binders:
1. Sub-system to be tested, provide and submit a test binder containing all test procedures and individual test forms for the test. References to other documents for test procedures and requirements are not acceptable.
 2. Fill out in advance headings and all other information known before the test.
 3. Include applicable test plan information, as well as a list of all test prerequisites, test personnel, and equipment.
 4. Include or list reference material and provide separately at the time of the test.
 5. Record test results and verify that all test requirements and conditions have been met.

- F. Test reports:
1. At the conclusion of each test, submit a complete test report, including all test results and certifications.
 2. Include all completed test binders, forms, and checklists.
 3. Submission, review, and acceptance of each test report is required before the start of the sub-system.

1.06 QUALITY ASSURANCE

- A. Test personnel:
1. Furnish qualified technical personnel to perform all calibration, testing, and verification. The test personnel are required to be familiar with this Project and the equipment, software, and systems before being assigned to the test program.

1.07 DELIVERY, STORAGE, AND HANDLING (NOT USED)

1.08 PROJECT OR SITE CONDITIONS (NOT USED)

1.09 SEQUENCING (NOT USED)

1.10 SCHEDULING

- A. As specified in Section 17050.

1.11 WARRANTY (NOT USED)

1.12 SYSTEM START-UP (NOT USED)

1.13 OWNER'S INSTRUCTIONS (NOT USED)

1.14 MAINTENANCE (NOT USED)

PART 2 PRODUCTS

2.01 MANUFACTURERS (NOT USED)

2.02 EXISTING PRODUCTS (NOT USED)

2.03 MATERIALS (NOT USED)

2.04 MANUFACTURED UNITS (NOT USED)

2.05 EQUIPMENT (NOT USED)

2.06 COMPONENTS (NOT USED)

2.07 ACCESSORIES (NOT USED)

2.08 MIXES (NOT USED)

2.09 FABRICATION (NOT USED)

2.10 FINISHES (NOT USED)

2.11 SOURCE QUALITY CONTROL (NOT USED)

PART 3 EXECUTION

3.01 EXAMINATION (NOT USED)

3.02 PREPARATION (NOT USED)

3.03 INSTALLATION

- A. As specified in Section 17050.
- B. Installation supervision:
 - 1. Provide as specified in Section 17050.

3.04 ERECTION, INSTALLATION, APPLICATION, CONSTRUCTION (NOT USED)

3.05 REPAIR/RESTORATION (NOT USED)

3.06 RE-INSTALLATION (NOT USED)

3.07 COMMISSIONING AND PROCESS START-UP

- A. Installation Testing:
 - 1. General:
 - a. The Owner reserves the right to test any specified function, whether or not explicitly stated in the test submittals.
 - b. Failure testing:
 - 1) In addition to demonstrating correct operation of all specified features, demonstrate how the system reacts and recovers from abnormal conditions.
 - c. Conduct testing Monday through Friday during normal working hours for no more than 8 hours per day:
 - 1) Testing at other times requires approval of the Engineer.
 - 2. Sequencing:
 - a. See additional requirements specified in the Sequencing article of Section 17050.
 - 3. Calibration:
 - a. After installation but before starting other tests, calibrate and adjust all instruments, devices, valves, and systems, in conformance with the component manufacturer's instructions and as specified in these Contract Documents.
 - b. Components having adjustable features are to be set carefully for the specific conditions and applications of this installation. Test and verify that components and/or systems are within the specified limits of accuracy.
 - c. Replace either individually or within a system, defective elements that cannot achieve proper calibration or accuracy.

- d. Calibration points:
 - 1) Calibrate each analog instrument at 0 percent, 25 percent, 50 percent, 75 percent, and 100 percent of span, using test instruments with accuracies traceable to NIST.
- e. Field verify calibration of instruments that have been factory-calibrated to determine whether any of the calibrations are in need of adjustment.
- f. Analyzer calibration:
 - 1) Calibrate and test each analyzer system as a workable system after installation. Follow the testing procedures directed by the manufacturers' technical representatives.
- g. Complete instrument calibration sheets for every field instrument and analyzer.
- h. Calibration tags:
 - 1) Attach a calibration and testing tag to each instrument, piece of equipment, or system.
 - 2) Sign the tag when calibration is complete.
- 4. Ultrasonic check out:
 - a. Check response under all operating conditions.
 - b. Track all responses through trend charts in the SCADA system.
 - c. Provide Echo Transmission and signal quality on all level transmitters including guided and unguided units.
 - 1) Provide printout of the actual transmission and all parameters.
- 5. Loop check/validation:
 - a. Check all control loops under simulated operating conditions by causing a range of input signals at the primary control elements and observing appropriate responses of the respective control and monitoring elements, final control elements, and the graphic displays associated with the SCADA system. Issue commands from the SCADA system and verify proper responses of field devices. Use actual process inputs wherever available.
 - b. Provide "end-to-end" tests:
 - 1) Test SCADA system inputs from field device to SCADA system operator workstations.
 - 2) Test SCADA system outputs from SCADA operator workstations to field devices and equipment.
 - 3) Observe and record responses at all intermediate devices.
 - 4) Test and record operator commands and signal readouts to each operator device where there is more than one operator interface point.
 - 5) For each signal, perform separate tests for SCADA computer screens, local operator interface (LOI) screens, and local control panels.
 - c. Retest any loop following any necessary corrections.
 - d. Specified accuracy tolerances for each analog network are defined as the square-root of the sum of the squares of individual component accuracy.
 - e. Apply simulated sensor inputs corresponding to 0 percent, 25 percent, 50 percent, 75 percent, and 100 percent of span for networks that incorporate analog elements, and monitor the resulting outputs to verify compliance to accuracy tolerance requirements.
 - f. Apply continuously variable up and down analog inputs to verify the proper operation and setting of discrete devices (signal trips, etc.).

- g. Apply provisional settings on controllers and alarm setpoints.
- h. Record all analog loop test data on test forms.
- i. Exercise each field device requiring an analog command signal, through the SCADA system. Vary, during the validation process, the output from the PLC SCADA system and measure the end device position, speed, etc. to confirm the proper operation of the device for the supplied analog signal. Manually set the output from the SCADA screen at 0 percent, 25 percent, 50 percent, 75 percent, and 100 percent and measure the response at the final device and at any intermediate devices.
- j. Exercise each field device providing a discrete input to the SCADA system in the field and observe the proper operation shall be observed at the operator workstation:
 - 1) Test limit switches, set limits mechanically, and observe proper operation at the operator workstation.
 - 2) Exercise starters, relay contacts, switch contacts, and observe proper operation.
 - 3) Calibrate and test instruments supplying discrete inputs, and observe proper operation.
- k. Test each device accepting a discrete output signal from the SCADA. Perform the appropriate operator action at the SCADA operator stations (including LOIs, if present) and confirm the proper operation of the field device:
 - 1) Exercise motors starters from the SCADA system and verify proper operation through direct field observation.
- l. Include in the test forms:
 - 1) Analog input devices:
 - a) Calibration range.
 - b) Calibration data: Input, output, and error at each test value.
 - c) Analog input associated PLC register address.
 - d) Value in PLC register at each test point.
 - e) Value displayed at each operator interface station (local operator interface displays and SCADA workstations).
 - 2) Discrete instrument input devices:
 - a) Switch setting, contact action, and dead band.
 - b) Operator interface switches (control stations and other pilot devices) and associated response.
 - c) Starter and drive auxiliary device contact response.
 - d) Response of all other discrete inputs to the PLC.
 - 3) Discrete output devices:
 - a) Observed response of field device to the discrete output from the PLC.
 - b) Observe the proper operation of Open, Close, Start, Stop, On, Off, etc.
 - 4) Test equipment used and associated serial numbers.

B. Functional Testing:

- 1. General:
 - a. Commence Functional tests after completion of all loop check/validation tests:
 - 1) As specified in Section 17050, Sequencing and Scheduling article.

- b. Functional to demonstrate proper operation of all systems with process equipment operating over full operating ranges under conditions as closely resembling actual operating conditions as possible.
 - c. Additional tests are specified in other Instrumentation and Control Sections.
 - d. Follow approved detailed test procedures and check lists for Functional Test activities.
2. Control logic operational validation:
- a. The purpose of control logic validation is to field test the operation of the complete control system, including all parts of the SCADA system, all control panels (including vendor control panels), all control circuits, all control stations, all monitored/controlled equipment, and final control elements.
 - b. Demonstrate all control functionality shown on the P&IDs, control schematics, and other drawings, and specified in the loop descriptions, control strategies, Electrical Specifications, and Mechanical Equipment Specifications.
 - c. Test in detail on a function-by-function and sentence-by-sentence basis.
 - d. Thoroughly test all hardware and software functions:
 - 1) Including all hardwired and software control circuit interlocks and alarms.
 - e. Test final control elements, controlled equipment, control panels, and ancillary equipment under startup, shut down, and steady-state operating conditions to verify all logic and control is achieved.
 - f. Control logic validation tests to include, but not limited to: a repeat of all control logic tests from the FAT, modified and expanded to include all field instruments, control panels, circuits, and equipment.
3. Loop tuning:
- a. Optimally tune software control logic incorporating proportional, integral, or derivative control. Apply control signal disturbances at various process variable levels and adjusting the gain, reset, or rate settings as required to achieve proper response.
 - b. Verify the transient stability of final control elements operating over the full range of operating conditions, by applying control signal disturbances, monitoring the amplitude and decay rate of control parameter oscillations and making necessary controller adjustments as required to eliminate excessive oscillatory amplitudes and decay rates. As a minimum, achieve 1/4 wave amplitude decay ratio damping (subsidence ratio of 4) under the full range of operating conditions.
 - c. If excessive oscillations or system instability occur, as determined by the Engineer, continue tuning and parameter adjustments, or develop and implement any additional control algorithms needed to achieve satisfactory control loop operation.
4. Functional validation sheets:
- a. Document each Functional test on an approved test form.
 - b. Document loop tuning with a report for each loop, including two-pen chart recordings showing the responses to step disturbance at a minimum of 3 setpoints or process rates approved by the Engineer. Show tuning parameters on the charts, along with time, date, and sign-off by Contractor and Engineer.

- c. Include on the form, functions which can be demonstrated on a loop-by-loop basis:
 - 1) Loop number and P&ID number.
 - 2) Control strategy, or reference to specification tested.
 - 3) Test procedures: Where applicable, use the FAT function-by-function, sentence-by-sentence loop test checklist forms modified to meet the requirements of the Functional test. Otherwise, create new forms.
 - 5. Functional certification:
 - a. Provide Manufacturer's Certificate of Installation and Functionality Compliance as specified in Section 01756:
 - 1) Including all test forms with test data entered, submitted to the Engineer with a clear and unequivocal statement that all Functional test requirements have been satisfied.
- C. Instrumentation and Controls Performance Testing:
- 1. After the Process Operational Period, test the PCIS for additional 60 days as specified in this Section to identify issues and make corrections, as needed.
 - 2. General:
 - a. The performance test is part of the Work that must be completed as a condition of substantial completion and final completion for the entire Project.
 - b. The complete PLC control and SCADA system must run continuously for the duration of the performance test.
 - c. Test and use the entire process control system under standard operating conditions.
 - d. Exercise all system functions.
 - e. Log failure, any system interruption and accompanying component, subsystem, or program failure including time of occurrence, duration of each failure, failure classification, and cause:
 - 1) Provide a competently trained technician or programmer on call for the Project Site during all normal working days and hours from the start of the performance test until final acceptance of the system:
 - a) Response time to the Project Site: 24 hours or less, for a major failure.
 - 3. SCADA system testing:
 - a. Exercise each system function, e.g., status report, alarms, logs, and displays several times at a minimum, and in a manner that approximates "normal" system operation.
 - b. Failure of the SCADA system during testing shall be considered as indicating that the programs and operating system do not meet the requirements of the specifications:
 - 1) Corrective action is required before restarting the performance test.
 - c. Only those components, sub-systems, and systems covered in this Section and supplied under this Contract shall be considered for this acceptance test. Problems and failures of other systems shall not be considered as part of this test, except as they display the capabilities of this system to detect failures.

4. Failures:
 - a. Classify failures as either major or minor:
 - 1) Minor failure:
 - a) A small and non-critical component failure or software problem that can be corrected by the Owner's operators.
 - b) Log this occurrence but this is not a reason for stopping the test and is not grounds for non-acceptance.
 - c) Should the same or similar component failure occur repeatedly, this may be considered as grounds for non-acceptance.
 - d) Failure of one printer or operator station is considered a minor failure providing all functions can be provided by backup equipment, i.e., alternate printers and operator station, and repairs can be made and equipment returned to service within 3 working days.
 - 2) Major failure:
 - a) Considered to have occurred when a component, subsystem, software control, or program fault causes a halt in or improper operation of the system and/or when a technician's work is required to make a repair or to re-initiate operation of the system.
 - b) Cause termination of the performance test.
 - c) Start a new acceptance test when the causes of a major failure have been corrected.
 - d) A failure is also considered major when failure of any control system that results in an overflow, underflow, overdose, or underdose condition occurs.
5. Technician report:
 - a. Each time a technician is required to respond to a system malfunction, they must complete a report, which includes details concerning the nature of the complaint or malfunction and the resulting repair action required and taken.
 - b. If a malfunction occurs which clears itself or which the operator on duty is able to correct, no report is required or logged as specified above.
 - c. If a technician has performed work but no report is written, then a major failure is considered to have occurred.
 - d. Each report shall be submitted within 24 hours to the Engineer and the Owner, or its representative.

3.08 FIELD QUALITY CONTROL (NOT USED)

3.09 ADJUSTING (NOT USED)

3.10 CLEANING (NOT USED)

3.11 PROTECTION (NOT USED)

3.12 SCHEDULES

A. Example test forms:

1. Example test forms are attached at the end of this Section. They may be used as a starting point for the development of Project-specific test forms for this Project.
2. The example test forms are not intended to be complete or comprehensive. Edit and supplement the forms to meet the requirements for testing and test forms specified in this Section and other Contract Documents.

END OF SECTION

FACTORY ACCEPTANCE TEST – CONTROL PANELS

1. GENERAL INSPECTION

A. Structural Inspection

- Verify Lifting Lugs Installed
- Verify enclosure has lock and lock is functional
- Confirm that seismic bracing components are provided per manufacturer's installation instructions

B. Exterior Inspection

- Cabinet exterior is clean, scratch, and dent free
- Inspect externally for corrosion and damage
- Verify enclosure door opens and closes easily
- Verify enclosure has a 3-point latch
- Verify enclosure has a flange mounted disconnect (where voltages greater than 120 VAC enter the cabinet)
- Verify enclosure has the appropriate NEMA rating (1, 1G, 12, 3R, 4, 4X, etc.)
- Verify enclosure is the appropriate size (not grossly larger than design, and will still fit in the plant)

Nameplates

- Cabinet has identification nameplate
- All door labels are straight, spelled correctly, and match the tagging defined in the Contract
- Cabinet has a nameplate that includes the following:
 - Power source(s)
 - Integrator's Logo
 - Circuit ID(s)
 - Short Circuit KAIC ratings
- If labels are screwed to door, silicone was utilized to cover screw holes (Labels screwed to the door of a NEMA 4/4X panel technically violates the NEMA rating.)

Door Devices

- All devices penetrating the outside of panel have gaskets, silicone or both
- All door devices are installed (HMIs, Pilot Devices, etc.)
- Door mounted equipment is mounted straight and square
- All exterior or door mounted equipment present and accounted for, installed and securely fastened
- NEMA classification has not been violated due to penetrations
- Door mounted equipment has the same NEMA rating as the panel
- All door mounted equipment installed at the correct height
- All door mounted equipment installed in the correct positions and order (layout of door mounted equipment is grouped properly and in a logical manner)
- Doors with multiple penetrations have adequate bracing (if needed)
- Visually check condition of indicators , controllers and annunciators
- Check that pilot lights illuminate correctly
- Check the Push-To-Test function
- Ensure correct pilot light color

Peripheral Devices

- Horn / Beacon is installed (where required)
- Silence and Reset pushbutton

PROJECT NAME: _____	TEST DATE: _____
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WITNESSED BY: _____	SIGNATURE: _____

FACTORY ACCEPTANCE TEST – CONTROL PANELS

1. GENERAL INSPECTION (continued)

C. Interior Inspection

- Cabinet is cleaned of marks and dirt.
- Inspect internally for corrosion and damage.
- Back panel is clean of marks and dirt.
- Interior of panel vacuumed and shall be free of all debris.
- Check that the panel roof is clean and clear of foreign materials.
- Bottom of panel has been cut out (where bottom entry is required), with angle iron welded around the bottom perimeter. Re-painting has been performed.
- If internal light door limit switch is provided, ensure the light automatically turns "on" when the doors are open.
- Intrusion alarms (where required).

Interior Labeling

- All panel mounted equipment has identification labeling, by using either a Brothers or Phenolic type tags.
- Verify that door mounted components are mounted square and symmetrical.
- Verify that nameplates are straight, legible, and spelled correctly.
- All terminal blocks are identified/labeled with permanent labels including tight end blocks and caps.
- All wiring shrink labeled and or phased correctly to the specifications.
- All wire labels shrunk completely rotated and aligned alike for easy identification.
- All fuses and circuit breakers are labeled with ID and current rating.
- System Integrator's label or labels installed on door.
- Panel manufacturer model/serial number tag is present.
- All required safety/warning tags installed and straight.
- Correct UL (typically UL 508) or cUL tag installed and registered and all other associated tags installed and straight (the UL tag might not be installed in the panel at the factory test. If the panel is modified due to changes during the factory test or a punch list generated from the factory test, the UL labeling would need to be re-applied. Some UL shops do not apply the UL label until the panel is released to be shipped.).

Wireways

- Plastic wire way covers installed properly.
- Plastic wireways have no sharp edges.
- No wire Ties inside the wireways.
- No sharp edges on wire ties.
- Separation: White duct is used for DC voltages, Gray duct is used for AC voltages.
- Ensure wiring duct is not over-full, includes provision for 20% more wiring and the cover may easily be installed. Panduit recommends 50% duct fill, but 40% is a better practice.

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FACTORY ACCEPTANCE TEST – CONTROL PANELS

1. GENERAL INSPECTION (continued)

C. Interior Inspection (continued)

Wiring

- Visually check terminals and condition of internal wirings
- Verify that the control panel has been assembled and wired as designed
- Verify that all components are operational and perform the functions intended
- Verify that all components are sized appropriately for the application
- Verify that equipment control circuits function as intended
- Back of door wiring is labeled and neatly formed
- Back panel to door wiring has sufficient bending radius with spiral wrap
- Wire connection has been verified wired to correct points within the panel
- Individual wires have been given a pull test to verify a good terminal connection
- Wire and cable minimum bending radius have not been violated
- All equipment installed straight and square to back panel
- Wire colors are correct:
 - Black and White > AC hot and neutral, respectively
 - Red > AC control signals
 - Blue > DC power and control (Blue w/White stripe for DC ground)
 - Yellow > Foreign voltages (those still present when panel power is disconnected)
 - Green > AC equipment ground
 - Black > TSP (+)
 - White > TSP(-)
- Analog wiring shields are continuous (connected by a dedicated terminal block for such shields)
- Analog shield wires are grounded within the panel, where not otherwise grounded at the transmitter itself
- Discrete inputs are separately fused or protected by a circuit breaker on a "per loop" basis
- Intrinsic Safety Wiring
 - Ensure wiring associated with intrinsic safety circuits or intrinsic safety barriers is kept away from all other wiring by UL minimum distances or by a physical (grounded metal) barrier preventing non-intrinsically safe wiring from coming in contact with intrinsically safe circuits or wiring
- Verify all spare terminals are installed according to the percentage listed in the specifications

Grounding

- Equipped with "Blackburn" or other grounding type lug
- Lug is securely fastened to the panel structure
- Verify Grounding bar is installed
- Verify Isolated ground bar is installed

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FACTORY ACCEPTANCE TEST – CONTROL PANELS

2. POWER TEST

A. AC Power

- AC Power is routed correctly within the panel, and is isolated from DC and network wiring.
- All fuses are installed and sized properly.
- All breakers are installed and sized properly.
- 24 VDC Power Supplies are functional.
- 24 VDC Power fail contacts are functional.
- 24 VDC power supplies are redundant, and have diode modules enabling the hot swap-over between supplies.
 - 24 VDC supplies are equipped with dry contact failure alarms, wired as PLC inputs to signal failure of any DC power supply. Such alarm inputs to the PLC have been tested as being functional.
- Dedicated receptacle is wired to receive a dedicated AC supply.
- Verify continuity for all DC commons, ground and AC neutrals.
- Verify that the CP temporary input power is connected correctly and is the correct voltage.
- Close the CP main circuit breaker(s).
- Verify that voltages at subsequent circuit breakers are correct.
- Close circuit breakers.
- Verify that power feeding interruptible and uninterruptible power supplies is correct.
- Turn on power supplies if they are not already on.
- Verify that voltages at distribution terminals are correct.
- Energize any remaining hardware such as the PLC.

B. Uninterruptible Power Supply (UPS)

- Mounted appropriately within the cabinet, on a dedicated shelf, or rear of a swing-out sub panel.
- Is equipped with maintenance bypass switch (or at least plug/receptacle means for bypassing the unit).
- Test all UPS alarms (on inverter, failure, battery failure etc.)
- Turn off the AC power supply and verify that the UPS will be switched on to supply the designated vital loads in the control panel.

3. CONTROLS & AUXILIARY DEVICES TEST

- Verify all interposing and auxiliary relays are functioning.
- Verify panel lights are functioning.

Ventilation and Heating

- If ventilation fans are fitted , check the fans operate correctly any associated air filters are clean and not blocked.
- Verify components are installed in the correct orientation for proper air flow.

4. HARDWIRED INTERLOCK AND SAFETY TEST

- Verify that hardwired interlocks through the control panel as shown on schematic drawings are functioning. For example, outlet high pressure switch interlock to a pump.
- Verify that all hardwired safety devices through the control panel is functioning. For example, the pull cord emergency stops of conveyors.

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FACTORY ACCEPTANCE TEST – CONTROL PANELS

5. PLC TEST

A. Components

- PLC interior High Temperature alarm is installed, wired to the PLC, and is shown to be functional.
- Relays have transient suppression across their coils. This is particularly important for DC coil relays, where diodes in reverse polarity are often used.
- TVSS is installed across the main incoming 120 VAC.

PLC and PLC Rack

- Verify all cards are securely seated.
- Ensure clearance around PLC rack has been met, such that convective heat transfer is not impeded by devices erroneously mounted in the “no encroachment” area. Confirm with manufacturer clearance recommendations.

B. PLC I/O Test

- Furnish **I/O test forms** and test all the listed input and output points as follows:
 - Discrete Inputs: Simulate a field contact closure by “shorting” across the appropriate terminal blocks. Observe the transition between a logical “0” and “1” in the PLC software.
 - Discrete Outputs: Force the output bit to toggle between logical “0” and logical “1” using the PLC software. Measure contact resistance at the wired terminal blocks using a digital meter selected for the “ohms” setting.
 - Analog Inputs: Connect a signal generator to the appropriate terminal blocks. Tailor the connection depending on whether a 2-wire or 4-wire simulation is required. Modulate the 4-20mA signal. Observe the associated PLC internal memory register to transition between 0-65535 or if scaled in engineering units, between 0 and the maximum scaled engineering unit. The latter method is preferred.
 - Analog Outputs: Force the output register to a value between 0-65535 or 0-100%, if the scaling block can be manipulated. Observe the measured 4-20mA value increment and decrement using a digital ammeter.

C. Redundant Controllers (where required) Test

- Remove Communication cable from PLC-1 to verify switching to PLC-1A
- Remove Communication cable from PLC-1A to verify switching back to PLC-1
- Remove Power from PLC-1 to verify switching to PLC-1A
- Remove Power from PLC-1A to verify switching to PLC-1
- Remove Communication cable from PLC-1 to I/O rack and verify switching to PLC-1A
- Remove Communication cable from PLC -1A to I/O rack and verify switching to PLC-1

D. PLC Control Logic Verification

- The PLC control strategy is verified by following the Control Logic Verification Form based on the specifications. Each control strategy will be verified by simulating the process and checking the state or value of PLC outputs. The results of equipment status and alarms and process instrument values and trends shall also be verified on the Plant SCADA graphic screens stored in a temporary SCADA computer. Since all PLC input and output wiring has been verified and some field devices are not available during Factory Acceptance Testing, certain inputs will be simulated either by means of additional hardware and/or software as described below.
 - DI states are either simulated by hardwired switches or forced inputs using a programming terminal.
 - For example, when starters and drives are not provided as part of the contract, jumpers may be installed from the output call relays to the running confirmation inputs to simulate the running state of the motors.
 - AI values are either simulated by an external source or within software using a programming terminal.
 - For example, when a level transducer is not provided as part of the contract the level transducer loop current may be simulated with a loop powered potentiometer and adjusted manually for the level input.

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FACTORY ACCEPTANCE TEST – CONTROL PANELS

5. PLC TEST (continued)

D. PLC Control Logic Verification (continued)

Typical Fault Logic

- If the fault input is high and the disable (if applicable) for the fault is not high and the common disable (if applicable) is not high begin timing. If any of these conditions changes, stop timing and reset the timer. If the timer reaches its preset, activate the alarm output. If the fault alarm is a shutdown alarm stop the associated motor and latch the alarm so that it remains present even if the condition clears.
- The fault condition must return to normal and the alarm must be reset for a latched alarm to clear.

Typical Fail to Start Logic

- If the motor is called to run (call output high) and no running feedback is received (running input is low) and the fail to start and common alarm disables (if applicable) are not high start timing. If any of these conditions changes, stop timing and reset the timer. If the timer reaches its preset, activate the alarm output, stop calling the motor and latch the alarm.

6. HMI OR OIT TEST

HMI / OIT Functionality

- Communication with PLC
- Screen Layouts
- Screen Navigation
- Set Point Entry
- Animation
- Color Correctness (Green=Run, Red=Off, Amber=Alarm, or the agreed upon convention)
- Alarms
- Acknowledge and Reset
- Security / Access Levels / Passwords

7. NETWORK COMMUNICATION TEST

A. Network Components

- Fiber optic cabling terminates in a patch panel
- Media converters are installed and functional
- Terminating resistors have been installed for trunk/tap topologies or where required
- Wire and cable bending limitations have not been violated

B. Networking Functions

- Verify data transfer via the network to different PLCs as shown on the Network Block Diagrams
- Verify network traffic rate and error margin is acceptable

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FACTORY ACCEPTANCE TEST – CONTROL PANELS

8. FAT DOCUMENTATION AND RECORD

Panel Documentation

- As-built panel drawings showing actual panel construction and devices arrangement and c/w Bill of Material.
- Panel schematic and interconnection drawings.
- P&ID drawings and schematic drawings for the process area controlled by the panel that is to be tested.
- I/O list test forms of the process area to be tested.
- FAT procedure of the process area to be tested.
- Test record forms of the process area to be tested. Forms shall include area for signature of responsible test personnel.
- Hard copy of the PLC application program of the process area to be tested.
- Hard copy of the HMI/OIT graphic screens of the process area to be tested.

9. FAT TOOLS AND SOFTWARE

- Simulation software if required
- Digital volt meter Fluke 87
- Process meter Fluke 787
- Laptop computer with PLC application program
- Temporary SCADA computer with HMI software and applicable graphic screens
- Jumper wires

PROJECT NAME: _____	TEST DATE: _____
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	INSTALLATION AND CERTIFICATION CHECKLIST DOCUMENTATION	
--	---	--

INSTRUMENT LOOP NO. _____

SERVICE DESCRIPTION _____

A COPY OF LATEST ISSUE OF THE FOLLOWING DOCUMENTS ARE INCLUDED IN THIS INSTRUMENT INSTALLATION CERTIFICATION FILE:

- INSTRUMENT SPECIFICATION SHEETS (FOR ALL INSTRUMENTS IN THE LOOP)
- INSTRUMENT INSTALLATION DETAILS (FOR ALL INSTRUMENTS IN THE LOOP)
- INSTRUMENT LOOP WIRING DIAGRAMS
- INSTRUMENT INSTALLATION CERTIFICATION CHECKLIST
- SIZING CALCULATIONS
- INSTRUMENT INSTALLATION SCHEDULE (APPLICABLE PART)
- NAMEPLATE SCHEDULE (APPLICABLE PART)
- VENDOR LITERATURE CALIBRATION INFORMATION

INSTRUMENT LOOP IS PART OF EQUIPMENT START-UP/SHUTDOWN INTERLOCKS? No Yes

REMARKS: _____

CHECKED BY (COMPANY) _____ ACCEPTED BY (COMPANY) _____

SIGNATURE _____ SIGNATURE _____

DATE		DATE
	SWITCHES INSTALLATION AND CALIBRATION CHECKLIST	

INSTRUMENT LOOP NO. _____

SERVICE DESCRIPTION _____

CHECK BELOW, WHEN COMPLETED:

- BENCH CALIBRATED PER SPECIFICATION SHEET NO. _____
- VERIFIED PER P&ID NO. _____
- CORRESPONDS TO SPECIFICATION SHEET NO. _____
- WIRING CORRECT PER INSTRUMENT LOOP DRAWING NO. _____
- INSTALLATION CORRECT PER DETAIL NO. _____
- ACCESSORIES ARE PRESENT AND PROPERLY INSTALLED
- INSTRUMENT IS ACCESSIBLE FOR MAINTENANCE OR REMOVAL
- ENGRAVED LAMINATED NAMEPLATE (NO SPELLING ERRORS) PERMANENTLY INSTALLED

INSTRUMENT LOOP IS PART OF EQUIPMENT START-UP/SHUTDOWN INTERLOCKS? No Yes

FIELD CALIBRATION CHECK

CONTACT NO.	FUNCTION	FOR SIGNAL	CONTACT IS TO	AT SPECIFIED VALUE FOR	ACTUAL TRIP POINT WAS
1	<input type="checkbox"/> ALARM	<input type="checkbox"/> INCR	<input type="checkbox"/> OPEN	SET PT = _____	SET PT = _____
	<input type="checkbox"/> S/D PERM	<input type="checkbox"/> DECR	<input type="checkbox"/> CLOSE	RESET = _____	RESET = _____
2	<input type="checkbox"/> ALARM	<input type="checkbox"/> INCR	<input type="checkbox"/> OPEN	SET PT = _____	SET PT = _____
	<input type="checkbox"/> S/D PERM	<input type="checkbox"/> DECR	<input type="checkbox"/> CLOSE	RESET = _____	RESET = _____
3	<input type="checkbox"/> ALARM	<input type="checkbox"/> INCR	<input type="checkbox"/> OPEN	SET PT = _____	SET PT = _____
	<input type="checkbox"/> S/D PERM	<input type="checkbox"/> DECR	<input type="checkbox"/> CLOSE	RESET = _____	RESET = _____
4	<input type="checkbox"/> ALARM	<input type="checkbox"/> INCR	<input type="checkbox"/> OPEN	SET PT = _____	SET PT = _____
	<input type="checkbox"/> S/D PERM	<input type="checkbox"/> DECR	<input type="checkbox"/> CLOSE	RESET = _____	RESET = _____

NOTE: PERM IS ABBREVIATION FOR PERMISSIVE

	SWITCHES INSTALLATION AND CALIBRATION CHECKLIST	
--	--	--

REMARKS: _____

CHECKED BY (COMPANY) _____ ACCEPTED BY (COMPANY) _____

SIGNATURE _____ SIGNATURE _____

DATE _____ DATE _____

	TRANSMITTER/CONTROLLER/INDICATOR INSTALLATION AND CALIBRATION CHECKLIST		
--	--	--	--

INSTRUMENT LOOP IS PART OF EQUIPMENT START-UP/SHUTDOWN INTERLOCKS?

No Yes

INSTRUMENT TYPE
INDICATOR

- TRANSMITTER CONTROLLER
 OTHER DESCRIPTION _____

INSTRUMENT TAG NO. _____ SERIAL NO. _____

SERVICE DESCRIPTION _____

BENCH CALIBRATION CHECK				
INPUT RANGE = _____		OUTPUT RANGE = _____		
HEAD CORRECTION = _____		<input type="checkbox"/> LINEAR		
CALIBRATED SPAN = _____		<input type="checkbox"/> SQUARE ROOT		
% CALIB SPAN	DESIRED VALUE	ACTUAL VALUE	EXPECTED VALUE	ACTUAL VALUE
0				
50				
100				

CHECK BELOW, WHEN COMPLETED:

- BENCH CALIBRATED PER SPECIFICATION SHEET NO. _____
- VERIFIED PER P&ID NO. _____
- CORRESPONDS TO SPECIFICATION SHEET NO. _____
- WIRING CORRECT PER INSTRUMENT LOOP DRAWING NO. _____
- INSTALLATION CORRECT PER DETAIL NO. _____
- ACCESSORIES ARE PRESENT AND PROPERLY INSTALLED
- INSTRUMENT IS ACCESSIBLE FOR MAINTENANCE OR REMOVAL
- ENGRAVED LAMINATED NAMEPLATE (NO SPELLING ERRORS) PERMANENTLY INSTALLED

FIELD CALIBRATION CHECK				
INPUT RANGE = _____		OUTPUT RANGE = _____		
% CALIB SPAN	DESIRED VALUE	ACTUAL VALUE	EXPECTED VALUE	ACTUAL VALUE
0				
50				
100				

	TRANSMITTER/CONTROLLER/INDICATOR INSTALLATION AND CALIBRATION CHECKLIST	
--	--	--

- DIRECT REVERSE
 ACTION VERIFIED AT 50% SPAN
 ACTION VERIFIED AT _____ SPAN

CONTROLLER SETTINGS								
SETTING	GAIN	PB	RESET (INTEGRAL)	DERIV. (RATE)	HIGH LIMIT	LOW LIMIT	ELEV. ZERO	ZERO SUPP
PRE-TUNE								
POST-TUNE								

PRE-TUNE SETTINGS					
	GAIN	PB	RESET (REPEAT/MIN)	RESET (MIN/REPEAT)	DERIVATION (MINUTES)
FLOW	1.0	100	10	0.1	N/A
LEVEL	1.0	100	MIN.	MAX.	N/A
PRESSURE	2.0	50	2.0	0.5	N/A
TEMP.	4.0	25	0.1	10	OFF

REMARKS _____

CHECKED BY (COMPANY) _____ ACCEPTED BY (COMPANY) _____

SIGNATURE _____ SIGNATURE _____

DATE _____ DATE _____

	ANALYZERS INSTALLATION AND CALIBRATION CHECKLIST	
--	---	--

INSTRUMENT LOOP IS PART OF EQUIPMENT START-UP/SHUTDOWN INTERLOCKS?

No Yes

TYPE OF INSTRUMENT _____

INSTRUMENT TAG NO. _____ SERIAL NO. _____

SERVICE DESCRIPTION _____

CHECK BELOW, IF TRUE

- BENCH CALIBRATED PER SPECIFICATION SHEET NO. _____
- VERIFIED PER P&ID NO. _____
- CORRESPONDS TO SPECIFICATION SHEET NO. _____
- WIRING CORRECT PER INSTRUMENT LOOP DRAWING NO. _____
- INSTALLATION CORRECT PER DETAIL NO. _____
- ACCESSORIES ARE PRESENT AND PROPERLY INSTALLED
- INSTRUMENT IS ACCESSIBLE FOR MAINTENANCE OR REMOVAL
- ENGRAVED LAMINATED NAMEPLATE (NO SPELLING ERRORS) PERMANENTLY INSTALLED

REMARKS _____

CHECKED BY (COMPANY) _____ ACCEPTED BY (COMPANY) _____

SIGNATURE _____ SIGNATURE _____

DATE _____ DATE _____

	CONTROL VALVES INSTALLATION AND CALIBRATION CHECKLIST	
--	--	--

INSTRUMENT LOOP IS PART OF EQUIPMENT START-UP/SHUTDOWN INTERLOCKS?

No Yes

- VALVE TAG NO. _____ SERIAL NO. _____
- TRANSDUCER TAG NO. _____ SERIAL NO. _____
- SOLENOID TAG NO. _____ SERIAL NO. _____
- VOLUME BOOSTER TAG NO. _____ SERIAL NO. _____
- POSITIONER _____ SERIAL NO. _____

SERVICE DESCRIPTION _____

TRANSDUCER CHECK					
INPUT RANGE =			OUTPUT RANGE =		
CALIBRATED SPAN =			CALIBRATED SPAN =		
BENCH					
SPAN	DESIRED	ACTUAL	SPAN	EXPECTED	ACTUAL
0%			0%		
50%			50%		
100%			100%		
FIELD					
SPAN	DESIRED	ACTUAL	SPAN	EXPECTED	ACTUAL
0%			0%		
50%			50%		
100%			100%		

CHECK BELOW, IF TRUE:

- BENCH CALIBRATED PER ABOVE _____
- VERIFIED PER P&ID NO. _____
- CORRESPONDS TO SPECIFICATION SHEET NO. _____
 - VALVE SPECIFICATION NO. _____
 - TRANSDUCER SPECIFICATION NO. _____
 - SOLENOID SPECIFICATION NO. _____
- WIRING CORRECT PER INSTRUMENT LOOP DRAWING NO. _____
- INSTALLATION CORRECT PER INSTRUMENT INSTALLATION DETAILS _____
 - VALVE DETAIL NO. _____
 - TRANSDUCER DETAIL NO. _____
 - SOLENOID DETAIL NO. _____

	CONTROL VALVES INSTALLATION AND CALIBRATION CHECKLIST	
--	--	--

- ACCESSORIES ARE PRESENT AND PROPERLY INSTALLED
- INSTRUMENT IS ACCESSIBLE FOR MAINTENANCE OR REMOVAL
- ENGRAVED LAMINATED NAMEPLATE (NO SPELLING ERRORS) PERMANENTLY INSTALLED

VALVE CHECK			
--------------------	--	--	--

FLOW CHECK	<input type="checkbox"/> PROCESS FLOW DIRECTION THROUGH THE VALVE IS CORRECT		
SAFETY CHECK	ON LOSS OF AIR VALVE FAILS <input type="checkbox"/> OPEN <input type="checkbox"/> CLOSE	ON LOSS OF POWER SOLENOID FAILS <input type="checkbox"/> TO VENT <input type="checkbox"/> TO VALVE	
TRAVEL CHECK	FULL OPEN AT _____ PSI	FULL CLOSED AT _____ PSI	MEASURED TRAVEL _____ INCHES
SEATING CHECK	<input type="checkbox"/> ON BENCH <input type="checkbox"/> IN-LINE	RESULTS	ACTUATOR BENCH SET

POSITIONER CHECK			
-------------------------	--	--	--

VALVE FULL OPEN AT _____	PSI TO POSITIONER		
VALVE FULL CLOSED AT _____	PSI TO POSITIONER		

VOLUME BOOSTER CHECK			
-----------------------------	--	--	--

BYPASS VALVE (GAIN) ADJUSTING SCREW BACKED OUT _____ TURNS FROM CLOSED TO ENSURE QUICK BUT STABLE OPERATION (TYPICALLY 1-1/2 TO 2 TURNS)
--

REMARKS _____

CHECKED BY (COMPANY) _____ ACCEPTED BY (COMPANY) _____

SIGNATURE _____ SIGNATURE _____

DATE _____ DATE _____

DEVICENET INSTALLATION TESTING

DeviceNet Network _____

Network Installation Characteristics

- | <u>Architecture</u> | <u>Baud Rate</u> | <u>Trunk Media</u> | <u>Drop Media</u> |
|---|------------------------------------|--------------------------------------|--|
| <input type="checkbox"/> Single Master | <input type="checkbox"/> 125 kBaud | <input type="checkbox"/> Thick Round | <input type="checkbox"/> Thick Round, Unshielded |
| or | | | |
| <input type="checkbox"/> Multi Master | <input type="checkbox"/> 250 kBaud | <input type="checkbox"/> Thin Round | <input type="checkbox"/> Thin Round, Shielded |
| <input type="checkbox"/> Redundant Power Supplies | <input type="checkbox"/> 500 kBaud | | <input type="checkbox"/> Thick Round, Shielded |
| <input type="checkbox"/> Per Network | | | |

Installed Node List

- 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63
- All nodes present and in accordance with network drawings/specifications ODVA approved devices
 Nodes/devices accessible for inspection and maintenance Nodes/devices properly addressed

Comments: _____

Media Inspection

- | <u>Trunk Cable</u> | <u>Drop Cable</u> | <u>Installation</u> |
|--|---|--|
| <input type="checkbox"/> ODVA approved | <input type="checkbox"/> ODVA approved | <input type="checkbox"/> No evidence of physical damage |
| <input type="checkbox"/> Labeling complete | <input type="checkbox"/> Labeling complete | <input type="checkbox"/> Installed in protective raceway |
| <input type="checkbox"/> Cable/conductor terminations | <input type="checkbox"/> Cable/conductor terminations | <input type="checkbox"/> Bending radius not exceeded |
| <input type="checkbox"/> Terminating resistors at ends | <input type="checkbox"/> Maximum drop length < 20' | <input type="checkbox"/> Cable supports in place |
| | | <input type="checkbox"/> V- and shield are grounded |
| | | <input type="checkbox"/> Clearance from high temperature/voltage sources |
| | | <input type="checkbox"/> No installation subject to vibration |

Comments: _____

Network Power Supplies

Power Supply Equipment

- ODVA compliant
- Quantity and ratings

Supply Source (120 VAC)

- Overcurrent protection
- Conductor size

Network Power Tap (24 VDC)

- Overcurrent protection
- Conductor size

Comments:

CHECKED BY (COMPANY)

ACCEPTED BY
(COMPANY)

SIGNATURE

SIGNATURE

DATE

DATE

**PROFIBUS
INSTALLATION QUALIFICATION AND TESTING**

General Network Description

The Profibus network serves the RO pretreatment, blended water, and concentrate processes and consists of both DP and PA slave devices. The master is located in programmable logic controller, PLC-900. Profibus DP repeaters are deployed in the network to essentially support a radial network topology from each process control panel.

Network Design Characteristics

ARCHITECTURE	BAUD RATE (kbits/sec)		
MASTER <input type="checkbox"/> SINGLE <input type="checkbox"/> REDUNDANT	<input type="checkbox"/> 9.6	<input type="checkbox"/> 187.5	<input type="checkbox"/> 3,000
TOTAL NODE COUNT ≤ 126 <input type="checkbox"/>	<input type="checkbox"/> 19.2	<input type="checkbox"/> 50	<input type="checkbox"/> 6,000
REPEATER COUNT _____	<input type="checkbox"/> 93.75	<input type="checkbox"/> 1,500	<input type="checkbox"/> 12,000
CASCADED REPEATER COUNT <9 _____			
NODE COUNT PER DP SEGMENT <32 <input type="checkbox"/>			
DP/PA SEGMENT COUPLERS _____			
REDUNDANCY (DP/PA COUPLERS) _____			
ACTIVE TERMINATORS <input type="checkbox"/>			
PROFIBUS DIAGNOSTICS <input type="checkbox"/> PA ONLY <input type="checkbox"/> DP & PA			
SURGE PROTECTION FOR SLAVES LOCATED OUTSIDE <input type="checkbox"/>			
SURGE PROTECTION FOR MEDIA ENTERING THE CONTROLLER CABINET <input type="checkbox"/>			
INTRINSIC SAFETY WIRING: REQUIRED FOR ANY PA NETWORK <input type="checkbox"/>			

INSTALLED NODE LIST

<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7	<input type="checkbox"/> 8	<input type="checkbox"/> 9	<input type="checkbox"/> 10	<input type="checkbox"/> 11	<input type="checkbox"/> 12	<input type="checkbox"/> 13	<input type="checkbox"/> 14	<input type="checkbox"/> 15
<input type="checkbox"/> 16	<input type="checkbox"/> 17	<input type="checkbox"/> 18	<input type="checkbox"/> 19	<input type="checkbox"/> 20	<input type="checkbox"/> 21	<input type="checkbox"/> 22	<input type="checkbox"/> 23	<input type="checkbox"/> 24	<input type="checkbox"/> 25	<input type="checkbox"/> 26	<input type="checkbox"/> 27	<input type="checkbox"/> 28	<input type="checkbox"/> 29	<input type="checkbox"/> 30	<input type="checkbox"/> 31
<input type="checkbox"/> 32	<input type="checkbox"/> 33	<input type="checkbox"/> 34	<input type="checkbox"/> 35	<input type="checkbox"/> 36	<input type="checkbox"/> 37	<input type="checkbox"/> 38	<input type="checkbox"/> 39	<input type="checkbox"/> 40	<input type="checkbox"/> 41	<input type="checkbox"/> 42	<input type="checkbox"/> 43	<input type="checkbox"/> 44	<input type="checkbox"/> 45	<input type="checkbox"/> 46	<input type="checkbox"/> 47
<input type="checkbox"/> 48	<input type="checkbox"/> 49	<input type="checkbox"/> 50	<input type="checkbox"/> 51	<input type="checkbox"/> 52	<input type="checkbox"/> 53	<input type="checkbox"/> 54	<input type="checkbox"/> 55	<input type="checkbox"/> 56	<input type="checkbox"/> 57	<input type="checkbox"/> 58	<input type="checkbox"/> 59	<input type="checkbox"/> 60	<input type="checkbox"/> 61	<input type="checkbox"/> 62	<input type="checkbox"/> 63
<input type="checkbox"/> 64	<input type="checkbox"/> 65	<input type="checkbox"/> 66	<input type="checkbox"/> 67	<input type="checkbox"/> 68	<input type="checkbox"/> 69	<input type="checkbox"/> 70	<input type="checkbox"/> 71	<input type="checkbox"/> 72	<input type="checkbox"/> 73	<input type="checkbox"/> 74	<input type="checkbox"/> 75	<input type="checkbox"/> 76	<input type="checkbox"/> 77	<input type="checkbox"/> 78	<input type="checkbox"/> 79
<input type="checkbox"/> 80	<input type="checkbox"/> 81	<input type="checkbox"/> 82	<input type="checkbox"/> 83	<input type="checkbox"/> 84	<input type="checkbox"/> 85	<input type="checkbox"/> 86	<input type="checkbox"/> 87	<input type="checkbox"/> 88	<input type="checkbox"/> 89	<input type="checkbox"/> 90	<input type="checkbox"/> 91	<input type="checkbox"/> 92	<input type="checkbox"/> 93	<input type="checkbox"/> 94	<input type="checkbox"/> 95
<input type="checkbox"/> 96	<input type="checkbox"/> 97	<input type="checkbox"/> 98	<input type="checkbox"/> 99	<input type="checkbox"/> 100	<input type="checkbox"/> 101	<input type="checkbox"/> 102	<input type="checkbox"/> 103	<input type="checkbox"/> 104	<input type="checkbox"/> 105	<input type="checkbox"/> 106	<input type="checkbox"/> 107	<input type="checkbox"/> 108	<input type="checkbox"/> 109	<input type="checkbox"/> 110	<input type="checkbox"/> 111
<input type="checkbox"/> 112	<input type="checkbox"/> 113	<input type="checkbox"/> 114	<input type="checkbox"/> 115	<input type="checkbox"/> 116	<input type="checkbox"/> 117	<input type="checkbox"/> 118	<input type="checkbox"/> 119	<input type="checkbox"/> 120	<input type="checkbox"/> 121	<input type="checkbox"/> 122	<input type="checkbox"/> 123	<input type="checkbox"/> 124	<input checked="" type="checkbox"/> R 125	<input checked="" type="checkbox"/> R 126	<input type="checkbox"/> 127

ALL NODES PRESENT IN ACCORDANCE WITH NETWORK DESIGN DOCUMENTS.

LEGEND

- M** MASTER NODE PRESENT AT THIS ADDRESS
- D** PROFIBUS DP NODE PRESENT AT THIS ADDRESS
- P** PROFIBUS PA NODE PRESENT AT THIS ADDRESS
- R** RESERVED ADDRESS
- NO DEVICE PRESENT AT THIS ADDRESS

COMMENTS (Comments referenced by number. Refer to the Comments, Observations, and Recommendations Summary.)

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

PROJECT NAME: _____	TEST DATE: _____
FACILITY NAME: _____	TESTED BY: _____
PROCESS AREA: _____	COMPANY: _____
NETWORK ID: _____	PAGE: _____
WITNESSED BY: _____	SIGNATURE: _____

PROFIBUS INSTALLATION QUALIFICATION AND TESTING

Media Inspection

CABLING	DP NETWORK	PA NETWORK SEGMENTS				
PI COMPLIANT	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
LABELING COMPLETE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GROUNDING	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CABLE AND CONDUCTOR TERMINATIONS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
NO STUB LINES (DP ONLY)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TERMINATING RESISTORS (IN PLACE)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DEDICATED DIAGNOSTICS BUS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
INSTALLATION						
NO EVIDENCE OF PHYSICAL DAMAGE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
INSTALLATION IN PROTECTIVE RACEWAY	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CLEARANCES FROM HIGH TEMPERATURE SOURCES	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CLEARANCES FROM HIGH VOLTAGE SOURCES	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
BEND RADIUS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
NO INSTALLATION SUBJECT TO VIBRATION, SHOCK, HIGH FLEX, CHEMICALS, OR MOISTURE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TERMINATING RESISTORS TURNED ON AT CORRECT LOCATION	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<u>COMMENTS</u> (Comments referenced by number. Refer to the Comments, Observations, and Recommendations Summary.)						
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Device Inspection

DEVICE QUANTITY/TYPE	INSTALLATION
<input type="checkbox"/> TOTAL SLAVE COUNT	<input type="checkbox"/> NO EVIDENCE OF PHYSICAL DAMAGE
<input type="checkbox"/> MOST UPDATED DEVICE DRIVER INSTALLED?	<input type="checkbox"/> ACCESSIBLE FOR INSPECTION AND MAINTENANCE
<input type="checkbox"/> INSTALLED DEVICES COMPLY WITH DRAWINGS AND SPECIFICATIONS	<input type="checkbox"/> FDT COMPLIANT DEVICES
<input type="checkbox"/> PI COMPLIANCE DEVICES	
<input type="checkbox"/> DIAGNOSTICS MODULE INSTALLED	
<u>COMMENTS</u> (Comments referenced by number. Refer to the Comments, Observations, and Recommendations Summary.)	
<input type="text"/>	<input type="text"/>

Power Supplies

ACTIVE TERMINATIONS	COUPLERS	REPEATERS
<input type="checkbox"/> SOURCE LOCATION	<input type="checkbox"/> SOURCE LOCATION	<input type="checkbox"/> SOURCE LOCATION
<input type="checkbox"/> OVERCURRENT PROTECTION	<input type="checkbox"/> OVERCURRENT PROTECTION	<input type="checkbox"/> OVERCURRENT PROTECTION
<input type="checkbox"/> CONDUCTOR SIZE	<input type="checkbox"/> CONDUCTOR SIZE	<input type="checkbox"/> CONDUCTOR SIZE
<input type="checkbox"/> GROUNDING	<input type="checkbox"/> GROUNDING	<input type="checkbox"/> GROUNDING
<u>COMMENTS</u> (Comments referenced by number. Refer to the Comments, Observations, and Recommendations Summary.)		
<input type="text"/>	<input type="text"/>	<input type="text"/>

PROJECT NAME: _____	TEST DATE: _____
FACILITY NAME: _____	TESTED BY: _____
PROCESS AREA: _____	COMPANY: _____
NETWORK ID: _____	PAGE: _____
WITNESSED BY: _____	SIGNATURE: _____

**PROFIBUS
INSTALLATION QUALIFICATION AND TESTING**

DP Network Media Testing

DESCRIPTION				SEGMENT ID											
TRUNK LENGTH (feet)															
ALLOWABLE TRUNK LENGTH AT SPECIFIED DATA RATE:															
MEASURED TRUNK LENGTH:															
SPARE TRUNK LENGTH															
RESISTANCE MEASUREMENTS (ohms)															
NETWORK CABLE: NO TERMINATIONS															
ONE TERMINATION															
TWO TERMINATIONS															
POWER SUPPLY VOLTAGE (volts DC)															
ACTIVE TERMINATOR															
REPEATER CP1100-RPT1															
REPEATER CP1000-RPT1															
REPEATER CP1000-RPT2															
REPEATER CP2700-RPT1															
CABLE TEXTS				PASS	FAIL	PASS	FAIL	PASS	FAIL	PASS	FAIL	PASS	FAIL	PASS	FAIL
TESTED FOR SHORT CIRCUIT BETWEEN SIGNAL LINES				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TESTED FOR SHORT CIRCUIT BETWEEN SIGNAL LINES AND SHIELD				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TESTED FOR SHIELD CONTINUITY				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TESTED FOR OPEN SIGNAL LINES				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TESTED FOR CROSSED SIGNAL LINES				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TESTED FOR CORRECT TERMINATOR POSITION				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CORRECT CABLE TYPE AND LENGTH				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
TESTED FOR SECURE AND TIGHT CONNECTORS				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
COMMENTS (Comments referenced by number. Refer to the Comments, Observations, and Recommendations Summary.)															

PROJECT NAME: _____	TEST DATE: _____
FACILITY NAME: _____	TESTED BY: _____
PROCESS AREA: _____	COMPANY: _____
NETWORK ID: _____	PAGE: _____
WITNESSED BY: _____	SIGNATURE: _____

May 2017sc
pwr://Carroll/Docs/Client/CAM/CMD/7568A10/Specifications/2016 Design/17950 (FINAL)

17950-32

7568A10

APPENDIX A

PERMITS

CITY OF MARINA
ENCROACHMENT PERMIT

CITY OF MARINA BUILDING DIVISION

PLAN CHECK and PERMIT APPLICATION

Applicant's Name: _____ Date: _____
 Address: _____ Phone: _____
 City: _____ State: _____ Zip: _____ Cell Phone: _____

Job Address: _____ APN # _____
 Nearest Cross Street: _____

Owner: _____ Phone: _____
 Mailing Address: _____

Architect / Engineer: _____ Phone: _____
 Mailing Address: _____

Contractor: _____ Phone: _____
 Mailing Address: _____ Cell Phone: _____

I hereby affirm under penalty of perjury that I am licensed under provisions of Chapter nine; section 7000 of division three of the Business and professions code, and my license is in full force and effect:

State Contractors License #: _____ City Business License #: _____

Permit Type: Build _____ Remodel _____ Addition: _____ Grading _____ Demo _____ Re-Roof: _____ Other _____

Project Description: _____

CONTRACT PRICE: _____ Total Sq Footage of Project: _____ # of Added Bedrooms: _____

Financing Agency: _____

- M.B.U.A.P.C.D. * Notice Submitted
 I Hereby Declare That I Have Contacted M.B.U.A.P.C.D. and have verified that the written notification is not required.

Monterey Bay Unified Air Pollution Control District

- I hereby declare that written asbestos notification is not applicable this project. (Sec. 19827.5 B & P code)

I hereby affirm that I am exempt from the Contractor's license law for the following reason:

_____ I as owner of the property, or my employees with wages as their sole compensation, will do the work, and the building is not intended or offered for sale. (Sec. 7044 B&P code.)

_____ I as owner of the property, am exclusively contracting with licensed contractors to build the project. (Sec. 7044 B&P code)

I hereby affirm under penalty of perjury one of the following declarations:

_____ I have and will maintain a certificate of consent of self-insure for worker's compensation, as provided for by Section 3700 of the Labor Code, for the work for which this permit is issued.

_____ I have and will maintain workers compensation insurance, as required by Section 3700 of the Labor Code, for the performance of the work for which this permit is issued.

My Worker's Compensation Insurance Carrier and Policy Number are: _____

_____ I certify that in the performance of the work for which this permit is issued, I shall not employ any person in any manner so as to become subject to the worker's compensation laws of California, and I agree that if I should become subject to the worker's compensation provisions of Section 3700 of the Labor Code, I shall forthwith comply with those provisions.

SIGNATURE OF APPLICANT: _____ DATE: _____

<table style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 20%;">Permit Fee</td><td style="width: 5%;">\$</td><td style="width: 75%;">_____</td></tr> <tr><td>Plan Check Fee</td><td>\$</td><td>_____</td></tr> <tr><td>S.I.M.P.</td><td>\$</td><td>_____</td></tr> <tr><td>B.D.T.</td><td>\$</td><td>_____</td></tr> <tr><td>Sub-Total</td><td>\$</td><td>_____</td></tr> <tr><td>Fire Plan Check Fee</td><td>\$</td><td>_____</td></tr> <tr><td>Public Buildings Fee</td><td>\$</td><td>_____</td></tr> <tr><td>Public Safety Fee</td><td>\$</td><td>_____</td></tr> <tr><td>Roadways Fee</td><td>\$</td><td>_____</td></tr> <tr><td>Intersections Fee</td><td>\$</td><td>_____</td></tr> <tr><td>Parks Fee</td><td>\$</td><td>_____</td></tr> <tr><td>TOTAL FEES</td><td>\$</td><td>_____</td></tr> </table>	Permit Fee	\$	_____	Plan Check Fee	\$	_____	S.I.M.P.	\$	_____	B.D.T.	\$	_____	Sub-Total	\$	_____	Fire Plan Check Fee	\$	_____	Public Buildings Fee	\$	_____	Public Safety Fee	\$	_____	Roadways Fee	\$	_____	Intersections Fee	\$	_____	Parks Fee	\$	_____	TOTAL FEES	\$	_____	<table style="width: 100%; border-collapse: collapse;"> <tr><td>Occupant Load:</td><td>_____</td></tr> <tr><td>Occupant Type:</td><td>_____</td></tr> <tr><td>Zone:</td><td>_____</td></tr> <tr><td>CY Fill</td><td>_____</td></tr> <tr><td>CY Excavation</td><td>_____</td></tr> <tr><td>As Graded Plan Req:</td><td>_____</td></tr> <tr><td>School Fee:</td><td>_____</td></tr> <tr><td>Asbestos Notification</td><td>_____</td></tr> </table>	Occupant Load:	_____	Occupant Type:	_____	Zone:	_____	CY Fill	_____	CY Excavation	_____	As Graded Plan Req:	_____	School Fee:	_____	Asbestos Notification	_____
Permit Fee	\$	_____																																																			
Plan Check Fee	\$	_____																																																			
S.I.M.P.	\$	_____																																																			
B.D.T.	\$	_____																																																			
Sub-Total	\$	_____																																																			
Fire Plan Check Fee	\$	_____																																																			
Public Buildings Fee	\$	_____																																																			
Public Safety Fee	\$	_____																																																			
Roadways Fee	\$	_____																																																			
Intersections Fee	\$	_____																																																			
Parks Fee	\$	_____																																																			
TOTAL FEES	\$	_____																																																			
Occupant Load:	_____																																																				
Occupant Type:	_____																																																				
Zone:	_____																																																				
CY Fill	_____																																																				
CY Excavation	_____																																																				
As Graded Plan Req:	_____																																																				
School Fee:	_____																																																				
Asbestos Notification	_____																																																				



CITY OF MARINA

SPECIAL INSPECTION AND TESTING AGREEMENT

To permit applicants of projects requiring special inspection and/or testing per Uniform Building Code Sec. 1701.5:

Project Address: _____

Building Permit No.: _____

BEFORE A PERMIT CAN BE ISSUED: The owner, the engineer or architect of record, acting as the owner's agent, shall complete two (2) copies of this agreement and the attached Special Inspection and Testing Schedule, including the required acknowledgements. A pre-construction conference with the parties involved may be required to review the special inspection requirements and procedures.

APPROVAL OF SPECIAL INSPECTORS: Special inspectors may have no financial interest in projects for which they provide special inspection. Special inspectors shall be approved by the building department prior to performing any duties. Special inspectors shall submit their qualifications and are subject to personal interviews for pre-qualification. Special inspectors shall display approved identification, as stipulated by the building official, when performing the function of special inspector.

Special inspection and testing shall meet the minimum requirements of the Uniform Building Code Section 1701. The following conditions are also applicable:

A. Duties and Responsibilities of the Special Inspector

1. **Observe work.** The special inspector shall observe the work for conformance with the building department approved (stamped) design drawings and specifications and applicable workmanship provisions of the Uniform Building Code. Architect/engineer-reviewed shop drawings may be used only as an aid to inspection.

Special inspections are to be performed on a continuous basis, meaning that the special inspector is on site in the general area at all times observing the work requiring special inspection. Periodic inspections, if any, must have prior approval based on a separate written plan reviewed and approved by the building department and the architect or engineer of record.

2. **Report nonconforming items.** The special inspector shall bring nonconforming items to the immediate attention of the contractor and note all such items in the daily report. If any item is not resolved in a timely manner or is about to be incorporated in the work, the special inspector shall immediately notify the building department by telephone or in person, notify the engineer or architect, and post a discrepancy notice.

3. **Furnish daily reports.** On request, each special inspector shall complete and sign both the special inspection record and the daily report form for each day's inspections to remain at the jobsite with the contractor for review by the building inspector.

4. **Furnish weekly reports.** The special inspector or inspection agency shall furnish weekly reports of tests and inspections directly to the building official, engineer and architect of record, and others as designated. These reports are to include the following:

5. **Furnish final report.** The special inspector or inspection agency shall submit a final signed report to the building official stating that all items requiring special inspection and testing were fulfilled and reported and, to the best of his/her knowledge, in conformance with the approved design drawings, specifications, approved change orders and the applicable workmanship provisions of the Uniform Building Code. Items not in conformance, unresolved items or any discrepancies in inspection coverage (i.e. missed inspections, periodic inspections when continuous were required, etc.) shall be specifically itemized on an addendum to this report.

B. Owner Responsibility

1. **Financial Responsibility.** The property owner or architect or engineer acting as the owner's agent shall employ one or more special inspectors as required by Chapter 17 (CBC) and/or directed by the Building Official.

2. **Supply Plan sets:** The owner or owner's agent shall be responsible to provide an approved set of structural plans or any other documentation as required by the Building Official to the special inspector/agency.

C. Contractor Responsibilities

1. **Notify the special inspector.** The contractor is responsible for notifying the special inspector or agency regarding individual inspections for items listed on the

attached Schedule and as noted on the building department approved plans. Adequate notice shall be provided so the special inspector has time to become familiar with the project.

2. **Provide access to approved plans.** The contractor is responsible for providing the special inspector access to approved plans at the job site.
3. **Retain special inspection records.** The contractor is also responsible for retaining at the job site all special inspection records submitted by the special inspector upon request.

D. **Owner Responsibilities.** The project owner or the engineer or architect of record acting as the owner's agent is responsible for funding special inspection services (ref. UBC Sec. 306(a)).

E. Designer Responsibilities

1. **Complete the Special Inspection & Testing Schedule.** The engineer or architect of record shall specify special inspection required in the construction documents and list these items on the Special Inspection & Testing Schedule on the plans.
2. **Respond to field discrepancies.** The engineer or architect of record shall respond to uncorrected field deficiencies in design, material, or workmanship observed by the special inspector.
3. **Document verbal approval of deviation from approved plans.** The engineer or architect of record shall submit to the building official and to the special inspection agency written approval of any verbally approved deviations from the approved plans.
4. **Submit design changes.** The engineer or architect of record is responsible for any design changes, in addition to acknowledgement and approval of shop drawings which may detail structural information, and for submission of such changes to the building official for approval.

F. Building Department Responsibilities

1. Approve special inspection. The building department shall approve all special inspectors and special inspection requirements.
2. Enforce special inspection. Work requiring special inspection and the performance of special inspectors shall be monitored by the building inspector. His/her approval must be obtained prior to placement of concrete, covering of structural steel, or other similar activities to that of the special inspector.

3. **Issue Certificate of Occupancy.** The building official may issue a Temporary Certificate of Occupancy or a Certificate of Final Completion and Occupancy after all special inspection reports and the final compliance report have been submitted and accepted.

ACKNOWLEDGEMENTS

I have read and agree to comply with the terms and conditions of this agreement.

Owner: _____ By: _____ Date: _____

Project Engineer/Architect

_____ By: _____ Date: _____

Soils Engineer

_____ By: _____ Date: _____

Contractor

_____ By: _____ Date: _____

Special Inspector or Inspection Agency:

_____ By: _____ Date: _____

ACCEPTED FOR THE BUILDING DEPARTMENT

By: _____ Date: _____

SPECIAL INSPECTION AND TESTING SCHEDULE

Pre-Construction conference required

1. Concrete – placement & Compression Tests
2. Bolts installed in concrete
 Installation inspection
3. Special moment resisting concrete frame
4. Reinforcing steel – placement
 Prestressing/post – tensioning tendons
5. Welding – Shop & Field
 Visual inspection – continuous
 Visual inspection – periodic
 Ultrasonic testing
 Other nondestructive testing: _____
6. High strength bolting
 A325 ____ A490
 Installation Sizes

 Tension Testing
7. Structural masonry
 Continuous inspection & tests
 Periodic inspection (describe below)
8. Reinforced gypsum concrete placement/tests
9. Insulating concrete fill placement/tests
10. Sprayed-on fireproofing thickness/density
11. *Piling,
 *drilled piers, and
 *cassions
12. Shotcrete – placement & tests
13. *Special grading
 *Excavation
 *Filing (Engineered)

14. Special cases:
- *Shoring
 - *Underpinning
 - Removal of toxic materials
 - Construction under asbestos containment
 - Other (describe below)

*Final compliance report approval is required for these items before proceeding with next phase of construction.

No.	Additional Information – Remarks, Specified, Etc. Strengths

SPECIAL INSPECTION FINAL COMPLIANCE APPROVAL	
Approved by:	Date:
_____	_____

Notes¹²³⁴

¹ The construction inspections listed are in addition to the called inspections required by Section 305 of the UBC. Special inspection is not a substitute for inspection by a City inspector. All work requiring special inspection which is installed or covered without the approval of the City inspector is subject to removal.

² Continuous inspection is always required during the performance of the work unless otherwise specified above.

³ Special inspectors must be qualified per UBC Section 306(b).

⁴ It is the responsibility of the contractor to inform the special inspection individual or agency at least one working day prior to performing any work that requires special inspection.

**City of Marina
Public Works Division**

211 Hillcrest Ave., Marina, CA 93933 • Phone: (831)-884-1212

APPLICATION AND PERMIT FOR ENCROACHMENT IN CITY STREET AREA

PERMIT NO: 1633

OWNER'S NAME:	CONTRACTOR'S NAME:	
ADDRESS:	ADDRESS:	
PHONE:	PHONE:	
PROJECT ADDRESS:	BUSINESS LICENSE #:	
	CONTRACTOR LICENSE #:	
DESCRIPTION OF WORK:	START DATE:	EXPIRES ON:
	ESTIMATED COST OF WORK:	
	\$	

Show location of existing street improvements to be removed and replaced and location of new work with reference to property lines. Provide inspector with grade sheets for curbs, gutter, and etc. one day in advance of construction.

<div style="border: 1px solid black; width: 80%; height: 40%; margin: auto;"></div>	<div style="border: 1px solid black; width: 80%; height: 40%; margin: auto;"></div>	<div style="border: 1px solid black; width: 80%; height: 40%; margin: auto; position: relative;"> <div style="position: absolute; top: 5px; right: 5px; font-size: 8px;">PROP. LINE</div> <div style="position: absolute; bottom: 5px; right: 5px; font-size: 8px;">CURB LINE</div> </div>
<div style="border: 1px solid black; width: 80%; height: 40%; margin: auto;"></div>	<div style="border: 1px solid black; width: 80%; height: 40%; margin: auto;"></div>	<div style="border: 1px solid black; width: 80%; height: 40%; margin: auto;"></div>

CALL FOR INSPECTION 24 HOURS BEFORE BEGINNING WORK – 884-1212

The permittee agrees to properly maintain said encroachment at no expense to the city and to indemnify the city from any liability arising out of or caused by said encroachment, and that all work shall be in accordance with city standards. The permittee unconditionally guarantees and implies warranty for all materials and workmanship affected by this permit for a period of one year from the date of acceptance of the work. Acceptance by the city of the work completed under this permit is not a waiver of the permittee's obligation as stated above.

Application Date _____

Application /Permittee's Signature _____

PERMIT FEE

Item of Work	Quantity	Unit Fee	Subtotal
<input type="checkbox"/> Street Parking Obstruction	EA	\$40.00	\$
<input type="checkbox"/> Pole Installation or Removal	EA	\$75.00	\$
<input type="checkbox"/> Tree Removal	EA	\$40.00	\$
<input type="checkbox"/> Curb/Gutter	LF	\$100.00 + \$1.00/LF	\$
<input type="checkbox"/> Sidewalks	SF	\$20.00 + \$0.20/SF	\$
<input type="checkbox"/> Driveway Approach	EA	\$ 60.00	\$
<input type="checkbox"/> Street Construction	SF	\$360.00+ \$50.00/100SF	\$
<input type="checkbox"/> Utility Vault	EA	\$ 100.00	\$
<input type="checkbox"/> Trenching W≥12"			\$
<input type="checkbox"/> 1 ~ 1000 LF	LF	\$300.00+\$2.00/LF	\$
<input type="checkbox"/> 1000+ LF	LF	\$300.00+\$1.00/LF	\$
<input type="checkbox"/> Trenching W<12"			\$
<input type="checkbox"/> 1 ~ 1000 LF	LF	\$300.00+\$1.00/LF	\$
<input type="checkbox"/> 1000+ LF	LF	\$300.00+\$0.50/LF	\$
<input type="checkbox"/> Excavation (less than 25 SF)	SF	\$50.00	\$
<input type="checkbox"/> Over 25 SF	SF	\$50.00+ \$1.50/LF	\$
<input type="checkbox"/> Over 5 FT in Depth	FT	\$50.00+\$1.00/2'	\$
<input type="checkbox"/> Plan Check	SH	\$240.00 / SH	\$
<input type="checkbox"/> Others	EA	\$40.00	\$
		Permit Fee (Min. \$20.00)	\$
RECEIPT NO.		Total Fee	\$

PERMIT APPROVED

By _____

Date _____

I HAVE EXAMINED THE WORK COVERED BY THIS PERMIT AND FIND THAT SAME IS IN ACCORDANCE WITH THE STANDARDS OF THE CITY OF MARINA AND RECOMMEND ACCEPTANCE.

ENCROACHMENT INSPECTOR

Date _____

Inspector's Comments

Standard Encroachment Permit Provisions

1. All work shall be in accordance with the City of Marina Standard Specifications, Design Standards, and Standard Plans 2006 Edition, as amended (herein after called City Standards). In case of conflict between the City Standards and these Conditions of Approval, the Conditions of Approval shall prevail.
2. Temporary traffic control shall be provided in accordance with the U.S. Department of Transportation Federal Highway Administration Manual on Uniform Traffic Control Devices 2003 Edition, as amended, and the State of California Department of Transportation MUTCD 2003 California Supplement dated May 20, 2004, as amended.
3. Pavement restoration shall conform to City Standard Plan No. SD-1, "Storm Drain Trench Backfill and Surface Restoration," except that storm drain trench backfill specifications shall be omitted.
4. Existing traffic stripes, pavement markings, and pavement markers within the limits of the proposed work that are damaged or partially damaged shall be replaced in whole.
5. Existing traffic signal loop detectors within the limits of the proposed work that are damaged shall be replaced.
6. Notify in writing abutting property owners at least 10 calendar days, and again in 48 hours, in advance of work which would affect their access.
7. Access to private property shall be maintained at all times unless the closing of such access is approved by the City Engineer. The permittee shall request in writing permission from the City Engineer in advance of making such closing.
8. Existing traffic signs shall be protected in place by the permittee during the construction period.
9. The permittee shall furnish, post, and maintain temporary "No Parking" signs in those parking areas in which the permittee will be working.
10. No trench shall be permitted to remain open overnight or when construction activities are not in progress. Each trench shall be backfilled to the surface. The permittee shall not open more trench than can be successfully completed and backfilled in one day. Where this requirement is impracticable, the permittee shall request in writing permission from the City Engineer to extend the trench to its practical limit and to bridge the trench with steel plates. When necessary, trenches and other excavations shall be bridged with steel plates as required by the City Engineer. The bridging shall be placed to permit an unobstructed flow of traffic. Advanced warning signs shall be required when trenches and other excavation are bridged in the travel way
11. Personal operated vehicles of the permittee's contractor(s) shall not be parked on the traveled way or shoulders, including any section closed to public traffic.
12. The permittee shall notify the Public Safety Department of this intent to begin work at least 5 working days before work is begun. The permittee shall cooperate with Public Safety Department relative to handling traffic through the area and shall make arrangements relative to keeping the working area clear of parked vehicles.
13. When construction noise is produced adjacent to residential uses, including transient lodging, hours of construction shall be between the hours of seven a.m. and seven p.m. (standard time), and on Sundays and holidays between the hours of ten a.m. and seven p.m. (standard time). During daylight savings time, the hours of construction may be extended one hour to eight p.m. Holidays shall include New Year's Day, July 4th, Thanksgiving, and Christmas. During the hours of construction, no construction, tools, or equipment shall produce a decibel level of more than sixty decibels for twenty-five percent of an hour at any receiving property line. (MMC 15.04.055)
14. Hours of construction within the intersection of Reservation Road and Crescent Avenue shall be between the hours of eight a.m. and four p.m. (standard time) on Monday through Saturday, and between the hours of ten a.m. and four p.m. (standard time) on Sunday and holidays. Holidays shall include New Year's Day, July 4th, Thanksgiving, and Christmas.

CITY OF SEASIDE
ENCROACHMENT PERMIT

Resource Management Services – Public Works Division

440 Harcourt Avenue
Seaside, CA 93955

Telephone (831) 899-6825
FAX (831) 899-6311
TDD (831) 899-6207

TO: All applicants for permits of encroachment in public rights of way

The fee for an Encroachment Permit, which covers any work performed in the City's right of way, is \$170.00 per application for projects where the estimated cost of improvements is less than \$5,000.00. Projects that are estimated at over \$5,000.00 will be charged the actual hourly rate plus 10% administration cost with a minimum of \$170.00 per application.

All applicants must obtain a City of Seaside business license and provide that information when applying.

Chapter 12.04 of the Municipal Code of the City of Seaside establishes minimum requirements for applicant's liability insurance and performance bonding.

The amounts of insurance coverage shall be not less than as follows:

Bodily injury: \$500,000 for each person and \$1,000,000 for each occurrence. Property damage; \$250,000 for each occurrence and with an aggregate limit of \$5000,000 during the term of insurance.

All applicants for an Encroachment Permit must file with the Public Works Department a certificate of liability insurance explicitly naming the City of Seaside as additionally insured and holding the City of Seaside, it's officers and employees free from any and all liability in connection with encroachments/excavations in the public right of way.

In addition, a bond must be posted in an amount as determined by the City Engineer (minimum of \$1,000) based on the value of the work to be performed, sufficient to cover restoration of the area and/or completion of work should the work be unsatisfactory and not meet the specifications. This bond may be surety bond, cash, cashier's check or money order in favor of the city. **BOND IN THE AMOUNT OF PUBLIC IMPROVEMENTS, PER ENGINEERS ESTIMATE.**

Encroachment permits shall be issued only after the condition of this section of the code, and all other applicable requirements, fees and codes have been met.

City of Seaside
Public Works Department

APPLICATION AND PERMIT FOR ENCROACHMENT IN CITY STREET AREA

NAME OF APPLICANT _____

ADDRESS _____ PHONE _____

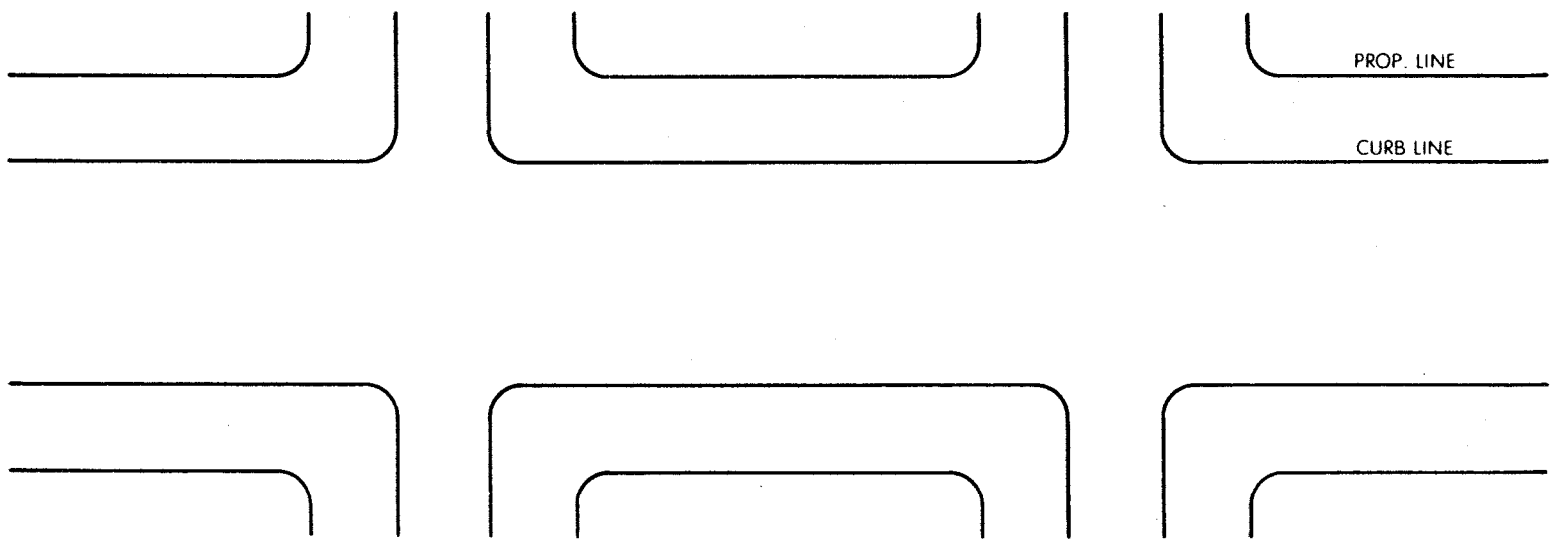
ADDRESS OF PROPOSED WORK _____

PROPOSED STARTING DATE _____
 (NOTE: PLEASE CALL FOR INSPECTION 24 HOURS BEFORE BEGINNING WORK 899-6230)

TYPE OF WORK _____ STREET IMPROVEMENTS _____ STREET EXCAVATION

DESCRIBE WORK PROPOSED _____

SHOW LOCATION OF EXISTING STREET IMPROVEMENTS TO BE REMOVED AND REPLACED AND LOCATION OF NEW WORK WITH REFERENCE TO PROPERTY LINES. PROVIDE INSPECTOR WITH GRADE SHEETS FOR STORM DRAINS, SEWERS, CURBS, ETC. ONE DAY IN ADVANCE OF CONSTRUCTION.



All work is to be effected within 30 days of initial issuance of this permit and completed in an expeditious manner as determined by the engineer.

The permittee agrees to properly maintain said encroachment at no expense to the city and to indemnify the city from any liability arising out of or caused by said encroachment, and that all work shall be in accordance with city standards. The permittee unconditionally guarantees and implies warranty for all materials and workmanship effected by this permit for a period of one year from the date of acceptance of the work. Acceptance by the city of the work completed under this permit is not a waiver of the permittee's obligations as stated above.

Application Date _____	Applicant/Permittee's Signature _____
PERMITTEE IS TO NOTIFY THE FOLLOWING UTILITIES: <input type="checkbox"/> P.G.&E. (ELECT.) <input type="checkbox"/> P.G.&E. (GAS) <input type="checkbox"/> P.T.&T. <input type="checkbox"/> CAL. AM WATER <input type="checkbox"/> CABLE T.V.	STANDARD PLAN NOS. FOR USE WITH THIS PERMIT _____ _____ _____
<p>PERMIT APPROVED</p> <p>_____ CITY OF SEASIDE • ENCROACHMENT INSPECTOR</p> <p>DATE: _____</p>	

PERMIT FEE \$ _____

RECEIPT NO. _____

PATCHING REQUIRED:
 _____ P.C.C.
 _____ A.C.

I HAVE EXAMINED THE WORK COVERED BY THIS PERMIT AND FIND THAT SAME IS IN ACCORDANCE WITH THE STANDARDS OF THE CITY OF SEASIDE AND RECOMMEND ACCEPTANCE.

 ENCROACHMENT INSPECTOR

DATE _____

CALIFORNIA STATE UNIVERSITY MONTEREY BAY
TEMPORARY PERMIT
AND
INSURANCE REQUIREMENTS

TEMPORARY PERMIT

The Trustees of the California State University (CSU), through California State University, Monterey Bay (CSUMB), hereby grant permission to Marina Coast Water District of Marina, CA its officers, agents, and invitees, to enter upon the portion of the Trustees' property shown on Exhibit A, and to use that property to install a recycled water pipeline under, across, and through said property generally within the alignment shown on said Exhibit A.

The permissive rights hereby granted shall be for the period beginning February 1, 2017 and ending December 31, 2017, or two calendar months after the completion of construction, whichever occurs first. After Grantee completes the task described above and satisfies all other conditions of this Permit, a Trustees' Agreement and Grant Easement shall be executed.

Grantee agrees to indemnify, defend and hold harmless the State of California, the Trustees of the CSU, CSUMB, and the employees, volunteers, officers and agents of each of them (collectively "the Grantor"), for any loss or liability caused by, or in any way connected with, the exercise of this Permit, except those arising out of the sole negligence of the Grantor.

Additional conditions on pages 2 through 13 of this document constitute an integral part of this Permit.

Date: (____)

APPROVED:

Kathleen Ventimiglia, AIA
Director for Campus Planning & Development
CSU, Monterey Bay

GRANTEE: Marina Coast Water District

APPROVED:

By: _____

Arthur J. Evjen
Director, Business and Support Services
CSU, Monterey Bay

Print Name: Howard Gustafson_____

Print Title Rep for (Corporate Name):

President, Marina Coast Water District

APPROVED AS TO FORM:

Carrie Hemphill Rieth
University Counsel
Office of General Counsel

Temporary Construction Permit Terms and Conditions

ADDITIONAL CONDITIONS OF PERMIT:

1) General

- a) Contractor is hereby advised that utility lines of unknown nature and origin may be present in the proposed easement area. Marina Coast Water District is to employ an independent locator service to determine location of existing utilities prior to any excavation work. Contractor must pothole and locate all utilities identified by the locating service or indicated on CSUMB as-builts and utility plans. Contact and coordinate with Marina Coast Water District, CSUMB Campus Planning and Development department prior to any excavation. CSUMB will provide existing utility plans to contractor, but does not warrant their completeness or accuracy.
- b) Contractor will provide CSUMB field notes and plan sheets in hard copy and CD format of all surveys Where "Contractor" is used within this document, it implies Marina Coast Water District or a Contractor and/or Subcontractor working under Marina Coast Water District's direction.
- c) Contractor will advise CSU Monterey Bay, Campus Planning and Development Office (831-582-3709) of the work schedule prior to starting construction.
 - Contractor shall provide project schedule updates a minimum of once each month, and additionally whenever the progress of the work varies from the most recent schedule.
 - Schedule updates shall include a narrative listing all potential impacts to Campus operations described herein. Campus approval is required before any work may take place that impacts Campus operations as described herein.
 - Contractor must provide 30 day notice to CSUMB for review and approval of all impacts to Campus operations, especially any and all utility interruptions.
- d) Contractor will provide as-built drawings and CAD files electronically to the Campus Planning and Development Office within 30 days after the completion of construction. Provide a CD and a hard copy of all soils test reports Marina Coast Water District performs on the campus of CSUMB. Information will include date of test, and GPS coordinate location of percolation or boring test sites.
- e) performed on the California State University, Monterey Bay property. Survey data will have a point of beginning tied to a known campus monument and will use the campus basis of bearings.
- f) Using the record of survey for the campus as the referenced record map, the basis of bearings, and the point of commencement, Contractor will provide a metes and bounds or other appropriate legal description, in accordance with the requirements of Business and Professions Code, and a plat of the easement as-built location to the campus and to the Land Records Section of the Division of Capital Planning, Design and Construction within twenty-eight (28) calendar days of the completion of construction in order that an Agreement and Grant of Easement may be timely granted. Upon request, the Land Records Section will provide a copy of the campus record of survey for the use of Contractor.
- g) Contractor will ensure that its employees, contractors, and agents will coordinate with the Campus Planning and Development Office with respect to other ongoing work on the campus and with respect to allowable work hours.

- h) Normal construction activities shall be performed Monday through Friday between the hours of 7:30am and 5:00pm, excluding holidays. Any weekend work after 5:00pm shall not be conducted without the prior approval by CSUMB.
- i) CSUMB will perform an initial construction document review and approval within 30 days and back check within 14 days.
- j) CSUMB will be reimbursed for the time required to complete the project including but not limited to staff time, consultants or inspections.
- k) Campus review of construction documents shall include but shall not be limited to review for conformance to: SWPP requirements; fencing and safety requirements; waterline engineering standards; compaction requirements; site restoration plans; conformance to all applicable building codes;
- l) Construction shall conform to all applicable: building codes; air and water pollution control requirements; mitigation monitoring and reporting programs as required by CEQA; SWPP requirements;
- m) The Contractor shall not cause or allow sounds to be produced in excess of 65 decibels measured at the job site between the hours of 7:00 p.m. and 7:00 a.m. The Contractor shall not cause or allow sounds to be produced in excess of 85 decibels measured at the job site between the hours of 7:00 a.m. and 7:00 p.m. without the consent of the University;
- n) If the Contractor discovers any artifacts during excavation and/or construction, the Contractor shall stop all affected Work and notify the Trustees, who will call in a qualified archaeologist designated by the California Archaeological Inventory to assess the discovery and suggest further mitigation, as necessary. If the Contractor discovers human remains, the Contractor shall notify the Trustees who will be responsible for contacting the county coroner and a qualified archaeologist. If the remains are determined to be Native American, the Trustees shall contact the appropriate tribal representatives to oversee removal of the remains.
- o) Contractor will observe all of the University activities as described:
Commencement - May 20, 2017 (No closing of campus roadways)
Assessment/final exam periods - May 15-19, 2017 and December dates TBD (limit noise near Library)
Summer Orientation – TBD (limit noise near the library)
- p) Control the conduct of labor forces and prevent unwanted interaction initiated by workers with the staff, students or other individuals not associated with the project. In the event that any worker initiates unwarranted interaction, or in the opinion of the University's Representative conducts him/herself in an offensive or unprofessional manner, immediately remove the worker from the project and replace with another worker of equivalent technical skill at no cost to CSUMB.
- q) All contractor personnel associated with the project shall wear shirts at all times, no smoking is allowed except in smoking approved areas and no radios other than 2-way communication type are allowed on the project site.
- r) The contractor shall limit their use of site and premises to allow for:
Work by others as designated by the University,
Maintain constant access for fire fighting or rescue equipment,
Accessibility for the disabled,
Access for trash removal.

- s) Contractor shall bear all expenses to restore any element of the campus that they damage or destroy to equal or better condition.
- t) Contractor shall perform a site survey along the water line alignment prior to the start of construction to familiarize themselves with and document existing site features/improvements.
- u) Any liability regarding disagreement as to pre-construction condition of site utilities not properly documented shall accrue to the contractor.
- v) Contractor shall restore all site features including but not limited to: hardscapes; landscape; irrigation; and utilities disturbed as part of the work to pre-construction condition or better.
- w) Restoration of any and all site improvements regardless of unknown site conditions or other conditions that are not observable as part of a site survey.
- x) If any utility is affected, the Contractor must provide a temporary connection to the affected utility/facility/area reestablishing service within four (4) hours of occurrence with due diligence at no additional cost to the University.
- y) All construction areas are to be kept clean, safe, and orderly at all times. The contractor shall assume full responsibility for protection and safekeeping of products and equipment stored on premises.
- z) Prior to starting construction, the contractor shall obtain University parking permits and instructions from University Department of Parking and Transportation at 831-582-3573. All workers and suppliers shall observe University traffic and parking regulations and park in areas designated by the University. No vehicles shall be parked on lawn areas or within the drip line of any tree.

2) General Continued

- a) All contractors performing ground disturbing activities are required to participate in a 1 hour Unexploded Ordinance (UXO) training provided by the US Army Corp of Engineers.
- b) The pipeline alignment will seek to avoid the removal of any existing trees. A qualified biologist or arborist will provide a report of the type, size and location of any trees to be removed. MCWD will pay CSUMB for the cost of replacing trees at a 2:1 (replacement: removal) rate at the time any other fees are paid to the University.
- c) Any ice plant or other invasive species disturbed as a result of the construction process will be placed in a contractor supplied waste dumpster and discarded off site.
- d) Contractor shall protect adjoining property and nearby buildings, roads, and other facilities and improvements from dust, dirt, debris and other nuisances arising out of Contractor's operations or storing practices. Dust shall be controlled by sprinkling or other effective methods acceptable to Trustees. An erosion and sedimentation control program shall be initiated, which includes measures addressing erosion caused by wind and water sediment in runoff from site. A regular watering program shall be initiated to adequately control the amount of fugitive dust in accordance with applicable Air Quality Management District (AQMD) rules, see Article 4.03, subsections: a-Air Pollution Control and b-Water Pollution Control.

3) Temporary Services

- a) No temporary services are allowed on the campus of California State University, Monterey Bay without prior written approval from the Director of Campus Planning & Development.
- b) Conditions of Use:

- i) Keep temporary services and facilities clean and neat in appearance.
 - ii) Operate in a safe and efficient manner.
 - iii) Take necessary fire prevention measures.
 - iv) Do not allow hazardous, dangerous, or unsanitary conditions or public nuisances to develop or persist on the site.
- c) In addition to other requirements and regulations contained herein, comply with regulations of the authorities having jurisdiction, including but not limited to:
- i) Utility company regulations.
 - ii) Police, Fire Department, and Rescue Squad rules.
 - iii) Environmental protection regulations.
 - iv) University Health and Life Safety regulations, procedures, and requirements.
 - v) University Hazardous Materials consultant directives.
- d) Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).
- i) Electricity shall be taken from the existing system as available. Coordinate the installation with the University, as applicable, to identify point of connection and metering location(s).
 - ii) All temporary services must first be inspected by a University Inspector. A stamp of approval will be affixed to the utility before the final connection is made.
 - iii) All costs associated with electrical power, water, telephones and Internet service access for Temporary Field Office Facility shall be paid for by Grantee of this temporary permit.
 - iv) A monthly fee will be charged for electrical power.
- e) Temporary telephone and DATA is available at the Grantee's request and at the Grantee's expense to get them to a location on the project site. A monthly fee will be charged for campus telephone & DATA.
- f) Install temporary toilets for the crew(s) as required. Using toilets within CSUMB buildings are prohibited. At no time shall there be less than the State-required number (based upon actual staffing levels) of combined operating toilets and/or portable toilets provided and readily accessible to the construction work force.
- i) All portable toilets shall be located within the fenced staging yard or within the boundary fence of the trenching operation.
 - ii) Maintain temporary toilets in a clean and sanitary condition on the construction site for the duration of the project. Units shall be routinely maintained and inspected.

4) Temporary Fencing :

- a) Provide, install, and maintain a minimum of a 4' high plastic "snow" fence at the entire perimeter of the pipeline work areas and a 6' high chain link staging yard fencing over at all staging and laydown yards, alternative forms of site security may be mutually agreed upon and reviewed periodically.
- i) Design and install to prevent easy access to site by people and animals.
 - ii) Locate fence as required to ensure complete security of entire site.
 - iii) Provide gates as required for access.
 - iv) Place a legible "No Trespassing" sign on every other chain link panel.
 - v) Provide locks and keys for all gates in temporary fencing. Provide emergency access keys to Campus Police
 - vi) Submit temporary facility and fencing location layout plan for review and approval by the University prior to occupying any portion of the site and prior to issuance of Notice to Proceed.

- b) Preserve the natural resources within the project boundaries and outside the limits of permanent work.
- c) Confine construction activities to within the limits of the work indicated or specified. Work shall not exceed 7.5' to each side of the pipeline right of way. Fencing shall be placed at this limit of construction.

5) Protection

- a) Contractor shall take all necessary precautions to prevent injury to the public, building occupants, or damage to property of others, and be responsible for all associated costs. For the purposes of this agreement, the public or building occupants shall include all persons not employed by Contractor.
- b) All work shall conform to the Cal Trans Temporary Pedestrian Facilities Handbook available at: http://www.dot.ca.gov/hq/construc/safety/Temporary_Pedestrian_Facilities_Handbook.pdf
- c) Work shall not be performed in any area occupied by the public or Owner's employees unless specifically permitted by the Contract or otherwise provided for in writing by the Owner and shall include adequate measures for the protection of the public, students, and CSUMB employees.
- d) In all cases, the work area shall be fenced, barricaded, or otherwise blocked off from the public or building occupants to prevent unauthorized entry into the work area.
- e) Alternate Precautions: When the nature of the Work prevents isolation of the work area, and the public or building occupants may be in or pass through, under or over the work area, alternate precautions may be provided during daytime periods of work only. These precautions shall include, but not be limited to the posting of signs, the use of signal persons, the erection of barricades or similar protection around particularly hazardous operations, trench plates, etc. . All alternate precautions shall be approved by the CSUMB inspector.
- f) When Work is to be performed over a public thoroughfare such as a sidewalk, lobby, or corridor, the thoroughfare shall be closed, if possible, or other precautions taken such as the installation of screens or barricades. When the exposure to heavy falling objects exists, as during the erection of building walls or during demolition, special protection of the type detailed in 29 CFR 1910/1926 shall be provided.
- g) Fences and barricades shall be removed upon completion of the project to the satisfaction of the University's Representative.
- h) Storing, positioning or use of equipment, tools, materials, scraps, and trash in a manner likely to present a hazard to the public or building occupants by its accidental shifting, ignition, or other hazardous qualities is prohibited.
- i) All equipment shall be equipped with functioning backup alarms, and there shall be a flag person isolating equipment from the public at all times equipment is operating in the proximity of the public.

6) Work within areas of pedestrian access

- a) Sidewalk closures and restrictions:

- i) Use State of California, Department of Transportation (Cal-Trans) standard reflectorized signage where required to indicate closure of sidewalks, temporary revisions to crosswalks and other impacts to normal pedestrian walk routes.
- ii) Where sidewalks which are partially restricted due to construction activities, a minimum width of 48" shall be maintained.
- iii) Where portions of a sidewalk are temporarily closed, temporary fencing shall be placed at the nearest intersection to prevent the site impaired from traveling in a direction which will require them to eventually stop and return to said intersection. Pedestrian detour signs and "sidewalk closed" signs shall also be provided at the point of closure.

7) Maintenance of thoroughfares

- a) Pedestrian thoroughfares and crossings shall be maintained in a safe, clean condition, free of dirt, gravel and other debris resulting from construction operations at all times.
- b) Where work occurs on or adjacent to pedestrian thoroughfares, Contractor shall employ adequate measures (such as sandbagging, earthen barriers, etc.) to ensure that walks are protected from overflow of construction materials or runoff into the pedestrian area.
- c) Where work occurs on or adjacent to pedestrian thoroughfares, Contractor shall employ adequate measures to ensure that walks are protected from hazards related moving equipment and/or materials.

8) Work within roadways and parking areas

- a) All construction activities which occur within campus streets and parking areas shall comply with the most current Cal-Trans standards for traffic control, signage and barricading.
- b) Contractor shall provide trained and equipped flagger to regulate traffic when construction operations or traffic encroach on University or public traffic lanes and walking areas. Flagger Requirements are as follows:
 - i) Whenever existing traffic lanes are altered, contractor shall provide properly equipped and trained flagger to direct traffic. Comply with most current Cal-Trans standards and "Instructions to Flaggers".
 - ii) Whenever a section of two-way traffic is temporarily reduced to one lane, a minimum of two flagmen shall be provided to ensure proper traffic control in each direction. Two-way radio devices shall be used for communication between the flagmen where both direct line of site and audible communication cannot be maintained.
 - iii) Flagmen shall be dedicated solely to traffic and pedestrian control and shall not perform additional duties while assigned as flagmen.
 - iv) Flagman shall be trained and shall direct pedestrians and traffic in accordance with the requirements set forth below.
 - v) Contractor is advised that the Campus Community includes a large volume of students and staff with disabilities, including but not limited to wheel chair users, persons with hearing impairments, and persons with sight impairments; for this reason, escorting of equipment and vehicle traffic with flagmen shall be required as necessary.
- c) All temporary traffic control signage shall comply with California Vehicle Code Section 21400 and Cal-Trans standards. All signage shall be reflectorized.
- d) Where trenches, excavations or other work is required within streets, the Work shall be scheduled so as to maintain a minimum of one open traffic lane. A minimum of two lanes as required to allow safe 2-way traffic shall be restored prior to completion of Contractor's operations each day. All roadways will remain open to two way traffic during Commencement as noted in General Conditions section (i).

- e) All work within Campus streets and parking areas requires approval of Contractor's work schedule prior to commencement of work.

9) Steel plating

- a) Where temporary traffic controls must remain in place overnight or at other times when Contractor is not continuously present in the work area, cones, plastic delineators and other lightweight traffic control devices subject to displacement shall not be used for traffic control.
- b) Where temporary fencing and/or barricades remain in place overnight, weighted barricades with flashing amber lights shall be used to delineate the protruding corners of the of the work area enclosure at the approach from each direction.
- c) Where trenches or excavations are directly adjacent to a drive lane, the trench shall be plated in accordance with Cal-Trans standards, or concrete barricades (k-rail) shall be installed to protect vehicle traffic from entering the excavation during times when the work area is not manned by Contractor.
- d) Where trenches or excavations of a depth of 4'-0" or greater are directly adjacent to a drive lane or pedestrian walk, install 6' high chain link staging yard protective fencing a minimum horizontal distance of 4'-0" from the edge of the excavation.
- e) All traffic plates shall be beveled in the direction of vehicle traffic and secured in place.
- f) Comply with the most current Cal-Trans standards for sizing of traffic plates and shoring of trenches.

10) Traffic controls

- a) Traffic signs shall be installed at approaches to construction work, crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.
- b) Contractor shall control traffic to maintain orderly flow in areas under Contractor's control and areas affected by Contractor's operations.
- c) Relocate as Work progresses, to maintain effective traffic control.

11) Construction Parking Control

- a) Contractor shall control vehicular parking to prevent interference with public traffic, parking and University operations.
- b) Contractor shall monitor parking of construction personnel's vehicles in Construction Staging Yard.
- c) Contractor shall prevent parking on or adjacent to access roads or in non-designated areas.

12) Emergency Response Access

- a) Contractor shall confirm local Fire Dept. requirements for access to the construction site and other Campus facilities impacted by the Work throughout the course of construction. Where Fire Dept. access must be maintained at specific areas, Contractor shall tailor the Work Plan and provide necessary temporary measures to accommodate same.
- b) Contractor shall maintain adequate provisions for passage of emergency response vehicles (ambulances, fire trucks etc.) over campus roads and inner-campus thoroughfares at all times.

- c) Provide and maintain access to fire lanes and fire hydrants. These areas shall be kept free of any obstructions.
- d) At all times that work is occurring which requires trenching, excavations, or other blockages of any fire lane or emergency access location, Contractor shall have traffic plating and other materials and equipment on hand as required to permit immediate passage of response vehicles in the case of an emergency. At no time shall said blockages be left unmanned.

13) Access Routes

- a) Prepare a map showing proposed trade parking and truck haul routes. Submit to Campus Planning & Development for approval prior to the start of work. Haul routes and site access shall be only on routes as described by the University approved map and will not block any fire access routes, specifically to the east of the Library. Deviations from designated haul routes shall only be permitted only with prior approval. Contractor activity (pedestrian and/or vehicular) shall be conducted so as to avoid any interference with existing University facilities or their normal operations.
- b) Weight loads carried by vehicles shall be within capacity recommended by manufacturer and shall comply with applicable laws and regulations relating to allowable capacities for specific streets.
- c) Streets shall be maintained in a clean condition at all times. Sweeping of streets shall occur, at minimum, on a daily basis, or more often as required by continual hauling operations or construction traffic.
- d) All loads shall be covered with secured tarpaulins when loose materials are removed from or hauled into the Campus.
- e) Truck staging shall not occur on campus streets, unless prior authorization is received.
- f) Provide protection against damage to existing sidewalks, curbs and gutters and other improvements at locations where construction vehicles enter. Contractor shall be responsible for repair of all damage resulting from its operations. Damage to concrete shall be repaired by replacement of full sections to the nearest existing construction joint in each direction.
- g) All central sidewalk areas of campus (between buildings) are potential routes for fire and rescue equipment. Contractor must have available at all times sufficient heavy steel plating and equipment with which to place the plating, to provide access routes to loaded fire department equipment over any open trenching.
- h) All sidewalk areas more than eight feet wide which are obstructed by an open trench must be covered by heavy steel plating of sufficient size and thickness to provide a route to fully loaded fire department equipment prior to completion of the work day.
- i) Provide means of removing mud from vehicle wheels before entering streets. Contractor shall clean streets to maintain streets free from dirt from Contractor's construction operations.
- j) Designated existing on-site roads may be used for construction traffic as coordinated with the University Project Manager.

14) Removal

- a) Remove equipment and devices when no longer required.
- b) Repair damage caused by installation and the travel of Contractor equipment.

15) Inspections

- a) Meet with a CSUMB inspector before construction commencement and agree upon what inspections will be required and what forms will be used. CSUMB will be monitoring: public safety, but shall not be construed to relieve contractor for all safety responsibilities and liabilities; compaction of all backfill, contractor shall provide 3rd party compaction testing reports to CSUMB inspector; restoration of site improvements.
- b) Notify the inspector 24 hours in advance of a required inspection by submitting a Request for Inspection form to Campus Planning & Development.
- c) For successful inspections, the inspector will so note on the request for inspection.
- d) For unsuccessful inspections, the inspector will issue a Correction Notice.

16) Bonding:

- a) Contractor shall provide a performance bond equal to one half the total cost of the work to guarantee performance to this agreement.

Insurance Requirements:

http://www.calstate.edu/cpdc/CM/cgcs_majors/2016_cgcs_dbb_major.pdf

(p. 21 – 4.06a) they must be edited for use herein.

4.06 Insurance Requirements

a. The Contractor shall not commence Work on the site until it has obtained all the insurance required in this Article, and such insurance has been approved by the Trustees. This Project shall be enrolled in the Trustees' Builders Risk Insurance Program, for which the provisions of Article 4.06-c shall apply. This Project may be enrolled in the Trustees' Owner Controlled Insurance Program ("OCIP"), and if so, the provisions of Article 4.06-b shall apply. Contractor shall refer to the Supplementary General Conditions to determine if this Project is enrolled in OCIP.

(1) Policies and Coverage

(a) The Contractor shall obtain and maintain for the term of the Contract the following policies and coverage:

(i) Comprehensive or Commercial Form General Liability Insurance on an occurrence basis, covering work done or to be done by or on behalf of the Contractor and providing insurance for bodily injury, personal injury, property damage and contractual liability. The aggregate limit shall apply separately to the work.

(ii) Business Automobile Liability Insurance on an occurrence basis, covering owned, hired and non-owned automobiles used by or on behalf of the Contractor and providing insurance for bodily injury, property damage and contractual liability. Such insurance shall include coverage for uninsured and underinsured motorists.

(iii) Workers' Compensation including Employer's Liability Insurance as required by law.

(b) The Contractor also may be required to obtain and maintain the following policies and coverage:

(i) Environmental Impairment Liability Insurance should the work involve hazardous materials, such as asbestos, lead, fuel storage tanks and PCBs.

(ii) Other Insurance by agreement between the Trustees and the Contractor.

(2) Verification of Coverage.

The Contractor shall submit original certificates of insurance and endorsements to the policies of insurance required by the Contract to the Trustees as evidence of the insurance coverage. Renewal certifications and endorsements shall be timely filed by the Contractor for all coverage until the work is accepted as completed pursuant to Article 8.01, Acceptance. The Trustees reserve the right to require the Contractor to furnish the Trustees complete, certified copies of all required insurance policies.

(3) Insurance Provisions.

Nothing in these insurance provisions shall be deemed to alter the indemnification provisions in Article 4.07. The insurance policies shall contain, or be endorsed to contain, the following provisions:

- (a) General and Automobile Liability Policies.
- (i) General Liability policies: the State of California, the Trustees of the California State University, the University, their officers, employees, representatives, volunteers and agents are to be covered as additional insureds.
- (ii) Automobile Liability: Contractor shall use Insurance Service Office (ISO) Form Number CA 0001 covering any auto.
- (b) For any claims related to the work, the Contractor's insurance coverage shall be primary insurance as respects the State of California, the Trustees of the California State University, the University, their officers, employees, representatives, volunteers and agents. Any insurance or self-insurance maintained by the State of California, the Trustees of the California State University, their officers, employees, representatives, volunteers and agents shall be in excess of the Contractor's insurance and shall not contribute with it.
- (c) The Contractor shall immediately upon receipt of any notice of cancellation or any notice of non-renewal of any insurance required under this Article 4.06, provide written notice of any such insurance cancellation or non-renewal by certified mail to the Trustees.
- (d) The State of California, the Trustees of the California State University, the University, their officers, employees, representatives, volunteers and agents shall not by reason of their inclusion as additional insureds incur liability to the insurance carriers for payment of premiums for such insurance.

(4) Amount of Insurance.

- (a) For All Projects.
The insurance furnished by Contractor under this Article shall provide coverage in amounts not less than the following ('M' indicates millions):

*Contract General Conditions for Design-Bid-Build Major Projects
Revised May, 2016 - Page 21 of 51 pages*

(i) Comprehensive or Commercial Form General Liability Insurance – Limits of Liability

Contract Amount	Up to \$2M	\$2M+1 to \$5M	\$5M+1 to \$10M	\$10M+1 and Over
General Aggregate	\$2M	\$5M	\$10M	\$10M
Each Occurrence – combined single limit for bodily injury and property damage	\$1M	\$5M	\$10M	\$10M

- (ii) Business Automobile Liability Insurance – Limits of Liability (Each Accident– combined single limit of bodily injury and property damage to include uninsured and underinsured motorist coverage.)

Contract Amount	Up to \$2M	\$2M+1 to \$5M	\$5M+1 to \$10M	\$10M+1 and Over
Each Accident	\$1M	\$5M	\$10M	\$10M

- (iii) Workers' Compensation limits as required by law with Employer's Liability limits of \$1,000,000. These requirements and limits are the same for all size contracts.

(b) For Projects Involving Hazardous Materials.

The Contractor shall provide additional coverage in amounts not less than the following:

(i) Environmental Impairment (pollution) Liability Insurance – Limits of Liability

Contract Amount	Up to \$2M	\$2M+1 to \$5M	\$5M+1 to \$10M	\$10M+1 and Over
General Aggregate	\$10M	\$10M	\$10M	\$10M
Each Occurrence – combined single limit for bodily injury and property damage, including clean-up costs.	\$5M	\$5M	\$10M	\$10M

- (ii) In addition to the coverage described in 4.06-a (4)(a)(ii), Business Automobile Liability Insurance, the Contractor shall obtain for hazardous material transporter services:

- (A) MCS-90 endorsement.
(B) Sudden & Accidental Pollution endorsement – Limits of Liability*
\$2M Each Occurrence
\$2M General Aggregate

* These requirements and limits are the same for all size contracts. A higher limit on the MCS-90 endorsement required by law must be matched by the Sudden & Accidental Pollution Insurance.

With the Trustees' approval, the Contractor may delegate the responsibility to provide this additional coverage, as described in this Article 4.06-a (4) (b) above, to its hazardous materials subcontractor. When the Contractor returns its signed Project construction phase agreement to the

Trustees, the Contractor shall also provide the Trustees with a letter stating that it is requiring its hazardous materials subcontractor to provide this additional coverage, if applicable. The Contractor shall affirm in this letter that the hazardous materials subcontractor's certificate of insurance shall also adhere to all of the requirements in Article 4.06-a: (2) Verification of Coverage and (3) Insurance Provisions. Further, this letter will provide that the subcontractor's certificate of insurance will be provided to the Trustees as soon as the Contractor fully executes its subcontract with the hazardous materials subcontractor, or within 30 days of the Notice to Proceed, whichever is less.

- (5) **Acceptability of Insurers.**
Insurers shall be licensed by the State of California to transact insurance and shall hold a current A.M. Best's rating of no less than A:VII, or shall be a carrier otherwise acceptable to Trustees.
- (6) **Subcontractor's Insurance.**
Contractor shall ensure that its subcontractors are covered by insurance of the types required by this Article, and that the amount of insurance for each subcontractor is appropriate for that subcontractor's work. Contractor shall not allow any subcontractor to commence work on its subcontract until the insurance has been obtained.
- (7) **Miscellaneous.**
 - (a) Any deductible under any policy of insurance required in this Article shall be the Contractor's liability.

- (b) Acceptance of certificates of insurance by the Trustees shall not limit the Contractor's liability under the Contract.
- (c) In the event the Contractor does not comply with these insurance requirements, the Trustees may, at its option, provide insurance coverage to protect the Trustees. The cost of the insurance shall be paid by the Contractor and, if prompt payment is not received, may be deducted from Contract sums otherwise due to the Contractor.
- (d) If the Trustees are damaged by the failure of the Contractor to provide or maintain the required insurance, the Contractor shall pay the Trustees for all such damages.
- (e) The Contractor's obligations to obtain and maintain all required insurance are nondelegable duties under this Contract.

APPENDIX B

REVISED RUWAP MMRP 11-15-16

**MITIGATION MONITORING AND REPORTING PLAN
FOR THE REGIONAL URBAN RECYCLED WATER PROJECT (RWP)**

NOTES: Section 21081.6 of the Public Resources Code requires all state and local agencies to establish monitoring or reporting programs whenever approval of a project relies upon an environmental impact report (EIR). The purpose of the monitoring or reporting program is to ensure implementation of the measures being imposed to mitigate or avoid the significant adverse environmental impacts identified in the EIR as amended in Addendum No. 1 to the certified Final EIR for the MCWD Regional Urban Water Augmentation Project.

For those project features outside of MCWD's service areas (specifically, at the Monterey Regional Water Pollution Control Association, Regional Treatment Plant and within the Monterey Peninsula/Cal-Am Service Area) the lead agency and/or project proponent shall replace "MCWD" with their name each time it occurs prior to implementation of those project components.

RUWAP EIR Mitigation Measure with text edits to apply specifically to the RWP shown in strikeout for deleted text and <u>underline</u> for added text.	Timing of Implementation	Responsibility for Implementation	Verified for Compliance by:	X
4.1-R1: Prior to the finalization of project specific plans, the design engineer and MCWD should ensure that the design and placement of the final treatment and filtration facility and pump/lift stations will minimize impacts on the aesthetic nature of their surrounding areas, by providing screening using decorative fencing, vegetation, and painting new buildings and facilities in a color that will blend in with the surrounding landscape.	Prior to finalizing project design	Contractor and MCWD	MCWD	
4.3-R1: The contractors shall adhere to the following requirements <u>as required</u> to reduce particulate matter emissions below the MBUAPCD threshold: <ul style="list-style-type: none"> • water all active construction areas as required with non-potable sources to the extent feasible; frequency should be based on the type of operation, soil, and wind exposure and minimized to prevent wasteful use of water. • prohibit grading activities during periods of high wind (over 15 mph). • cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least two feet of freeboard, • pave or apply water three times daily or apply non-toxic soil stabilizers on all unpaved access roads, parking areas & staging areas at construction sites, • sweep daily (with water sweepers) all paved access roads, parking areas and staging areas at construction sites, • sweep streets daily (with water sweepers) if visible soil material is carried onto adjacent public streets, • hydroseed or apply (non-toxic) soil stabilizers to inactive construction areas (previously graded areas inactive for ten days or more), • enclose, cover, water twice daily or apply (non-toxic) soil binders to exposed stockpiles (dirt, sand, etc.), • limit traffic speeds on unpaved roads to 15 mph, • install appropriate best management practices or other erosion control measures to prevent silt runoff to public roadways, • replant vegetation in disturbed areas as quickly as possible, • install wheel washers for all exiting trucks, or wash off the tires or tracks of all trucks and equipment leaving the site, • limit the area subject to excavation, grading and other construction activity at any one time, • post a publicly visible sign which specifies the telephone number and person to contact regarding dust complaints (the person shall respond to complaints and take corrective action within 48 hours), and • ensure that the phone number of MBUAPCD is visible to ensure compliance with Rule 402 (Nuisance). (Please note that mitigation measure 4.3-R1 is consistent with mitigation measure AQ-1 from Final Pure Water Monterey Groundwater Replenishment Project MMRP). 	During Construction	Contractor and MCWD	MBUAPCD	
4.3-R2: Subject to approval by the MBUAPCD prior to <u>and, as needed, during project construction approval and implementation</u> , MCWD <u>and the contractor</u> shall implement measures to reduce or eliminate diesel exhaust emissions to meet identified thresholds of significance, such as reduction in hours of operation of equipment contributing to such emissions or by utilizing oxidation catalysts or catalytic particulate matter filters on all diesel powered equipment above 50 horsepower that require CARB-certified low-sulfur diesel fuel (less than or equal to 15 parts per million by weight (ppmw)). Site-specific risk assessment may be required to determine the appropriate measures to implement.	Confirm with MBUAPCD prior to project construction; implement measures during	Contractor and MCWD	MBUAPCD	
4.4-R1: Conduct Pre-Construction Survey. A qualified biologist shall conduct a pre-construction survey for Hickman's onion <u>special-status plant species</u> to determine presence of this <u>these</u> species. The biologist shall prepare a report that provides the results of the survey, including a description of the baseline habitat conditions, and, if found, the number of individuals and location of the populations identified within the area of impact. If no individual are found, no further mitigation is necessary. If individuals are found, the following measures shall be implemented: <ul style="list-style-type: none"> • Based on the results of the report, the design of the alternative shall avoid individuals to the maximum extent possible. • If avoidance is not feasible, a Rare Plant Restoration Plan shall be prepared by a qualified biologist and implemented. The plan shall include, but is not limited to, the following: <ul style="list-style-type: none"> ○ a description of the baseline conditions of the habitats within the area of impact, including the presence of any special-status species, their locations, and densities; ○ procedures to control non-native species invasion and elimination of existing non-native species within the area of impact; ○ provisions for ongoing training of facility maintenance personnel to ensure compliance with the requirements of the plan; ○ a detailed description of on-site and off-site restoration areas, salvage of seed and/or soil bank, plant salvage, seeding and planting specifications; and ○ a monitoring program that describes annual monitoring efforts which incorporate success criteria and contingency plans if success criteria are not met. 	Prior to project construction (within 30 days)	Qualified Biologist and Contractor	MCWD	
4.4-R2: Conduct Pre-Construction Surveys for Burrowing Owls and Implement CDFG Guidelines. Pre-construction surveys shall be conducted to locate active nesting burrows. Surveys will consist of visually checking the area within 500 feet of the proposed storage reservoir site within 30 days of initiating construction. If active nests are found, no-disturbance buffers shall be established around all active nesting burrows during the breeding season, and the CDFG burrowing owl guidelines shall be implemented during the non-breeding season. If no burrowing owls are found, no further mitigation measures are required. Breeding season: If active nests are found, biologist shall establish a 250-foot buffer zone around each burrow. No construction activities shall be permitted within the zone until after the breeding season, which extends from February 1 to August 21, or until it is determined that the young have fledged. Winter Season: Adult burrowing owls can occupy burrows year-round. Therefore, before construction activities begin in the vicinity of active burrows (and following the breeding season), CDFG mitigation guidelines for burrowing owls (1995) shall be implemented. The guidelines require that one-way doors be installed at least 48 hours before construction at all active burrows that exist	Prior to project construction (within 30 days)	Qualified Biologist and Contractor	MCWD	

**MITIGATION MONITORING AND REPORTING PLAN
FOR THE REGIONAL URBAN RECYCLED WATER PROJECT (RWP)**

NOTES: Section 21081.6 of the Public Resources Code requires all state and local agencies to establish monitoring or reporting programs whenever approval of a project relies upon an environmental impact report (EIR). The purpose of the monitoring or reporting program is to ensure implementation of the measures being imposed to mitigate or avoid the significant adverse environmental impacts identified in the EIR as amended in Addendum No. 1 to the certified Final EIR for the MCWD Regional Urban Water Augmentation Project.

For those project features outside of MCWD's service areas (specifically, at the Monterey Regional Water Pollution Control Association, Regional Treatment Plant and within the Monterey Peninsula/Cal-Am Service Area) the lead agency and/or project proponent shall replace "MCWD" with their name each time it occurs prior to implementation of those project components.

RUWAP EIR Mitigation Measure with text edits to apply specifically to the RWP shown in strikeout for deleted text and <u>underline</u> for added text.	Timing of Implementation	Responsibility for Implementation	Verified for Compliance by:	X
within the construction area so that the burrows are not occupied during construction. The guidelines also require installation of two artificial burrows for each occupied burrow that is removed. Qualified wildlife biologists shall conduct pre-construction surveys for burrowing owls within 30 days of initiating construction activities. The one-way doors shall be installed at that time to ensure that the owls can get out of the burrows and not back in. Artificial burrows shall be constructed within the area prior to installation of the one-way doors. (Please note that mitigation measure 4.4-R2 is consistent with mitigation measure BT-11 from Final Pure Water Monterey Groundwater Replenishment Project MMRP).				

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**MITIGATION MONITORING AND REPORTING PLAN
FOR THE REGIONAL URBAN RECYCLED WATER PROJECT (RWP)**

NOTES: Section 21081.6 of the Public Resources Code requires all state and local agencies to establish monitoring or reporting programs whenever approval of a project relies upon an environmental impact report (EIR). The purpose of the monitoring or reporting program is to ensure implementation of the measures being imposed to mitigate or avoid the significant adverse environmental impacts identified in the EIR as amended in Addendum No. 1 to the certified Final EIR for the MCWD Regional Urban Water Augmentation Project.

For those project features outside of MCWD's service areas (specifically, at the Monterey Regional Water Pollution Control Association, Regional Treatment Plant and within the Monterey Peninsula/Cal-Am Service Area) the lead agency and/or project proponent shall replace "MCWD" with their name each time it occurs prior to implementation of those project components.

RUWAP EIR Mitigation Measure with text edits to apply specifically to the RWP shown in strikeout for deleted text and <u>underline</u> for added text.	Timing of Implementation	Responsibility for Implementation	Verified for Compliance by:	X
4.4-R3: A Memorandum of Understanding (MOU) with CDFG shall be obtained to allow a qualified biologist to remove and relocate coast horned lizards from the construction area if encountered during construction activities. The MOU shall include, but is not limited to, the methods of capture and handling, an estimation of the number expected to be captured and handled, the duration of capture and handling, and a description of the established relocation area. If the relocation is proposed to occur outside of the project site, MCWD must coordinate and obtain approval from the landowner. Details of this procedure shall be reviewed by CDFG and implemented by a qualified biologist.	Prior to construction	Qualified Biologist and MCWD	CDFG	
4.4-R4: Conduct Construction Monitoring Program for coast horned lizards, which includes procedures for capture and release. A qualified biologist shall remain on-site during initial grading activities to salvage and move coast horned lizards that may be uncovered during earthmoving activities. Recovered individuals shall be placed in appropriate habitat outside of the within the project site in accordance with the MOU with CDFG. The monitor shall walk alongside the grading equipment in each new area of disturbance, and shall have the authority to halt construction temporarily if necessary to capture and relocate an individual. Any individual captured in the grading zone shall be relocated as soon as possible to adjacent suitable habitat outside of the area of impact.	During Construction	Qualified Biologist and Contractor	MCWD	
BT-1j: Conduct Pre-Construction Surveys for American Badger¹. To avoid and reduce impacts to the American badger, the project proponents shall retain a qualified biologist to conduct focused pre-construction surveys for badger dens in all suitable habitat proposed for construction, ground disturbance, or staging no more than two weeks prior to construction. If no potential badger dens are present, no further mitigation is required. If potential dens are observed, the following measures are required to avoid potential significant impacts to the American badger: <ul style="list-style-type: none"> • If the qualified biologist determines that potential dens are inactive, the biologist shall excavate these dens by hand with a shovel to prevent badgers from reusing them during construction. • If the qualified biologist determines that potential dens may be active, the den shall be monitored for a period sufficient (as determined by a qualified biologist) to determine if the den is a maternity den occupied by a female and her young, or if the den is occupied by a solitary badger. • Maternity dens occupied by a female and her young shall be avoided during construction and a minimum buffer of 200 feet in which no construction activities shall occur shall be maintained around the den. After the qualified biologist determines that badgers have stopped using active dens within the project boundary, the dens shall be hand-excavated with a shovel to prevent re-use during construction. Solitary male or female badgers shall be passively relocated by blocking the entrances of the dens with soil, sticks, and debris for three to five days to discourage the use of these dens prior to project construction disturbance. The den entrances shall be blocked to an incrementally greater degree over the three to five day period. After the qualified biologist determines that badgers have stopped using active dens within the project boundary, the dens shall be hand-excavated with a shovel to prevent re-use during construction.	Prior to project construction	MCWD construction contractors and qualified biologists	MCWD qualified biologist	
BT-1k: Conduct Pre-Construction Surveys for Protected Avian Species, including, but not limited to, white-tailed kite and California horned lark. Prior to the start of construction activities, a qualified biologist shall conduct pre-construction surveys for suitable nesting habitat within the Project Study Area and within a suitable buffer area from the Project Study Area. The qualified biologist shall determine the suitable buffer area based on the avian species with the potential to nest at the site. In areas where nesting habitat is present within the project area or within the determined suitable buffer area, construction activities that may directly (e.g., vegetation removal) or indirectly (e.g., noise/ground disturbance) affect protected nesting avian species shall be timed to avoid the breeding and nesting season. Specifically, vegetation and/or tree removal can be scheduled after September 16 and before January 31. Alternatively, a qualified biologist shall be retained by the project proponents to conduct pre-construction surveys for nesting raptors and other protected avian species where nesting habitat was identified and within the suitable buffer area if construction commences between February 1 and September 15. Pre-construction surveys shall be conducted no more than 14 days prior to the start of construction activities during the early part of the breeding season (February through April) and no more than 30 days prior to the initiation of these activities during the late part of the breeding season (May through August). Because some bird species nest early in spring and others nest later in summer, surveys for nesting birds may be required to continue during construction to address new arrivals, and because some species breed multiple times in a season. The necessity and timing of these continued surveys shall be determined by the qualified biologist based on review of the final construction plans. If active raptor or other protected avian species nests are identified during the preconstruction surveys, the qualified biologist shall notify the project proponents and an appropriate no-disturbance buffer shall be imposed within which no construction activities or disturbance shall take place until the young have fledged and are no longer reliant upon the nest or parental care for survival, as determined by a qualified biologist. (Please note that mitigation measure BT-1k was identified in the Final Pure Water Monterey Groundwater Replenishment Project MMRP as mitigation necessary for the construction and project implementation of the RWP. BT-1k is consistent with mitigation measure 4.4-R5 previously identified in this RWP MMRP and is more inclusive therefore has been added in place of 4.4-R5 to ensure compliance.)	Prior to Construction if it occurs between Aug. 1 & Apr. 14	Qualified Biologist and MCWD	MCWD	
4.4-R6: Conduct Pre-Construction Surveys for Coast Horned Larks and Loggerhead Shrike. A qualified biologist shall perform pre-construction surveys for active nests of these two species prior to construction (within 30 days of construction initiation). If active nests are found, a suitable construction buffer shall be established by a qualified biologist until the young of the year have fledged. Alternatively, construction activities that may affect nesting raptors can be timed to avoid the nesting season (generally the nesting season is April 15 to August 1).	Prior to Construction if it occurs between Aug. 1 & Apr. 14	Qualified Biologist and MCWD	MCWD	
4.4-R7: A Revegetation Plan shall be prepared by a qualified biologist to revegetate and restore impacted habitat. This plan shall include a list of appropriate species, planting specifications,	Prior to	Qualified	MCWD	

¹ Mitigation Measure BT-1j was identified in the Final Pure Water Monterey Groundwater Replenishment Project MMRP as mitigation necessary for the construction and project implementation of the RWP and therefore has been added to this MMRP to ensure compliance, The Pure Water Monterey Groundwater Replenishment Project Final EIR and MMRP approved and certified by Monterey Regional Water Pollution Control Agency (MRWPCA) on October 8, 2015.

**MITIGATION MONITORING AND REPORTING PLAN
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NOTES: Section 21081.6 of the Public Resources Code requires all state and local agencies to establish monitoring or reporting programs whenever approval of a project relies upon an environmental impact report (EIR). The purpose of the monitoring or reporting program is to ensure implementation of the measures being imposed to mitigate or avoid the significant adverse environmental impacts identified in the EIR as amended in Addendum No. 1 to the certified Final EIR for the MCWD Regional Urban Water Augmentation Project.

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R UWAP EIR Mitigation Measure with text edits to apply specifically to the RWP shown in strikeout for deleted text and <u>underline</u> for added text.	Timing of Implementation	Responsibility for Implementation	Verified for Compliance by:	X
monitoring procedures, success criteria, and contingency plan if success criteria are not met.	construction	Biologist and Contractor		
<p>4.4-R8: Conduct an Employee Education Program for Construction Crew and MCWD staff prior to construction activities. <u>A qualified biologist (if necessary, the biological monitor) shall meet with the construction crew at the onset of construction to educate the construction crew on the following: 1) the appropriate access route in and out of the construction area; 2) how biological monitor will examine the area and agree upon a method which will ensure the safety of the monitor during such activities; 3) the special-status species that may be present; 4) the specific mitigation measures that will be incorporated into the construction effort; 5) the general provisions and protections afforded by the USFWS and CDFW; and 6) the proper procedures if a special-status animal or any other animal is encountered within the project site. Refer to Mitigation Measure 4.4 D8 above.</u></p> <p>(Please note that mitigation measure 4.4-R8 is consistent with mitigation measure BT-1s #1 from Final Pure Water Monterey Groundwater Replenishment Project MMRP).</p>	Prior to construction	Qualified Biologist and Contractor	MCWD	
<p>4.4-R9: Trees and vegetation not planned for removal shall be protected during construction to the maximum extent possible. This includes the use of exclusionary fencing of herbaceous and shrubby vegetation, such as hay bales, and protective wood barriers for trees. Only certified weed-free straw shall be used to avoid the introduction of non-native, invasive species. A biological monitor shall supervise the installation of protective fencing and monitor at least once per week until construction is complete to ensure that the protective fencing remains intact.</p> <p>(Please note that mitigation measure 4.4-R9 is consistent with mitigation measure BT-1s #2 from Final Pure Water Monterey Groundwater Replenishment Project MMRP).</p>	Prior, during, and post construction	Contractor	MCWD	
<p>4.4-R10: Following construction, disturbed areas shall be restored to pre-project contours to the maximum extent possible and revegetated using locally-occurring native species and native erosion control seed mix, per the requirements of the Revegetation Plan.</p> <p>(Please note that mitigation measure 4.4-R10 is consistent with mitigation measure BT-1s #4 from Final Pure Water Monterey Groundwater Replenishment Project MMRP).</p>	Following construction	Contractor	MCWD	
<p>4.4-R11: Protective fencing shall be placed prior to and during construction so as to keep construction vehicles and personnel from impacting vegetation adjacent to the project site outside of work limits. A biological monitor shall supervise the installation of protective fencing and monitor at least once per week until construction is complete to ensure that the protective fencing remains intact.</p> <p>(Please note that mitigation measure 4.4-R11 is consistent with mitigation measure BT-1s #3 from Final Pure Water Monterey Groundwater Replenishment Project MMRP).</p>	Prior, during, and post construction	Contractor	MCWD	
<p>4.4-R12: Grading, excavating, and other activities that involve substantial soil disturbance shall be planned and carried out in consultation with a qualified hydrologist, engineer, or erosion control specialist, and shall utilize standard erosion control techniques to minimize erosion and sedimentation to native vegetation.</p> <p>(Please note that mitigation measure 4.4-R12 is consistent with mitigation measure BT-1a #5 from Final Pure Water Monterey Groundwater Replenishment Project MMRP).</p>	Prior, during, and post construction	Contractor & qualified hydrologist/engineer	MCWD	
<p>4.4-R13: A representative shall be appointed by MCWD who will be the contact source for any employee or contractor who may inadvertently kill or injure a special-status species or find one dead, injured, or trapped. The representative shall be notified immediately to notify USFWS and CDFG. The representative shall be identified during the Employee Education Program and his/her contact information shall be provided to USFWS and CDFG.</p>	Prior to construction	Appointed Representative and Contractor	MCWD	
<p>4.4-R14: If maintenance activities require ground disturbance, the impacts shall be subject to the requirements of the Revegetation Plan described in Mitigation Measure 4.4-R7.</p>	Ongoing if maintenance requires ground disturbance	MCWD	MCWD	
<p>4.4-R15: Conduct an Employee Education Program for Maintenance Construction Crew and other MCWD staff prior to project <u>implementation construction activities</u>. <u>A biological monitor shall meet with the maintenance crew at the onset of project operations to educate the crew on the following: 1) the appropriate access route in and out of the facility area; 2) how biological monitor will examine the area and agree upon a method which will ensure the safety of the monitor during such activities; 3) the special-status species that may be present; 4) the specific mitigation measures that will apply to maintenance activities; 5) the general provisions and protections afforded by the USFWS and CDFW; and 6) the proper procedures if a special-status animal or any other animal is encountered within the project site. Refer to Mitigation Measure 4.4 D8 above.</u></p> <p>(Please note that mitigation measure 4.4-R8 is consistent with mitigation measure BT-1a #1 from Final Pure Water Monterey Groundwater Replenishment Project MMRP).</p>	Prior to construction	Qualified Biologist and MCWD	MCWD	
<p>BT-1a: Implement Construction Best Management Practices². The following best management practices shall be implemented during all identified phases of construction (i.e., pre-, during, and post-) to reduce impacts to special-status plant and wildlife species:</p> <ol style="list-style-type: none"> 1. No firearms shall be allowed on the construction sites at any time. 2. To protect against spills and fluids leaking from equipment, the project proponent shall require that the construction contractor maintains an on-site spill plan and on-site spill containment measures that can be easily accessed. 3. Refueling or maintaining vehicles and equipment should only occur within a specified staging area that is at least 100 feet from a waterbody (including riparian and wetland habitat) and that has sufficient management measures that will prevent fluids or other construction materials including water from being transported into waters of the state. Measures shall include confined concrete washout areas, straw wattles placed around stockpiled materials and plastic sheets to cover materials from becoming airborne or otherwise transported due to wind or rain into surface waters. 	Prior to, during and after project construction	MCWD construction contractors and qualified biologist	MCWD qualified biologist and construction biological monitor;	

² Mitigation Measure BT-1a was identified in the Final Pure Water Monterey Groundwater Replenishment Project MMRP as mitigation necessary for the construction and project implementation of the RWP and therefore has been added to this MMRP to ensure compliance. The other components of BT-1a as identified in the Final Pure Water Monterey Groundwater Replenishment Project MMRP, are identified within this MMRP. The Pure Water Monterey Groundwater Replenishment Project Final EIR and MMRP approved and certified by Monterey Regional Water Pollution Control Agency (MRWPCA) on October 8, 2015.

**MITIGATION MONITORING AND REPORTING PLAN
FOR THE REGIONAL URBAN RECYCLED WATER PROJECT (RWP)**

NOTES: Section 21081.6 of the Public Resources Code requires all state and local agencies to establish monitoring or reporting programs whenever approval of a project relies upon an environmental impact report (EIR). The purpose of the monitoring or reporting program is to ensure implementation of the measures being imposed to mitigate or avoid the significant adverse environmental impacts identified in the EIR as amended in Addendum No. 1 to the certified Final EIR for the MCWD Regional Urban Water Augmentation Project.

For those project features outside of MCWD's service areas (specifically, at the Monterey Regional Water Pollution Control Association, Regional Treatment Plant and within the Monterey Peninsula/Cal-Am Service Area) the lead agency and/or project proponent shall replace "MCWD" with their name each time it occurs prior to implementation of those project components.

RUWAP EIR Mitigation Measure with text edits to apply specifically to the RWP shown in strikeout for deleted text and <u>underline</u> for added text.	Timing of Implementation	Responsibility for Implementation	Verified for Compliance by:	X
BT-1b: Implement Construction-Phase Monitoring³. The project proponents shall retain a qualified biologist to monitor all ground disturbing construction activities (i.e., vegetation removal, grading, excavation, or similar activities) to protect any special-status species encountered. Any handling and relocation protocols of special-status wildlife species shall be determined in coordination with CDFW prior to any ground disturbing activities, and conducted by a qualified biologist with appropriate scientific collection permit. After ground disturbing project activities are complete, the qualified biologist shall train an individual from the construction crew to act as the on-site construction biological monitor. The construction biological monitor shall be the contact for any special-status wildlife species encounters, shall conduct daily inspections of equipment and materials stored on site and any holes or trenches prior to the commencement of work, and shall ensure that all installed fencing stays in place throughout the construction period. The qualified biologist shall then conduct regular scheduled and unscheduled visits to ensure the construction biological monitor is satisfactorily implementing all appropriate mitigation protocols. Both the qualified biologist and the construction biological monitor shall have the authority to stop and/or redirect project activities to ensure protection of resources and compliance with all environmental permits and conditions of the project. The qualified biologist and the construction monitor shall complete a daily log summarizing activities and environmental compliance throughout the duration of the project. The log shall also include any special-status wildlife species observed and relocated.	Prior to and during project construction	MCWD, qualified biologists	MCWD qualified biologist and construction biological monitor; CDFW	X
BT-1c: Implement Non-Native, Invasive Species Controls⁴. The following measures shall be implemented to reduce the introduction and spread of non-native, invasive species: <ol style="list-style-type: none"> Any landscaping or replanting required for the project shall not use species listed as noxious by the California Department of Food and Agriculture (CDFA). Bare and disturbed soil shall be landscaped with CDFA recommended seed mix or plantings from locally adopted species to preclude the invasion on noxious weeds in the Project Study Area. Construction equipment shall be cleaned of mud or other debris that may contain invasive plants and/or seeds and inspected to reduce the potential of spreading noxious weeds, before mobilizing to arrive at the construction site and before leaving the construction site. All non-native, invasive plant species shall be removed from disturbed areas prior to replanting. 	During project construction	Construction contactors	MCWD qualified biologist and construction biological monitor	X
BT-1d: Conduct Pre-Construction Surveys for California Legless Lizard⁵. The project proponents shall retain a qualified biologist to prepare and implement a legless lizard management plan in coordination with CDFW, which shall include, but is not limited to, the protocols for pre-construction surveys, construction monitoring, and salvage and relocation. The management plan shall include, but is not limited to, the following: <ul style="list-style-type: none"> Pre-Construction Surveys. Pre-construction surveys for legless lizards shall be conducted in all suitable habitat proposed for construction, ground disturbance, or staging. The qualified biologist shall hold or obtain a CDFW scientific collection permit for this species. The pre-construction surveys shall use a method called "high-grading." The high grading method shall include surveying the habitat where legless lizards are most likely to be found, and the survey must occur under the conditions when legless lizards are most likely to be seen and captured (early morning, high soil moisture, overcast, etc.). The intensity of a continued search may then be adjusted, based on the results of the first survey in the best habitat. A "three pass method" shall be used to locate and remove as many legless lizards as possible. A first pass shall locate as many legless lizards as possible, a second pass should locate fewer lizards than the first pass, and a third pass should locate fewer lizards than the second pass. All search passes shall be conducted in the early morning when legless lizards are easiest to capture. Vegetation may be removed by hand to facilitate hand raking and search efforts for legless lizards in the soil under brush. If lizards are found during the first pass, an overnight period of no soil disturbance must occur before the second pass, and the same requirement shall be implemented after the second pass. If no lizards are found during the second pass, a third pass is not required. Installation of a barrier, in accordance with the three pass method, shall be required if legless lizards are found at the limits of construction (project boundaries) and sufficient soft sand and vegetative cover are present to suspect additional lizards are in the immediate vicinity on the adjacent property. A barrier shall prevent movement of legless lizards into the property. All lizards discovered shall be handled according to the salvage procedures outlined below. Construction Monitoring. Monitoring by a qualified biologist shall be ongoing during construction. The onsite monitor shall be present during all ground disturbing construction activities. To facilitate the careful search for lizards during construction, vegetation may need to be removed. If removal by hand is impractical, equipment such as a chainsaw, string trimmer, or skid-steer may be used, if a monitor and crew are present. The task of the vegetation removal is to remove plants under the direction of the monitor, allowing the monitor to watch for legless lizards. After plants are removed, the monitor and crew shall search the exposed area for legless lizards. If legless lizards are found during preconstruction surveys or construction monitoring, the protocols for salvage and relocation identified below shall be followed. Upon completion of pre-construction surveys, construction monitoring, and any resulting salvage and relocation actions, a report shall be submitted to the CDFW. The CDFW must be notified at least 48 hours before any field activity begins. Salvage and Relocation. Only experienced persons may capture or handle legless lizards. The monitor must demonstrate a basic understanding, knowledge, skill, and experience with this species and its habitat. Once captured, a lizard shall be placed in a lidded, vented box containing clean sand. Areas of moist and dry sand need to be present in the box. The boxes must be kept out of direct sunlight and protected from temperatures over 72°F. The sand must be kept at temperatures under 66°F. Ideal temperatures are closer to 60°F. On the same day as capture, the lizards shall be examined for injury and data recorded on location where found as well as length, color, age, and tail condition. Once data is recorded, lizards shall be relocated to appropriate habitat, as determined through coordination with the CDFW, qualified biologist, and potential landowners. 	Prior to and during project construction	MCWD qualified biologist	MCWD, qualified biologist	X

³ Mitigation Measure BT-1b was identified in the Final Pure Water Monterey Groundwater Replenishment Project MMRP as mitigation necessary for the construction and project implementation of the RWP and therefore has been added to this MMRP to ensure compliance, The Pure Water Monterey Groundwater Replenishment Project Final EIR and MMRP approved and certified by Monterey Regional Water Pollution Control Agency (MRWPCA) on October 8, 2015.

⁴ Mitigation Measure BT-1c was identified in the Final Pure Water Monterey Groundwater Replenishment Project MMRP as mitigation necessary for the construction and project implementation of the RWP and therefore has been added to this MMRP to ensure compliance, The Pure Water Monterey Groundwater Replenishment Project Final EIR and MMRP approved and certified by Monterey Regional Water Pollution Control Agency (MRWPCA) on October 8, 2015.

⁵ Mitigation Measure BT-1d was identified in the Final Pure Water Monterey Groundwater Replenishment Project MMRP as mitigation necessary for the construction and project implementation of the RWP and therefore has been added to this MMRP to ensure compliance, The Pure Water Monterey Groundwater Replenishment Project Final EIR and MMRP approved and certified by Monterey Regional Water Pollution Control Agency (MRWPCA) on October 8, 2015.

**MITIGATION MONITORING AND REPORTING PLAN
FOR THE REGIONAL URBAN RECYCLED WATER PROJECT (RWP)**

NOTES: Section 21081.6 of the Public Resources Code requires all state and local agencies to establish monitoring or reporting programs whenever approval of a project relies upon an environmental impact report (EIR). The purpose of the monitoring or reporting program is to ensure implementation of the measures being imposed to mitigate or avoid the significant adverse environmental impacts identified in the EIR as amended in Addendum No. 1 to the certified Final EIR for the MCWD Regional Urban Water Augmentation Project.

For those project features outside of MCWD's service areas (specifically, at the Monterey Regional Water Pollution Control Association, Regional Treatment Plant and within the Monterey Peninsula/Cal-Am Service Area) the lead agency and/or project proponent shall replace "MCWD" with their name each time it occurs prior to implementation of those project components.

RUWAP EIR Mitigation Measure with text edits to apply specifically to the RWP shown in strikeout for deleted text and <u>underline</u> for added text.	Timing of Implementation	Responsibility for Implementation	Verified for Compliance by:	X
Suitability of habitat for lizard release must be evaluated and presented in a management plan. The habitat must contain habitat factors most important to the health and survival of the species such as appropriate habitat based on soils, vegetated cover, native plant species providing cover, plant litter layer and depth, soil and ambient temperature, quality and composition of invertebrate population and prey availability. Potential relocation sites that contain the necessary conditions may exist within the habitat reserves on the former Fort Ord, including the Fort Ord National Monument. Lizards shall be marked with a unique tag (pit or tattoo) prior to release. Release for every lizard shall be recorded with GPS. GPS locations shall be submitted as part of the survey result report to document the number and locations of lizards relocated.				
<p>BT-1e: Prepare and Implement Rare Plant Restoration Plan to Mitigate Impacts to Sandmat Manzanita, Monterey Ceanothus, Monterey Spineflower, Eastwood's Goldenbush, Coast Wallflower, and Kellogg's Horkelia⁶. Impacts to rare plant species individuals shall be avoided through project design and modification, to the extent feasible while taking into consideration other site and engineering constraints. If avoidance is not possible, the species shall be replaced at a 1:1 ratio for area of impact through preservation, restoration, or combination of both. A Rare Plant Restoration Plan, approved by the lead agency prior to commencing construction on the project site, shall be prepared and implemented by a qualified biologist. The plan shall include, but is not limited to, the following:</p> <p>a. A detailed description of on-site and/or off-site mitigation areas, salvage of seed and/or soil bank, plant salvage, seeding and planting specifications, including, if appropriate, increased planting ratio to ensure the applicable success ratio. Specifically, seed shall be collected from the on-site individuals that would be impacted and grown in a local greenhouse, and then transplanted within the mitigation area. Plants shall be transplanted while they are young seedlings in order to develop a good root system. Alternatively, the mitigation area may be broadcast seeded in fall; however, if this method is used, some seed shall be retained in the event that the seeding fails to produce viable plants and contingency measures need to be employed.</p> <p>b. A description of a 3-year monitoring program, including specific methods of vegetation monitoring, data collection and analysis, restoration goals and objectives, success criteria, adaptive management if the criteria are not met, reporting protocols, and a funding mechanism.</p> <p>The mitigation area shall be preserved in perpetuity through a conservation easement or other legally enforceable land preservation agreement. Exclusionary fencing shall be installed around the mitigation area to prevent disturbance until success criteria have been met.</p>	Prior to project construction	Project engineers, project biologist, MCWD	MCWD qualified biologist	
<p>BT-1g: Conduct Pre-Construction Surveys for Special-Status Bats⁷. To avoid and reduce impacts to special-status bat species, the project proponents shall retain a qualified bat specialist or wildlife biologist to conduct site surveys during the reproductive season (May 1 through September 15) to characterize bat utilization of the site and potential species present (techniques utilized to be determined by the biologist) prior to tree or building removal. Based on the results of these initial surveys, one or more of the following shall occur:</p> <ul style="list-style-type: none"> • If it is determined that bats are not present at the site, no additional mitigation is required. • If it is determined that bats are utilizing the site and may be impacted by the Project, pre-construction surveys shall be conducted no more than 30 days prior to any tree or building removal (or any other suitable roosting habitat) within 100 feet of construction limits. If, according to the bat specialist, no bats or bat signs are observed in the course of the pre-construction surveys, tree and building removal may proceed. If bats and/or bat signs are observed during the pre-construction surveys, the biologist shall determine if disturbance would jeopardize a maternity roost or another type of roost (i.e., foraging, day, or night). • If a single bat and/or only adult bats are roosting, removal of trees, buildings, or other suitable habitat may proceed after the bats have been safely excluded from the roost. Exclusion techniques shall be determined by the biologist and would depend on the roost type. <p>If an active maternity roost is detected, avoidance is preferred. Work in the vicinity of the roost (buffer to be determined by biologist) shall be postponed until the biologist monitoring the roost determines that the young have fledged and are no longer dependent on the roost. The monitor shall ensure that all bats have left the area of disturbance prior to initiation of pruning and/or removal of trees that would disturb the roost. If avoidance is not possible and a maternity roost must be disrupted, authorization from CDFW shall be required prior to removal of the roost.</p>	Prior to project construction	MCWD qualified biologist (bat/wildlife specialist)	MCWD and qualified biologist	
<p>BT-1h: Implementation of Mitigation Measures BT-1a and BT-1b to Mitigate Impacts to the Monterey Ornate Shrew, Coast Horned Lizard, Coast Range Newt, Two-Striped Garter Snake, and Salinas Harvest Mouse⁸. If these species are encountered, implementation of Mitigation Measures BT-1a and BT-1b, which avoid and minimize impacts through implementing construction best management practices and monitoring, would reduce potential impacts to these species to a less-than-significant level.</p>	Prior to and during project construction	MCWD contractors and qualified biologists	MCWD qualified biologist	
<p>BT-1i: Conduct Pre-Construction Surveys for Monterey Dusky-Footed Woodrat⁹. To avoid and reduce impacts to the Monterey dusky-footed woodrat, the project proponents shall retain a qualified biologist to conduct pre-construction surveys in suitable habitat proposed for construction, ground disturbance, or staging within three days prior to construction for woodrat nests within the</p>	Prior to project construction	MCWD contractors and	MCWD	

⁶ Mitigation Measure BT-1e was identified in the Final Pure Water Monterey Groundwater Replenishment Project MMRP as mitigation necessary for the construction and project implementation of the RWP and therefore has been added to this MMRP to ensure compliance, The Pure Water Monterey Groundwater Replenishment Project Final EIR and MMRP approved and certified by Monterey Regional Water Pollution Control Agency (MRWPCA) on October 8, 2015.

⁷ Mitigation Measure BT-1g was identified in the Final Pure Water Monterey Groundwater Replenishment Project MMRP as mitigation necessary for the construction and project implementation of the RWP and therefore has been added to this MMRP to ensure compliance, The Pure Water Monterey Groundwater Replenishment Project Final EIR and MMRP approved and certified by Monterey Regional Water Pollution Control Agency (MRWPCA) on October 8, 2015.

⁸ Mitigation Measure BT-1h was identified in the Final Pure Water Monterey Groundwater Replenishment Project MMRP as mitigation necessary for the construction and project implementation of the RWP and therefore has been added to this MMRP to ensure compliance, The Pure Water Monterey Groundwater Replenishment Project Final EIR and MMRP approved and certified by Monterey Regional Water Pollution Control Agency (MRWPCA) on October 8, 2015.

**MITIGATION MONITORING AND REPORTING PLAN
FOR THE REGIONAL URBAN RECYCLED WATER PROJECT (RWP)**

NOTES: Section 21081.6 of the Public Resources Code requires all state and local agencies to establish monitoring or reporting programs whenever approval of a project relies upon an environmental impact report (EIR). The purpose of the monitoring or reporting program is to ensure implementation of the measures being imposed to mitigate or avoid the significant adverse environmental impacts identified in the EIR as amended in Addendum No. 1 to the certified Final EIR for the MCWD Regional Urban Water Augmentation Project.

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project area and in a buffer zone 100 feet out from the limit of disturbance. All woodrat nests shall be flagged for avoidance of direct construction impacts and protection during construction, where feasible. Nests that cannot be avoided shall be manually deconstructed prior to land clearing activities to allow animals to escape harm. If a litter of young is found or suspected, nest material shall be replaced, and the nest left alone for 2-3 weeks before a re-check to verify that young are capable of independent survival before proceeding with nest dismantling.		qualified biologists		
4.4-R18: A Memorandum of Understanding (MOU) with CDFG shall be obtained for a qualified biologist to remove and relocate black legless lizards, coast horned lizards, and globe dune beetles from the construction area if encountered during construction activities. The MOU shall include, but is not limited to, the methods of capture and an estimation of the number of individuals expected to be captured and handled, the duration of capture and handling, and a description of the established relocation area. If the relocation is proposed to occur outside of the project site, MCWD must coordinate and obtain approval from the landowner. Details of this procedure shall be reviewed by CDFG and implemented by a qualified biologist.	Prior to construction	Qualified Biologist and MCWD	CDFG	
4.4-R19: Conduct Construction Monitoring Program for Black Legless Lizards, which includes procedures for capture and release. A qualified biologist shall remain on-site during initial grading activities to salvage and move lizards that may be uncovered during earthmoving activities. Recovered individuals shall be placed in appropriate habitat outside of the within the project site in accordance with the MOU with CDFG. The monitor shall walk alongside the grading equipment in each new area of disturbance, and shall have the authority to halt construction temporarily if necessary to capture and relocate an individual. Any individual captured in the grading zone shall be relocated as soon as possible to adjacent suitable habitat outside of the area of impact.	During Construction	Qualified Biologist and Contractor	MCWD	
4.4-R22: All food-related and other trash shall be disposed of in closed containers and removed from the project area at least once a week during the construction period, or more often if trash is attracting avian or mammalian predators. Construction personnel shall not feed or otherwise attract wildlife to the area. (Please note that mitigation measure 4.4-R22 is consistent with mitigation measure BT-1a #7 from Final Pure Water Monterey Groundwater Replenishment Project MMRP).	During construction	Contractor	MCWD	
BT-4. HMP Plant Species Salvage¹⁰. For impacts to the HMP plant species within the Project Study Area that do not require take authorization from USFWS or CDFW, salvage efforts for these species shall be evaluated by a qualified biologist per the requirements of the HMP and BO. A salvage plan shall be prepared and implemented by a qualified biologist, which shall include, but is not limited to: a description and evaluation of salvage opportunities and constraints; a description of the appropriate methods and protocols of salvage and relocation efforts; identification of relocation and restoration areas; and identification of qualified biologists approved to perform the salvage efforts, including the identification of any required collection permits from USFWS and/or CDFW. Where proposed, seed collection shall occur from plants within the Project Study Area and topsoil shall be salvaged within occupied areas to be disturbed. Seeds shall be collected during the appropriate time of year for each species by qualified biologists. At the time of seed collection, a map shall also be prepared that identifies the specific locations of the plants for any future topsoil preservation efforts. The collected seeds shall be used to revegetate temporarily disturbed construction areas and reseeded and restoration efforts on- or off-site, as determined appropriate in the salvage plan.	Prior to, during, and after construction	MCWD Biologist	MCWD qualified biologist	
4.6-R1 See Note 1				
4.6-R2: If buried human remains are encountered during construction, work within 50 meters (±160 feet) of the find must halt and the archaeologist and the coroner immediately notified. If the find is determined to be significant, appropriate mitigation measures shall be formulated and implemented. If the remains are determined to be Native American, then the NAHC must be notified within 24 hours as required by Public Resources Code 5097. The NAHC will notify designated Most Likely Descendants who will provide recommendations for the treatment of the remains within 24 hours. The NAHC will mediate any disputes regarding treatment of remains. (Please note that mitigation measure 4.6-R2 is consistent with mitigation measure BT-1s #1 from Final Pure Water Monterey Groundwater Replenishment Project MMRP).	During construction	Qualified Archaeologist and MCWD	MCWD	
CR-2c: Native American Notification¹¹. Because of their continuing interest in potential discoveries during construction, all listed Native American Contacts shall be notified of any and all discoveries of archaeological resources in the project area.	During project construction	MCWD and qualified archaeologist	MCWD and qualified archaeologist	
4.6-R3: MCWD shall comply with the policies and programs for the Cities of Marina, Seaside, and Monterey, and Monterey County relating to protecting resources and identifying additional archaeological sites that may be affected by project implementation.	All phases of project	Qualified Archaeologist & MCWD	MCWD	
4.6-R4: Unsurveyed areas within the areas proposed for ground disturbance or other construction activities shall be inventoried for the presence of cultural resources. This would include surface examination of the project site. Cultural resources, if found, shall be recorded on State Forms DPR 523 depending on the type of resource. After field studies are completed, an Archaeological Survey Report will be prepared, as appropriate, for documenting the type(s) of resources encountered.	Prior to and during construction	Qualified Archaeologist and MCWD	MCWD	
4.6-R5: If cultural resources cannot be avoided, they shall be evaluated for CEQA significance. The purpose of which would be to define a course of action to satisfy CEQA requirements for an Assessment of Effects. If cultural resources are considered significant resources per CEQA, then a data recovery program shall be implemented to reduce impacts to less-than-significant levels as required by CEQA Guidelines.	All phases of project	Qualified Archaeologist and MCWD	MCWD	

⁹ Mitigation Measure BT-1i was identified in the Final Pure Water Monterey Groundwater Replenishment Project MMRP as mitigation necessary for the construction and project implementation of the RWP and therefore has been added to this MMRP to ensure compliance, The Pure Water Monterey Groundwater Replenishment Project Final EIR and MMRP approved and certified by Monterey Regional Water Pollution Control Agency (MRWPCA) on October 8, 2015.

¹⁰ Mitigation Measure BT-4 was identified in the Final Pure Water Monterey Groundwater Replenishment Project MMRP as mitigation necessary for the construction and project implementation of the RWP and therefore has been added to this MMRP to ensure compliance, The Pure Water Monterey Groundwater Replenishment Project Final EIR and MMRP approved and certified by Monterey Regional Water Pollution Control Agency (MRWPCA) on October 8, 2015.

¹¹ Mitigation Measure CR-2c was identified in the Final Pure Water Monterey Groundwater Replenishment Project MMRP as mitigation necessary for the construction and project implementation of the RWP and therefore has been added to this MMRP to ensure compliance, The Pure Water Monterey Groundwater Replenishment Project Final EIR and MMRP approved and certified by Monterey Regional Water Pollution Control Agency (MRWPCA) on October 8, 2015.

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4.6-R6: To insure that no inadvertent damage occurs to cultural resources, the resource boundaries should be marked as exclusion zones both on the ground and on construction maps. Construction supervisory personnel should be notified of the existence of these resources and required to keep personnel and equipment away from these areas. Periodic monitoring of cultural resources to be avoided should be completed by MCWD to insure that no inadvertent damage to the resources occurs as a result of construction or construction-related activities.	Prior to construction	Qualified Archaeologist and MCWD	MCWD	
4.6-R7: Prior to the initiation of construction or ground-disturbing activities adjacent to cultural resources, all construction personnel should be alerted to the possibility of buried cultural remains. Personnel should be instructed that upon discovery of cultural materials, no collection is to be undertaken and work in the immediate area of the find should be halted and MCWD be notified. During construction and operation, personnel and equipment will be restricted to the corridor surveyed for archaeological resources.	All phases of project	Qualified Archaeologist and MCWD	MCWD	
4.6-R8: Unsurveyed areas within proposed areas of ground disturbance or other construction activities shall be inventoried for the presence of historical resources. This would include surface examination of the project site. Historical resources, if found, shall be recorded on State Forms DPR 523 depending on the type of resource. The proposed alternative shall comply with the Office of Historic Preservation's instructions for recording historical resources. Refer to http://www.ohp.parks.ca.gov/ for more information.	All phases of project	Qualified Archaeologist and MCWD		
4.6-R9: If historical resources cannot be avoided, they shall be evaluated for CEQA significance and eligibility for the CRHP. The purpose of which would be to define a course of action to satisfy CEQA requirements for an Assessment of Effects. Historical resource mitigation measures may include further study to evaluate the sites, detailed recording, and/or excavation. If the historical resources per CEQA are significant or eligible for the CRHP, then a data recovery program shall be implemented to reduce impacts to less-than-significant levels as required by CEQA Guidelines.	When resources are encountered	Qualified Archaeologist and MCWD		
4.6-R10: Prior to the initiation of construction or ground-disturbing activities adjacent to cultural resources, all construction personnel should be alerted to the possibility of buried cultural remains. This would include prehistoric and/or historic resources. Personnel should be instructed that upon discovery of prehistoric and/or historic resources, no collection is to be undertaken and work in the immediate area of the find should be halted and MCWD be notified.	Prior to construction	Qualified Archaeologist and MCWD	MCWD	
EN-1: Construction Equipment Efficiency Plan¹². MCWD shall contract a qualified professional (i.e., construction planner/energy efficiency expert) to prepare a Construction Equipment Efficiency Plan that identifies the specific measures that MCWD (and its construction contractors) will implement as part of project construction to increase the efficient use of construction equipment. Such measures shall include, but not necessarily be limited to: procedures to ensure that all construction equipment is properly tuned and maintained at all times; a commitment to utilize existing electricity sources where feasible rather than portable diesel-powered generators; consistent compliance with idling restrictions of the state; and identification of procedures (including the use of routing plans for haul trips) that will be followed to ensure that all materials and debris hauling is conducted in a fuel-efficient manner.	Prior to project construction	MCWD energy efficiency expert, construction contractors	MCWD	
4.7-R1: To minimize the potential effects from strong seismic ground shaking on the project, a project specific geotechnical analysis shall be performed by a registered professional engineer with geotechnical expertise prior to the development of project level plans. <u>The recommendations of the geotechnical analysis shall be incorporated into project plans and implemented during construction, as appropriate.</u>	Prior to final design	Registered geotechnical engineer	MCWD	
4.7-R2: The engineer shall develop project level plans based upon and in response to the observations and recommendations made in the project specific geotechnical analysis.	Prior to final design and after geotech	Design engineer and MCWD		
4.7-R3: <u>MCWD</u> , the contractor and engineer (<u>as appropriate</u>) shall develop emergency response procedures in order to control and stop the release of recycled water in the event that seismic ground shaking causes a leak or rupture in the <u>earthen or tank</u> reservoirs or pipelines.	Prior to project completion	MCWD, engineer, contractor, as appropriate	MCWD	
HH-2a: Environmental Site Assessment¹³. If required by local jurisdictions and property owners with approval responsibility for construction, MCWD shall conduct a Phase I Environmental Site Assessment in conformance with ASTM Standard 1527-05 to identify potential locations where hazardous material contamination may be encountered. If an Environmental Site Assessment indicates that a release of hazardous materials could have affected soil or groundwater quality at a project site, a Phase II environmental site assessment shall be conducted to determine the extent of contamination and to prescribe an appropriate course of remediation, including but not limited to removal of contaminated soils, in conformance with state and local guidelines and regulations. If the results of the subsurface investigation(s) indicate the presence of hazardous materials, additional site remediation may be required by the applicable state or local regulatory agencies, and the contractors shall be required to comply with all regulatory requirements for facility design or site remediation.	Prior to project construction (if presence of hazardous materials is identified, site remediation or design changes may be	MCWD project engineers, construction contractors	MCWD	

¹² Mitigation Measure EN-1 was identified in the Final Pure Water Monterey Groundwater Replenishment Project MMRP as mitigation necessary for the construction and project implementation of the RWP and therefore has been added to this MMRP to ensure compliance, The Pure Water Monterey Groundwater Replenishment Project Final EIR and MMRP approved and certified by Monterey Regional Water Pollution Control Agency (MRWPCA) on October 8, 2015.

¹³ Mitigation Measure HH-2a was identified in the Final Pure Water Monterey Groundwater Replenishment Project MMRP as mitigation necessary for the construction and project implementation of the RWP and therefore has been added to this MMRP to ensure compliance, The Pure Water Monterey Groundwater Replenishment Project Final EIR and MMRP approved and certified by Monterey Regional Water Pollution Control Agency (MRWPCA) on October 8, 2015.

**MITIGATION MONITORING AND REPORTING PLAN
FOR THE REGIONAL URBAN RECYCLED WATER PROJECT (RWP)**

NOTES: Section 21081.6 of the Public Resources Code requires all state and local agencies to establish monitoring or reporting programs whenever approval of a project relies upon an environmental impact report (EIR). The purpose of the monitoring or reporting program is to ensure implementation of the measures being imposed to mitigate or avoid the significant adverse environmental impacts identified in the EIR as amended in Addendum No. 1 to the certified Final EIR for the MCWD Regional Urban Water Augmentation Project.
For those project features outside of MCWD's service areas (specifically, at the Monterey Regional Water Pollution Control Association, Regional Treatment Plant and within the Monterey Peninsula/Cal-Am Service Area) the lead agency and/or project proponent shall replace "MCWD" with their name each time it occurs prior to implementation of those project components.

RUWAP EIR Mitigation Measure with text edits to apply specifically to the RWP shown in strikeout for deleted text and <u>underline</u> for added text.	Timing of Implementation (required)	Responsibility for Implementation	Verified for Compliance by:	X
<p>HH-2b: Health and Safety Plan¹⁴. The construction contractor(s) shall prepare and implement a project-specific Health and Safety Plan (HSP) for each site on which construction may occur, in accordance with 29 CFR 1910 to protect construction workers and the public during all excavation, grading, and construction. The HSP shall include the following, at a minimum:</p> <ul style="list-style-type: none"> • A summary of all potential risks to construction workers and the maximum exposure limits for all known and reasonably foreseeable site chemicals (the HSP shall incorporate and consider the information in all available existing Environmental Site Assessments and remediation reports for properties within ¼-mile using the EnviroStor Database); • Specified personal protective equipment and decontamination procedures, if needed; • Emergency procedures, including route to the nearest hospital; <p>Procedures to be followed in the event that evidence of potential soil or groundwater contamination (such as soil staining, noxious odors, debris or buried storage containers) is encountered. These procedures shall be in accordance with hazardous waste operations regulations and specifically include, but are not limited to, the following: immediately stopping work in the vicinity of the unknown hazardous materials release, notifying Monterey County Department of Environmental Health, and retaining a qualified environmental firm to perform sampling and remediation; and The identification and responsibilities of a site health and safety supervisor.</p>	<p>Prior to project construction</p>	<p>Construction contactors</p>	<p>MCWD Monterey County Dept. of Environmental Health</p>	<p></p>
<p>HH-2c: Materials and Dewatering Disposal Plan¹⁵. MCWD and/or their contractors shall develop a materials disposal plan specifying how the contractor will remove, handle, transport, and dispose of all excavated material in a safe, appropriate, and lawful manner. The plan must identify the disposal method for soil and the approved disposal site, and include written documentation that the disposal site will accept the waste.</p> <p>The contractor shall develop a groundwater dewatering control and disposal plan specifying how the contractor will remove, handle, and dispose of groundwater impacted by hazardous substances in a safe, appropriate, and lawful manner. The plan must identify the locations at which potential contaminated groundwater dewatering are likely to be encountered (if any), the method to analyze groundwater for hazardous materials, and the appropriate treatment and/or disposal methods. If the dewatering effluent contains contaminants that exceed the requirements of the General WDRs for Discharges with a Low Threat to Water Quality (Order No. R3-2011-0223, NPDES Permit No. CAG993001), the construction contractor shall contain the dewatering effluent in a portable holding tank for appropriate offsite disposal or discharge. The contractor can either dispose of the contaminated effluent at a permitted waste management facility or discharge the effluent, under permit, to the Regional Treatment Plant.</p>	<p>Prior to and during project construction</p>	<p>Contractor and MCWD</p>	<p>MCWD</p>	<p></p>

¹⁴ Mitigation Measure HH-2b was identified in the Final Pure Water Monterey Groundwater Replenishment Project MMRP as mitigation necessary for the construction and project implementation of the RWP and therefore has been added to this MMRP to ensure compliance , The Pure Water Monterey Groundwater Replenishment Project Final EIR and MMRP approved and certified by Monterey Regional Water Pollution Control Agency (MRWPCA) on October 8, 2015.

¹⁵ Mitigation Measure HH-2c was identified in the Final Pure Water Monterey Groundwater Replenishment Project MMRP as mitigation necessary for the construction and project implementation of the RWP and therefore has been added to this MMRP to ensure compliance , The Pure Water Monterey Groundwater Replenishment Project Final EIR and MMRP approved and certified by Monterey Regional Water Pollution Control Agency (MRWPCA) on October 8, 2015.

**MITIGATION MONITORING AND REPORTING PLAN
FOR THE REGIONAL URBAN RECYCLED WATER PROJECT (RWP)**

NOTES: Section 21081.6 of the Public Resources Code requires all state and local agencies to establish monitoring or reporting programs whenever approval of a project relies upon an environmental impact report (EIR). The purpose of the monitoring or reporting program is to ensure implementation of the measures being imposed to mitigate or avoid the significant adverse environmental impacts identified in the EIR as amended in Addendum No. 1 to the certified Final EIR for the MCWD Regional Urban Water Augmentation Project.

For those project features outside of MCWD's service areas (specifically, at the Monterey Regional Water Pollution Control Association, Regional Treatment Plant and within the Monterey Peninsula/Cal-Am Service Area) the lead agency and/or project proponent shall replace "MCWD" with their name each time it occurs prior to implementation of those project components.

<p>RUWAP EIR Mitigation Measure with text edits to apply specifically to the RWP shown in strikeout for deleted text and <u>underline</u> for added text.</p>	<p>Timing of Implementation</p>	<p>Responsibility for Implementation</p>	<p>Verified for Compliance by:</p>	<p>X</p>
<p>4.8-R1: The MCWD shall require review of construction plans for the pipeline by the Fort Ord BRAC office to confirm that construction is planned in cleared areas <u>cleared of Military Munitions (MM)</u> before construction is initiated. <u>An Army-approved MM monitor shall be present during grading in areas where excavation exceeds two feet and any MM encountered shall be properly managed. Access shall be restricted to adjacent areas by means of temporary fencing and signage.</u></p>	<p>Prior and during to construction</p>	<p>MCWD and Contractors</p>	<p>MCWD</p>	
<p>4.8-R2: For areas recommended or required by Army's BRAC Fort Ord (see EPA Superfund Record of Decision; EPA ID CA7210020676, dated 4/6/05), the MCWD shall require that all pipeline construction workers receive an Army OE <u>MM</u> safety briefing <u>from the BRAC Fort Ord office</u> prior to starting construction <u>and, as needed thereafter</u>. In the event OE <u>MM</u> is suspected or discovered, <u>the following actions shall be taken:</u></p> <ul style="list-style-type: none"> • <u>MCWD and their contractors shall immediately suspend actions which may affect the item,</u> • <u>the item shall not be touch or disturbed, work shall be stopped immediately,</u> • <u>the location shall be clearly marked, all personnel evacuated, and</u> • <u>the local law enforcement agency (Presidio of Monterey (POM) Police or applicable City Police Department) shall be contacted immediately for further investigation. Upon notification, the police shall secure the area and make arrangements to have the item identified and destroyed.</u> 	<p>Prior and during to construction</p>	<p>MCWD and Contractors</p>	<p>MCWD</p>	
<p>4.11-R1: The construction contractor shall limit exterior construction related activities to the hours of restriction consistent with the noise ordinance of, and encroachment permits issued, by the relevant land use jurisdictions <u>between 7:00 a.m. and 7:00 p.m. on weekdays and Saturdays, and between 10:00 a.m. and 7:00 p.m. on Sundays and holidays. If alternative traffic control measures are unavailable and if approved by staff of the relevant City identified below through their encroachment permit, nighttime construction may be conducted for the following segments of road (as identified in the Higgins' Associates letter dated October 17, 2006) provided that sensitive receptors (in this case, residences, nursing homes, and hotels/motels) are located an adequate distance from construction activities (as determined by the relevant land use jurisdiction):</u></p> <ul style="list-style-type: none"> • <u>Reservation Road between Seacrest Avenue and Crescent Avenue [Marina - preferred alignment]</u> • <u>Fremont Street between Kimball Avenue and Airport Boulevard [Seaside – preferred alignment]</u> • <u>Del Monte Avenue between Park Avenue and Camino Aguajito [Monterey – alternative alignment]</u> • <u>Del Monte Avenue between Camino Aguajito and Figueroa Street [Monterey – preferred alignment]</u> <p>(Please note that mitigation measure 4.11-R1 is consistent with mitigation measure NV-1d from Final Pure Water Monterey Groundwater Replenishment Project MMRP).</p>	<p>Prior to construction</p>	<p>MCWD and Contractors</p>	<p>MCWD</p>	
<p>4.11-R2: The contractor shall locate all stationary noise-generating equipment as far as possible from nearby noise-sensitive receptors. Where possible, noise-generating equipment shall be shielded from nearby noise-sensitive receptors by the use of noise-attenuating buffers. Stationary noise sources located 500 feet from noise-sensitive receptors shall be equipped with noise reducing engine housings. Portable acoustic barriers shall be placed around noise-generating equipment that is located less than 200 feet from noise-sensitive receptors. (Please note that mitigation measure 4.11-R2 is consistent with mitigation measure NV-1d from Final Pure Water Monterey Groundwater Replenishment Project MMRP).</p>	<p>During construction</p>	<p>Contractor</p>	<p>MCWD</p>	
<p>4.11-R3: The contractor shall assure that construction equipment powered by gasoline or diesel engines have sound control devices at least as effective as those provided by the original equipment manufacturer (OEM). No equipment shall be permitted to have an un-muffled exhaust. (Please note that mitigation measure 4.11-R3 is consistent with mitigation measure NV-1d from Final Pure Water Monterey Groundwater Replenishment Project MMRP).</p>	<p>During construction</p>	<p>Contractor</p>	<p>MCWD</p>	
<p>NV-2b: Construction Hours. The construction contractor shall limit all noise-producing construction activities within the City of Marina to between the hours of 7:00 AM and 7:00 PM on weekdays and between 9:00 AM and 7:00 PM Saturdays.</p>	<p>During project construction</p>	<p>Construction contractor</p>	<p>MCWD</p>	
<p>4.11-R4: The contractor shall assure that noise-generating mobile equipment and machinery are shut-off when not in use. (Please note that mitigation measure 4.11-R4 is consistent with mitigation measure NV-1d from Final Pure Water Monterey Groundwater Replenishment Project MMRP).</p>	<p>During construction</p>	<p>Contractor</p>	<p>MCWD</p>	
<p>4.11-R5: Residences within 500 feet of a construction area shall be notified of the construction schedule in writing, prior to construction. The Project Applicant <u>MCWD</u> and contractor shall designate a noise disturbance coordinator who would be responsible for responding to complaints regarding construction noise. The coordinator shall determine the cause of the complaint and ensure that reasonable measures are implemented to correct the problem. A contact number for the noise disturbance coordinator shall be conspicuously placed on construction site fences and written into the construction notification schedule sent to nearby residences.</p>	<p>Prior to and during construction</p>	<p>MCWD and Contractor</p>	<p>MCWD</p>	
<p>NV-2a: Construction Equipment. Contractor specifications shall include a requirement that the contractor shall:</p> <ul style="list-style-type: none"> • Assure that construction equipment with internal combustion engines has sound control devices at least as effective as those provided by the original equipment manufacturer. No equipment shall be permitted to have an un-muffled exhaust. • Impact tools (i.e., jack hammers, pavement breakers, and rock drills) used for project construction shall be hydraulically or electrically powered wherever possible to avoid noise associated with compressed air exhaust from pneumatically powered tools. Where use of pneumatic tools is unavoidable, an exhaust muffler shall be placed on the compressed air exhaust to lower noise levels by approximately 10 dBA. External jackets shall be used on impact tools, where feasible, in order to achieve a further reduction of 5 dBA. Quieter procedures shall be used, such as drills rather than impact equipment, whenever feasible. • The construction contractor(s) shall locate stationary noise sources (e.g., generators, air compressors) as far from nearby noise-sensitive receptors as possible. <p>For Product Water Conveyance pipeline segments within the City of Marina, noise controls shall be sufficient to not exceed 60 decibels for more than twenty-five percent of an hour.</p>	<p>During project construction</p>	<p>Contractor and MCWD</p>	<p>MCWD</p>	

**MITIGATION MONITORING AND REPORTING PLAN
FOR THE REGIONAL URBAN RECYCLED WATER PROJECT (RWP)**

NOTES: Section 21081.6 of the Public Resources Code requires all state and local agencies to establish monitoring or reporting programs whenever approval of a project relies upon an environmental impact report (EIR). The purpose of the monitoring or reporting program is to ensure implementation of the measures being imposed to mitigate or avoid the significant adverse environmental impacts identified in the EIR as amended in Addendum No. 1 to the certified Final EIR for the MCWD Regional Urban Water Augmentation Project.

For those project features outside of MCWD's service areas (specifically, at the Monterey Regional Water Pollution Control Association, Regional Treatment Plant and within the Monterey Peninsula/Cal-Am Service Area) the lead agency and/or project proponent shall replace "MCWD" with their name each time it occurs prior to implementation of those project components.

RUWAP EIR Mitigation Measure with text edits to apply specifically to the RWP shown in strikeout for deleted text and <u>underline</u> for added text.	Timing of Implementation	Responsibility for Implementation	Verified for Compliance by:	X
4.13-R1: During construction, the contractor shall insure that adequate access to open space, park and public areas is made available to the public at all times. If construction activities require temporary closing of an existing entrance or exit, the contractor shall provide an alternate entrance/exit for the duration of construction within the vicinity. The appropriate City or County shall approve the alternate entrance/exit prior to installation. The contractor shall also provide adequate noticing and/or signage, as directed by the City or County, for public notification and safety.	During construction	Contractor and MCWD	MCWD/ staff at affected City or County	
PS-3: Construction Waste Reduction and Recycling Plan. The construction contractor(s) shall prepare and implement a construction waste reduction and recycling plan identifying the types of construction debris the Project will generate and the manner in which those waste streams will be handled. In accordance with the California Integrated Waste Management Act of 1989, the plan shall emphasize source reduction measures, followed by recycling and composting methods, to ensure that construction and demolition waste generated by the project is managed consistent with applicable statutes and regulations. In accordance with the California Green Building Standards Code and local regulations, the plan shall specify that all trees, stumps, rocks, and associated vegetation and soils, and 50% of all other nonhazardous construction and demolition waste, be diverted from landfill disposal. The plan shall be prepared in coordination with the Monterey Regional Waste Management District and be consistent with Monterey County's Integrated Waste Management Plan. Upon project completion, MCWD shall collect the receipts from the contractor(s) to document that the waste reduction, recycling, and diversion goals have been met.	Prior to, during, and after project construction	Contractor and MCWD	MCWD	
4.14-R1: The construction contractor shall prepare traffic control/management management plans for construction of the pipeline within each of the affected jurisdictions including the Cities of Monterey, Seaside and Marina, Monterey County, and Caltrans as appropriate. These traffic control plans shall be reviewed and approved by the affected public agency prior to the commencement of work <u>and an encroachment permit obtained based upon the traffic control plan(s) or other information prepared by a qualified traffic engineer.</u> The traffic control/management plan shall specify the times during which construction activities would occur and times when travel lanes cannot be blocked (e.g., peak traffic periods as directed by the affected City Engineer). The plans shall provide details regarding the placement of traffic control and warning devices, detours, and that the trench must be covered and/or plated during times of non-construction. (Please note that mitigation measure 4.14-R1 is consistent with mitigation measure TR-2 from Final Pure Water Monterey Groundwater Replenishment Project MMRP).	Prior to construction within each jurisdiction	Contractor and MCWD	MCWD and staff at affected City or County	
4.14-R2: The traffic control/management plan must include a program that provides continual coordination program with the affected Agencies to allow for adjustments and refinements to the plan once construction is underway. (Please note that mitigation measure 4.14-R2 is consistent with mitigation measure TR-2 from Final Pure Water Monterey Groundwater Replenishment Project MMRP).	During construction within each jurisdiction	Contractor and MCWD	MCWD and staff at affected City or County	

**MITIGATION MONITORING AND REPORTING PLAN
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NOTES: Section 21081.6 of the Public Resources Code requires all state and local agencies to establish monitoring or reporting programs whenever approval of a project relies upon an environmental impact report (EIR). The purpose of the monitoring or reporting program is to ensure implementation of the measures being imposed to mitigate or avoid the significant adverse environmental impacts identified in the EIR as amended in Addendum No. 1 to the certified Final EIR for the MCWD Regional Urban Water Augmentation Project.

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<p>4.14-R3: As a supplement to the traffic control/management plan, the construction contractor shall coordinate with the affected agencies to determine the need for a public information program that would inform area residents, employers, and business owners of the details concerning construction schedules and expected travel delays. The public information program could utilize various media venues (e.g. newspaper, radio, television, telephone hot lines, Internet, etc.) to disseminate information such as: 1) Overview of construction project. 2) Updates on location of construction zone. 3) Identification on street(s) locations anticipated to be affected by construction. 4) Times when construction activities would occur and when traffic delays can be expected. 5) Identification of alternate travel routes that could be used to avoid construction delays. (Please note that mitigation measure 4.14-R3 is consistent with mitigation measure TR-2 from Final Pure Water Monterey Groundwater Replenishment Project MMRP).</p>	<p>Prior to and during construction within each jurisdiction</p>	<p>Contractor and MCWD</p>	<p>MCWD and staff at affected City or County</p>	
<p>4.14-R4: During the preparation and implementation of traffic control/management plans, special consideration shall be given to the locations where direct driveway access is being impacted. Measures shall be developed and coordinated with the individual property owners who are affected by project construction to minimize access disruption to their private residences and/or businesses. (Please note that mitigation measure 4.14-R4 is consistent with mitigation measure TR-2 from Final Pure Water Monterey Groundwater Replenishment Project MMRP).</p>	<p>During the preparation / implementation of traffic control/management plans</p>	<p>Contractor and MCWD</p>	<p>MCWD</p>	
<p>4.14-R5: A component of the traffic control/management plan public information program shall include provisions for informing area residents, major employers, and commercial businesses that access restrictions/disruptions would occur. Additional information shall be prepared to advise the affected public of alternative access routes if local affected agencies determine that such a plan is necessary. (Please note that mitigation measure 4.14-R5 is consistent with mitigation measure TR-2 from Final Pure Water Monterey Groundwater Replenishment Project MMRP).</p>	<p>During the preparation / implementation of traffic control/management plans</p>	<p>Contractor and MCWD</p>	<p>MCWD</p>	
<p>4.14-R6: The construction contractor shall coordinate with MST to identify routes affected by the pipeline construction. It is suggested that MST post notices at bus stops and on buses along affected routes to notify passengers of potential delays or service adjustments on these routes. Sufficient notification as to the exact dates when delays can be expected or service adjustments would be necessary would be given to MST to allow for timely posting of these notices. (Please note that mitigation measure 4.14-R6 is consistent with mitigation measure TR-2 from Final Pure Water Monterey Groundwater Replenishment Project MMRP).</p>	<p>During construction along MST routes</p>	<p>Contractor and MCWD</p>	<p>MST</p>	
<p>4.14-R7: Traffic control/management plans which need to be prepared for the affected jurisdictions or agencies shall identify all bus stops in the immediate vicinity of construction zones and shall make provisions for these bus stops to remain accessible throughout the duration of the localized construction impact. In cases where the blockage of existing bus stops cannot be avoided the construction contractor shall coordinate with MST to provide temporary bus stop locations. (Please note that mitigation measure 4.14-R7 is consistent with mitigation measure TR-2 from Final Pure Water Monterey Groundwater Replenishment Project MMRP).</p>	<p>During construction along MST routes</p>	<p>Contractor and MCWD</p>	<p>MST</p>	
<p>TR-3: Roadway Rehabilitation Program. Prior to commencing project construction, MCWD shall detail the preconstruction condition of all local construction access and haul routes proposed for substantial use by project-related construction vehicles. The construction routes surveyed must be consistent with those identified in the construction traffic control and safety assurance plan developed under Mitigation Measure TR-2. After construction is completed, the same roads shall be surveyed again to determine whether excessive wear and tear or construction damage has occurred. Roads damaged by project-related construction vehicles shall be repaired to a structural condition equal to, or greater than, that which existed prior to construction activities. In the City of Marina, the construction in the city rights-way must comply with the City's design standards, including restoration of the streets from curb to curb, as applicable. In the City of Monterey, asphalt pavement of full travel lanes will be resurfaced without seams along wheel or bike paths.</p>	<p>Prior to project construction, after project construction</p>	<p>MCWD construction contractors</p>	<p>MCWD, and local jurisdictions</p>	
<p>TR-4: Construction Parking Requirements. Prior to commencing project construction, the construction contractor(s) shall coordinate with the potentially affected jurisdictions to identify designated worker parking areas that would avoid or minimize parking displacement in congested areas of Marina, and Seaside. The contractors shall provide transport between the designated parking location and the construction work areas. The construction contractor(s) shall also provide incentives for workers that carpool or take public transportation to the construction work areas. The engineering and construction design plans shall specify that contractors limit time of construction within travel lanes and public parking spaces and provide information to the public about locations of alternative spaces to reduce parking disruptions.</p>	<p>Prior to project construction</p>	<p>MCWD construction contractor</p>	<p>MCWD, City of Marina, City of Seaside,</p>	
<p>CUM-R2: Conduct pre-construction and post-construction biological surveys for special-status plant and wildlife species and their habitat for projects affecting undeveloped dune habitat, compensate for losses, and conduct construction monitoring. Each project proponent for other projects that would contribute to this cumulative impact (see Table 5.3-1) will retain a qualified botanist to conduct pre-construction and post-construction surveys for Hickman's onion to quantify the number of plants and size of the population removed by construction and to determine appropriate habitat compensation. The project proponent will compensate for habitat loss related to dune habitats by contributing to the habitat restoration and enhancement program implemented by the California Department of Parks and Recreation at the Marina State Beach. Each project proponent MCWD will retain a qualified biologist to conduct pre-construction and post-construction surveys for burrowing owl, loggerhead shrike, California horned lark, California horned lizard, black legless lizards, and raptors to determine whether species are present. The project proponent MCWD will implement the recommendations of the biologist. Recommendations could include relocating the species, altering the construction schedule to avoid breeding season, educating construction workers, and monitoring construction activities. These measures are described in more detail in Chapter 4.4 (see Mitigation Measures 4.4-R1, through 4.4-R23).</p>	<p>Prior to, during and after construction</p>	<p>Qualified Biologist and MCWD</p>	<p>MCWD</p>	
<p>CUM-R3: MCWD and/or MRWPCA shall coordinate with Relevant Local Agencies to Develop and Implement a Phased Construction Plan to Reduce Cumulative Traffic, and Noise Impacts. The MCWD and/or MRWPCA will contact local agencies that have projects planned in the same area (i.e., project sites within 1 mile or projects that affect the same roadways) and that have construction</p>	<p>Prior to construction</p>	<p>Contractor and MCWD</p>	<p>MCWD and staff at</p>	

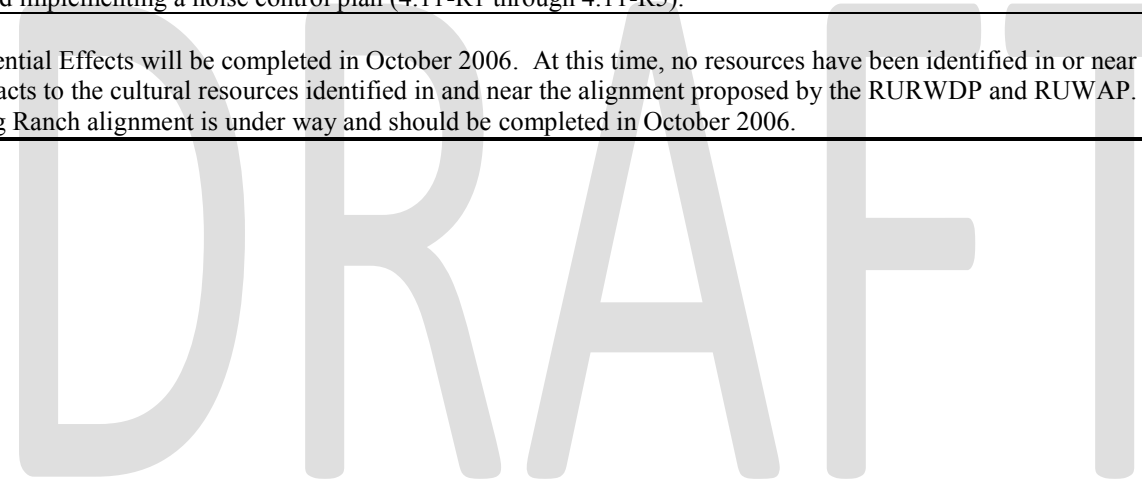
**MITIGATION MONITORING AND REPORTING PLAN
FOR THE REGIONAL URBAN RECYCLED WATER PROJECT (RWP)**

NOTES: Section 21081.6 of the Public Resources Code requires all state and local agencies to establish monitoring or reporting programs whenever approval of a project relies upon an environmental impact report (EIR). The purpose of the monitoring or reporting program is to ensure implementation of the measures being imposed to mitigate or avoid the significant adverse environmental impacts identified in the EIR as amended in Addendum No. 1 to the certified Final EIR for the MCWD Regional Urban Water Augmentation Project.

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RUWAP EIR Mitigation Measure with text edits to apply specifically to the RWP shown in strikeout for deleted text and <u>underline</u> for added text.	Timing of Implementation	Responsibility for Implementation	Verified for Compliance by:	X
<p>schedules that overlap with construction of the Recycled Water Alternative. MCWD (or their contractor) will coordinate with local agencies responsible for said projects to develop a phased construction plan that includes the following components.</p> <ul style="list-style-type: none"> • Evaluate roadways affected by construction activities and minimize roadway and traffic disturbance (e.g., lane closures and detours) and the number of construction vehicles using the roadways. This may involve scheduling some construction activities simultaneously or phasing. • Prepare compatible traffic control plans for construction projects. If one traffic control plan cannot be prepared, the construction contractor for the Recycled Water Alternative and the relevant local agencies (or their construction contractors) will ensure that the traffic control plans for projects affecting the same roadways are compatible. The traffic control plan can be modeled after that required for the Recycled Water Alternative (refer to Mitigation 4.14-R1 through 4.14-R3). • Implement noise reductions measures for each project with overlapping construction timeframes. These measures, which are described in more detail in Section 4.11, include: limiting hours of construction activities, employing noise-control construction practices, and implementing a noise control plan (4.11-R1 through 4.11-R5). 	within each jurisdiction		affected City or County	X

NOTES:
Note 1: A preliminary archaeological survey for the project Areas of Potential Effects will be completed in October 2006. At this time, no resources have been identified in or near the Ord Community and Central Marina segments of the project. The portion of the pipeline within the City of Monterey has been revised to avoid impacts to the cultural resources identified in and near the alignment proposed by the RURWDP and RUWAP. It is preferred the impacts to cultural resources be avoided wherever possible and mitigated where avoidance is not feasible. A survey of the Armstrong Ranch alignment is under way and should be completed in October 2006.



APPENDIX C

TRAFFIC DETOUR ROUTES



**REGIONAL WATER AUGMENTATION PROJECT
MCWD RECYCLED WATER PIPELINE**

DETOUR ROUTES

MARINA COAST WATER DISTRICT

November 28, 2006

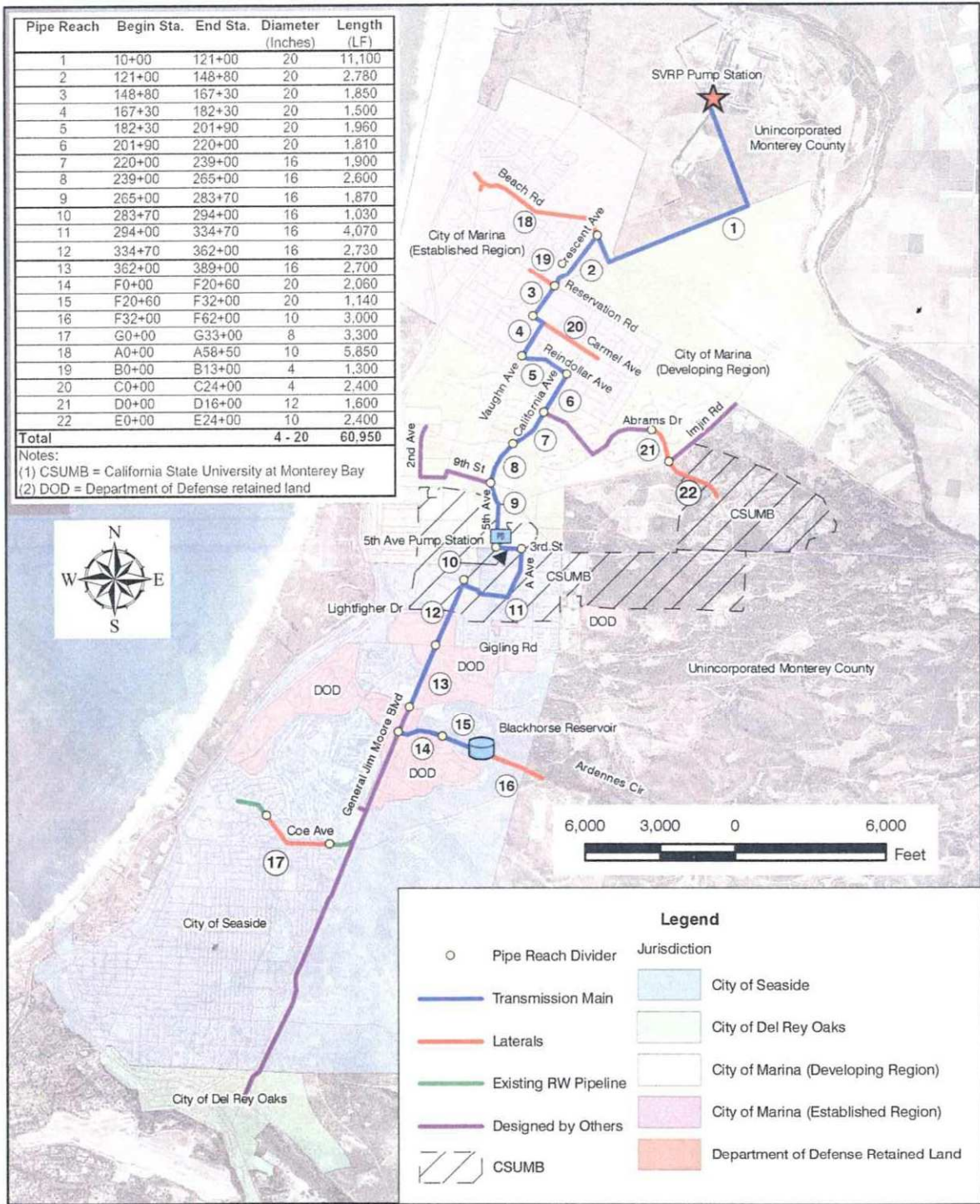


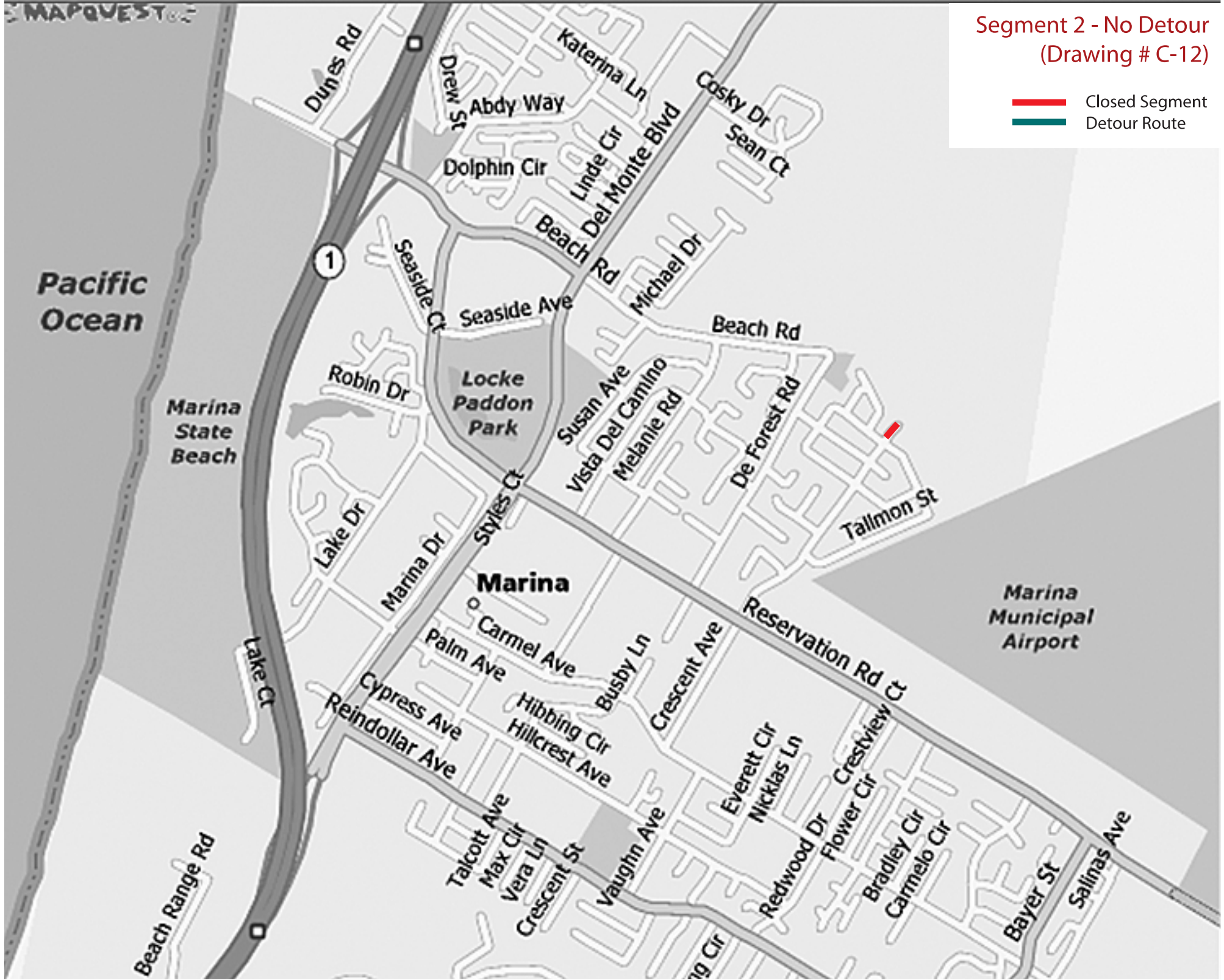


Figure 1
PIPE REACH IDENTIFICATION MAP
RECYCLED WATER PIPELINE
MARINA COAST WATER DISTRICT





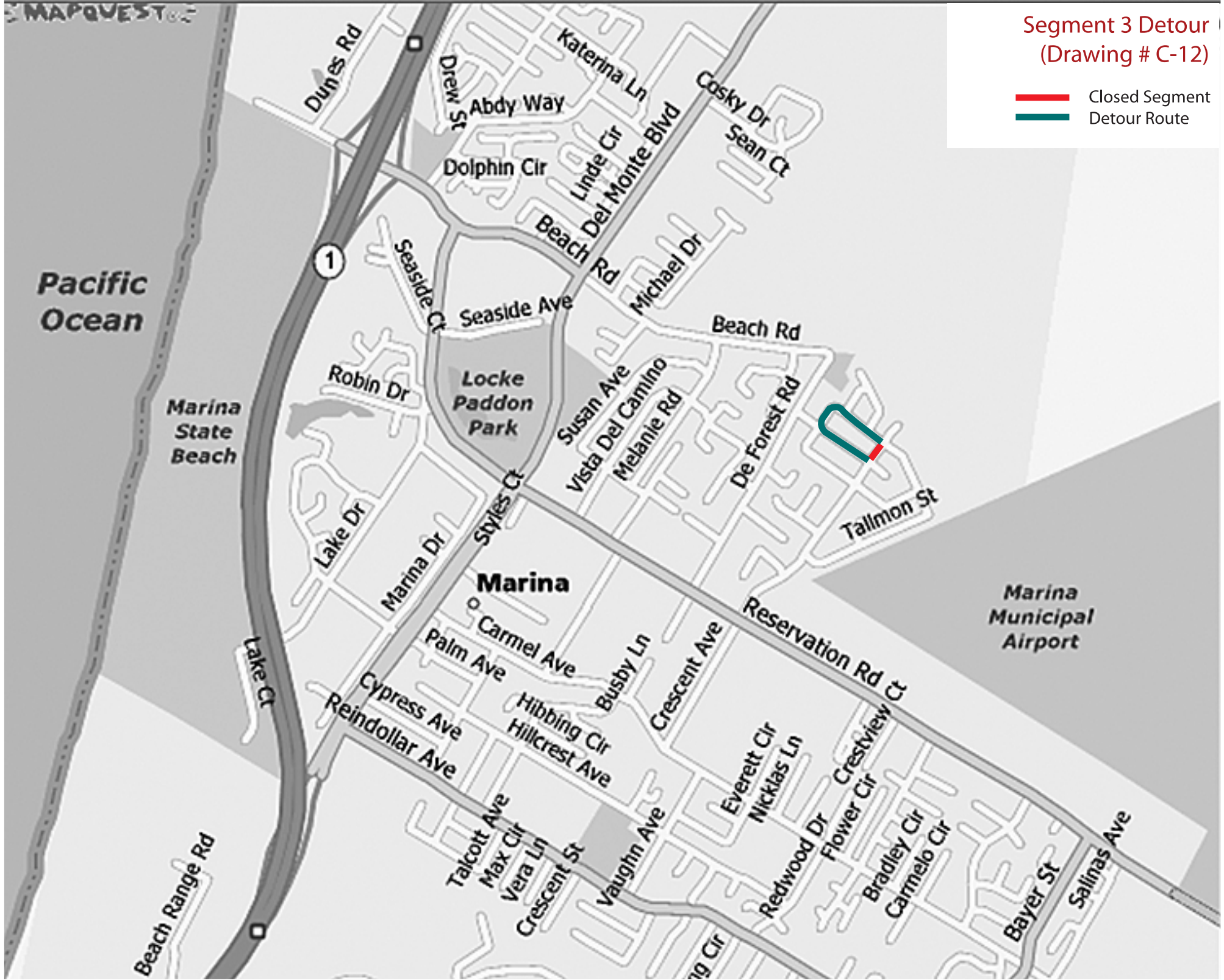
Segment 2 - No Detour
(Drawing # C-12)

-  Closed Segment
-  Detour Route





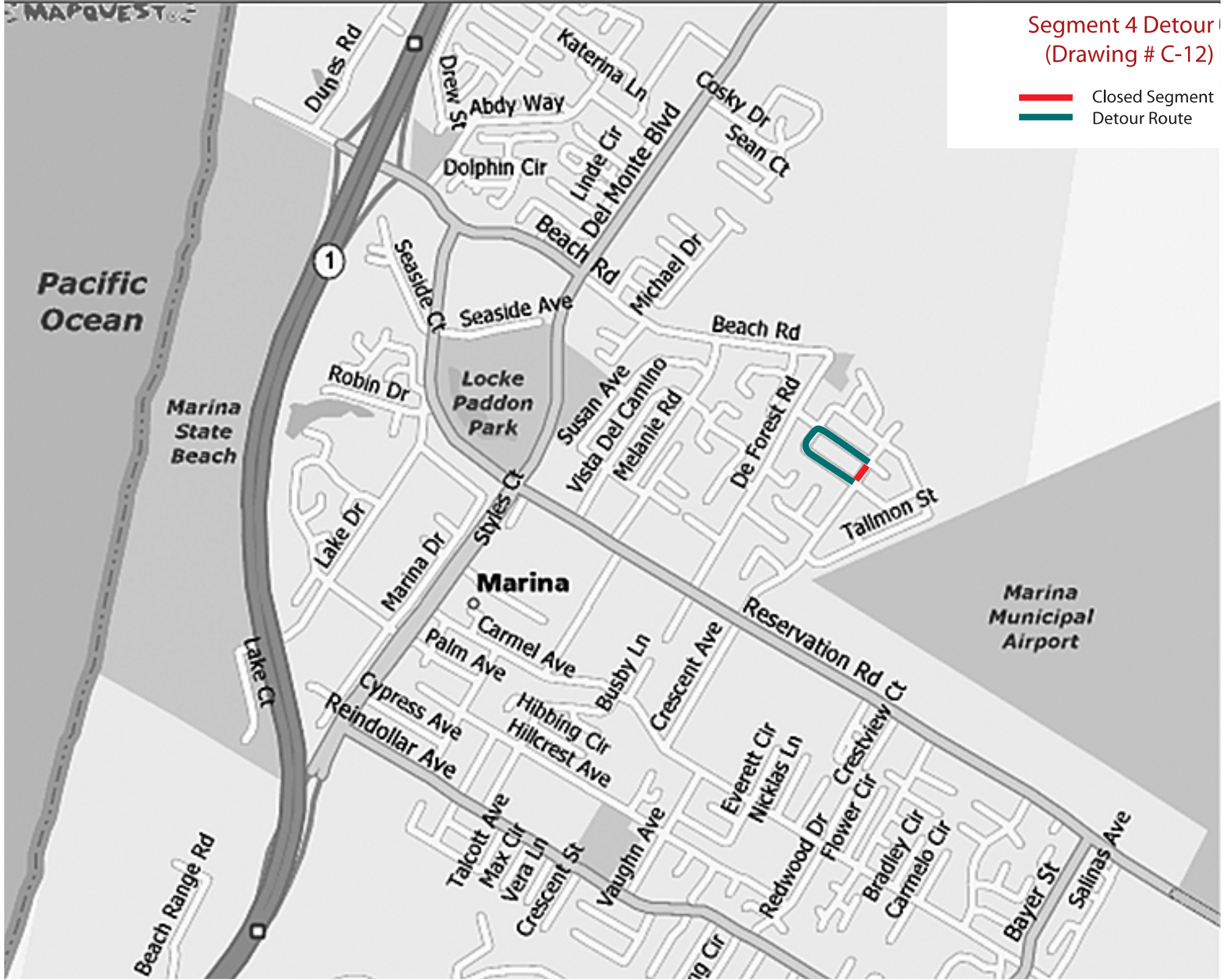
Segment 3 Detour (Drawing # C-12)

-  Closed Segment
-  Detour Route





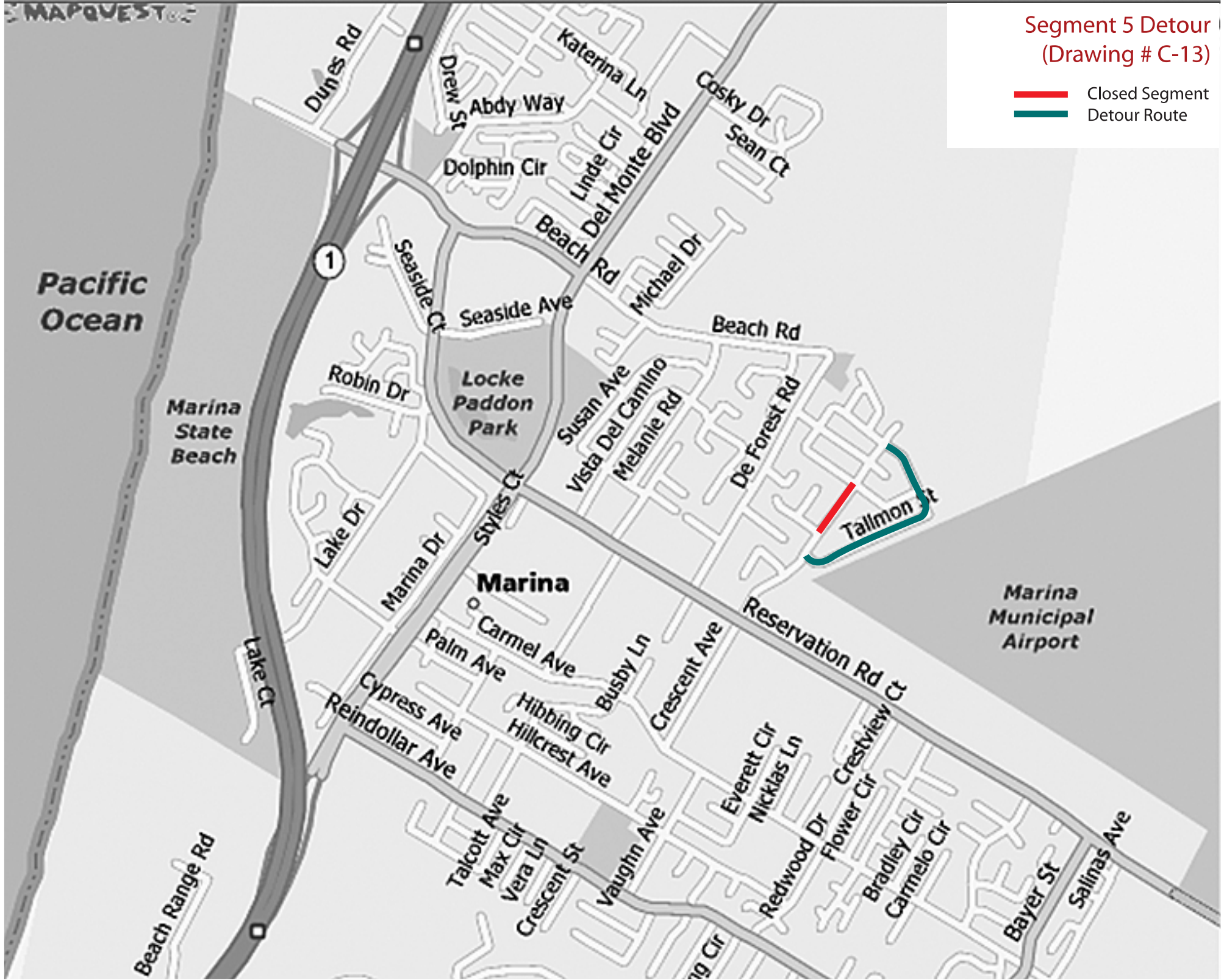
Segment 4 Detour
(Drawing # C-12)

-  Closed Segment
-  Detour Route





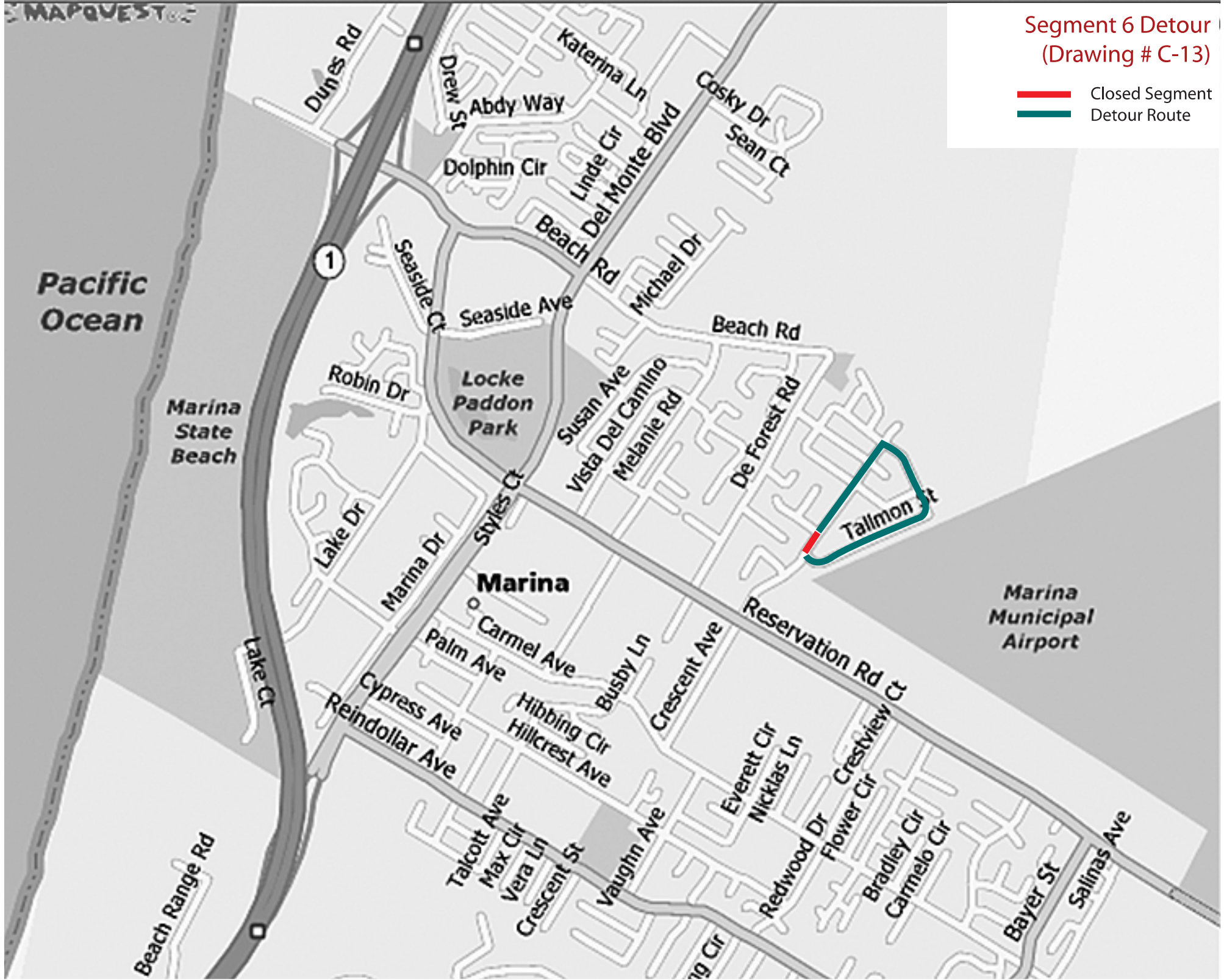
Segment 5 Detour (Drawing # C-13)

-  Closed Segment
-  Detour Route





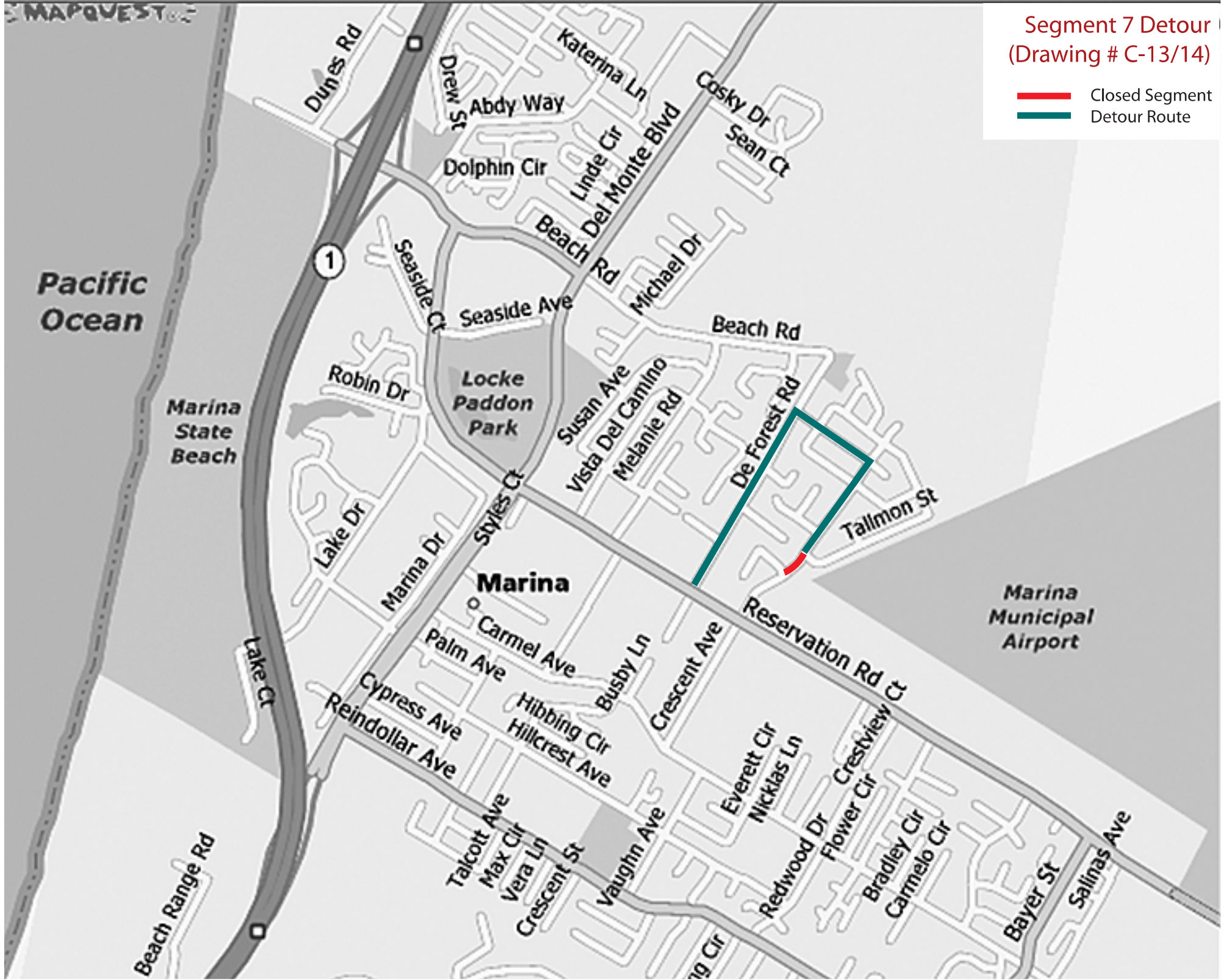
Segment 6 Detour (Drawing # C-13)

-  Closed Segment
-  Detour Route





Segment 7 Detour
(Drawing # C-13/14)

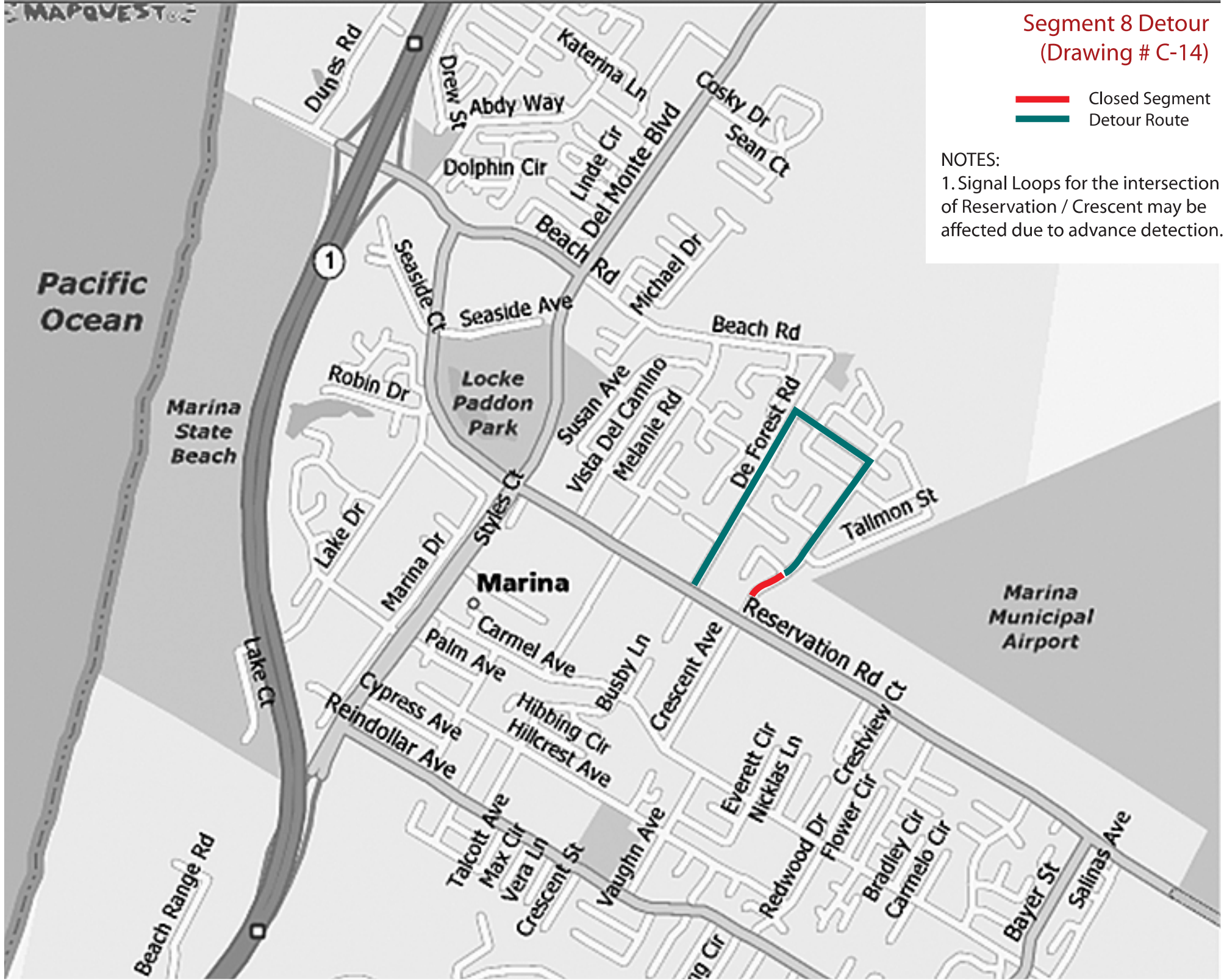
-  Closed Segment
-  Detour Route





Segment 8 Detour (Drawing # C-14)

 Closed Segment
 Detour Route

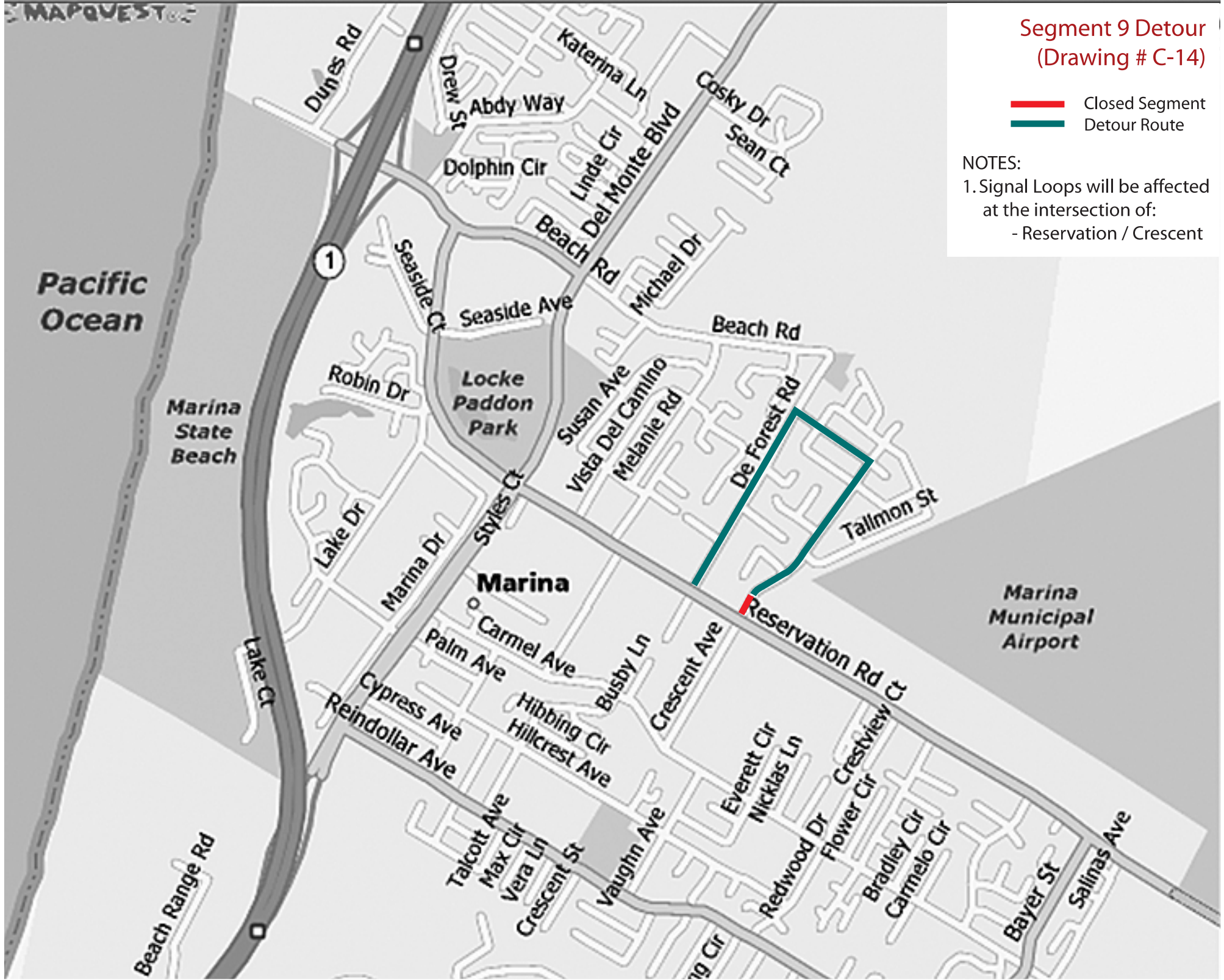
NOTES:
 1. Signal Loops for the intersection of Reservation / Crescent may be affected due to advance detection.

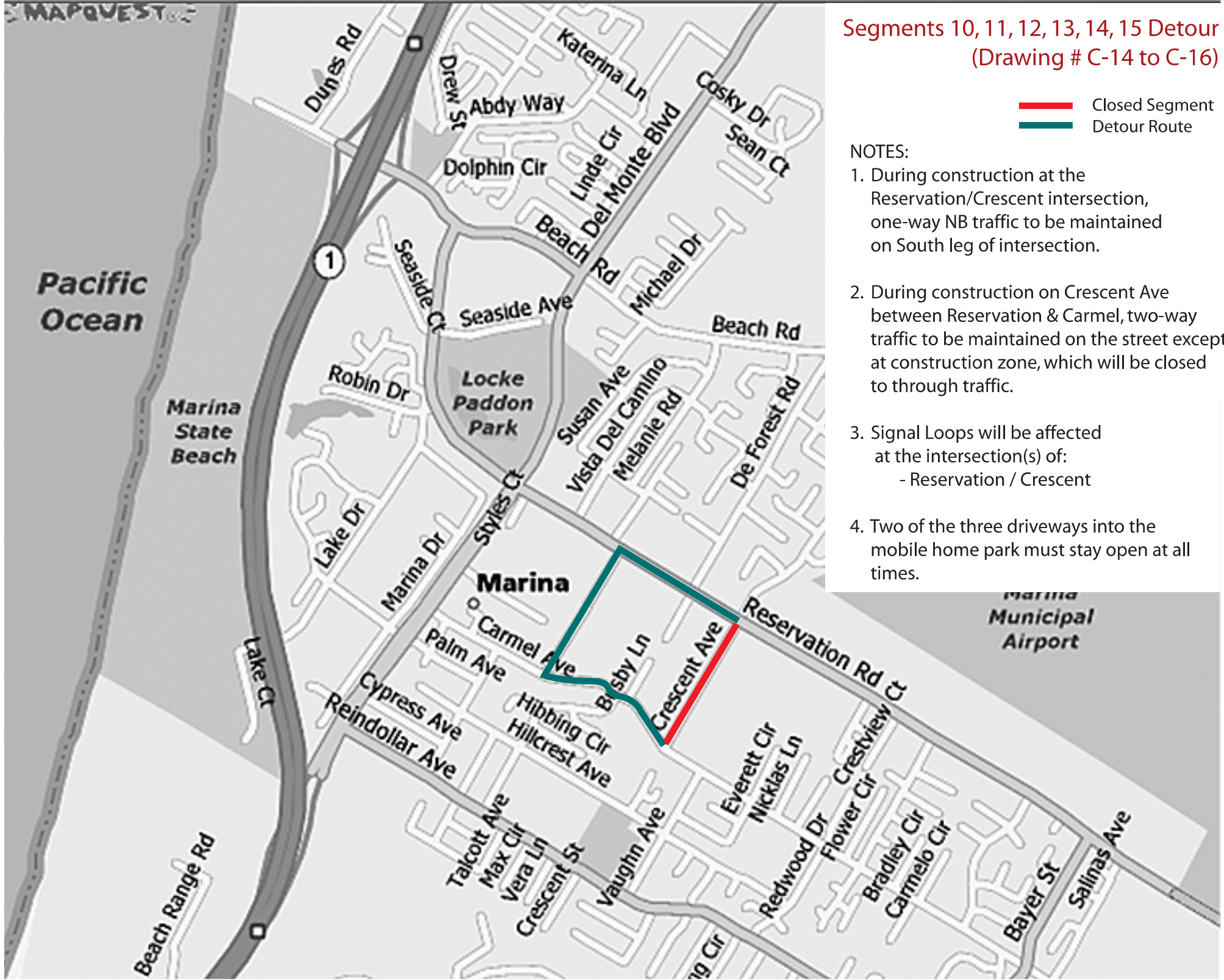


Segment 9 Detour (Drawing # C-14)

-  Closed Segment
-  Detour Route

NOTES:
1. Signal Loops will be affected at the intersection of:
- Reservation / Crescent





Segments 10, 11, 12, 13, 14, 15 Detour
(Drawing # C-14 to C-16)

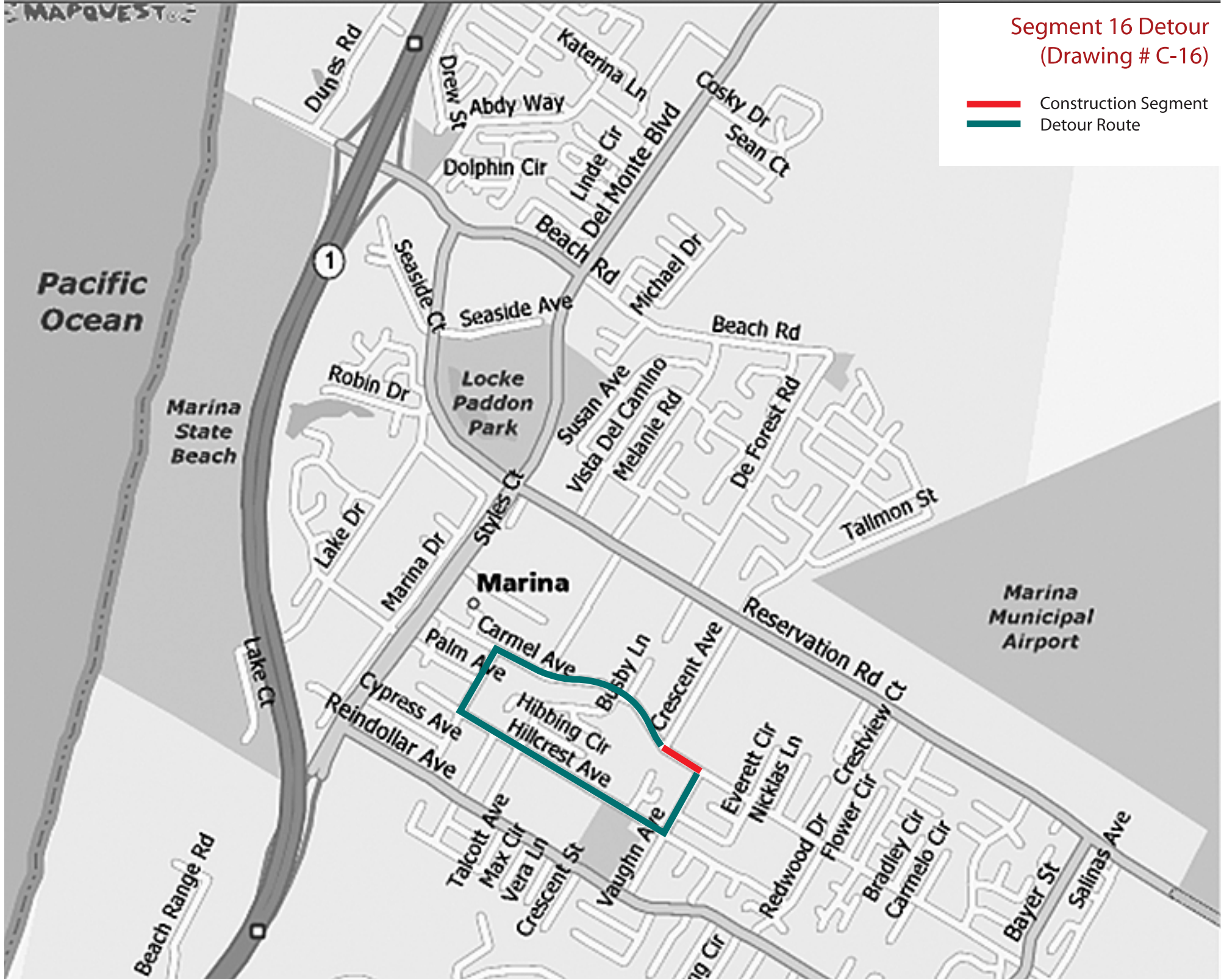
— Closed Segment
— Detour Route

NOTES:



1. During construction at the Reservation/Crescent intersection, one-way NB traffic to be maintained on South leg of intersection.
2. During construction on Crescent Ave between Reservation & Carmel, two-way traffic to be maintained on the street except at construction zone, which will be closed to through traffic.
3. Signal Loops will be affected at the intersection(s) of:
 - Reservation / Crescent
4. Two of the three driveways into the mobile home park must stay open at all times.

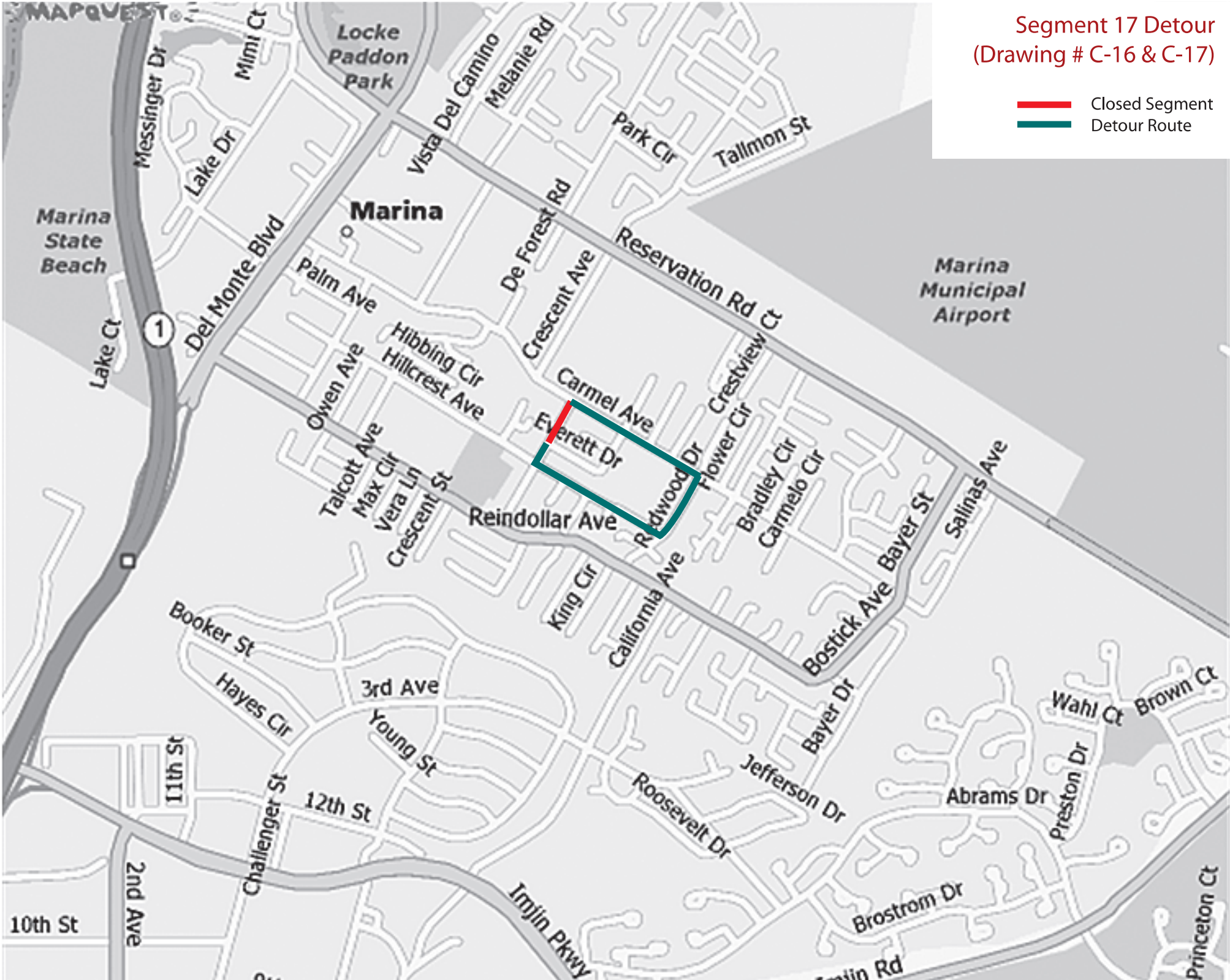
Segment 16 Detour (Drawing # C-16)

- Construction Segment
- Detour Route



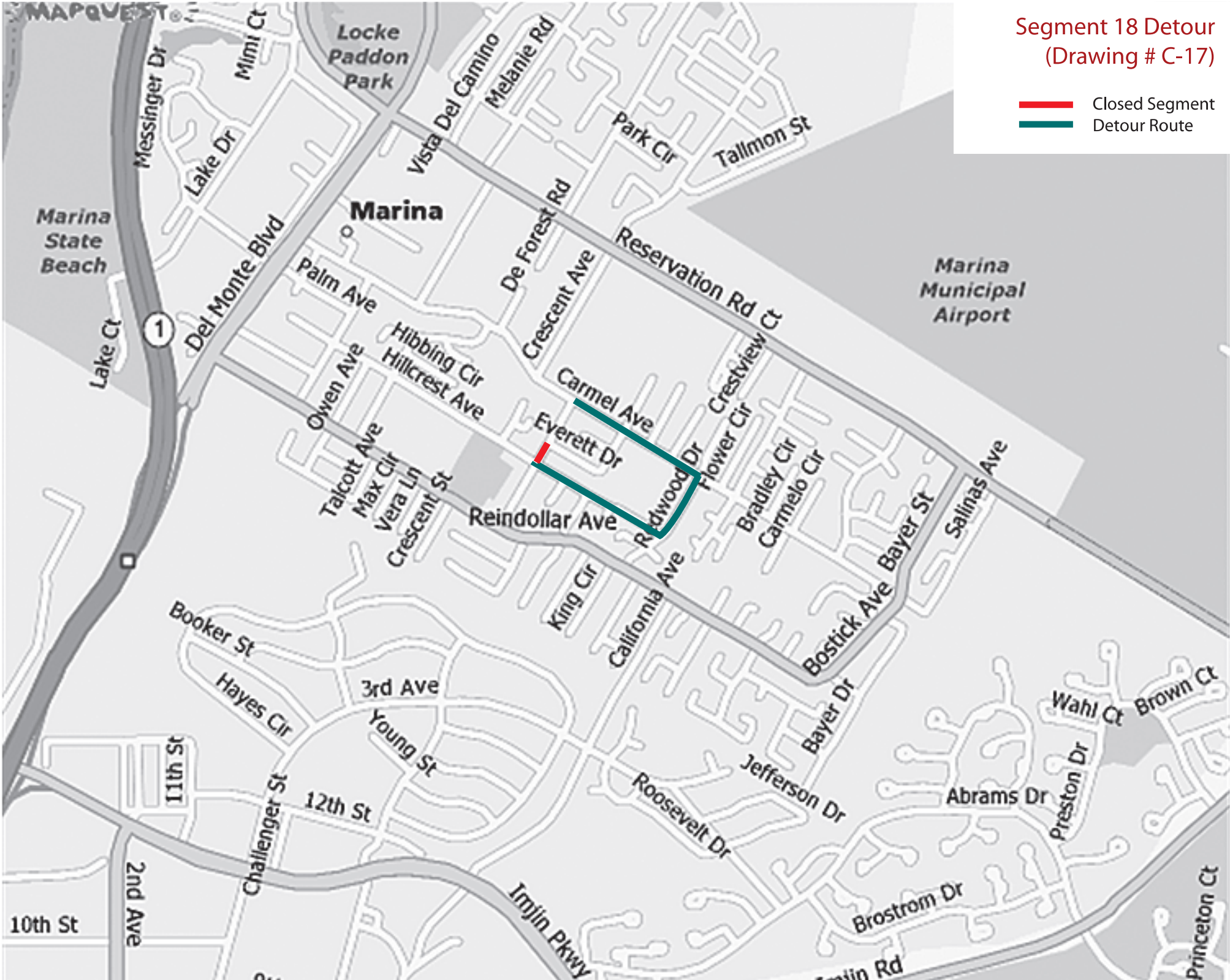
Segment 17 Detour
(Drawing # C-16 & C-17)

-  Closed Segment
-  Detour Route





Segment 18 Detour
(Drawing # C-17)

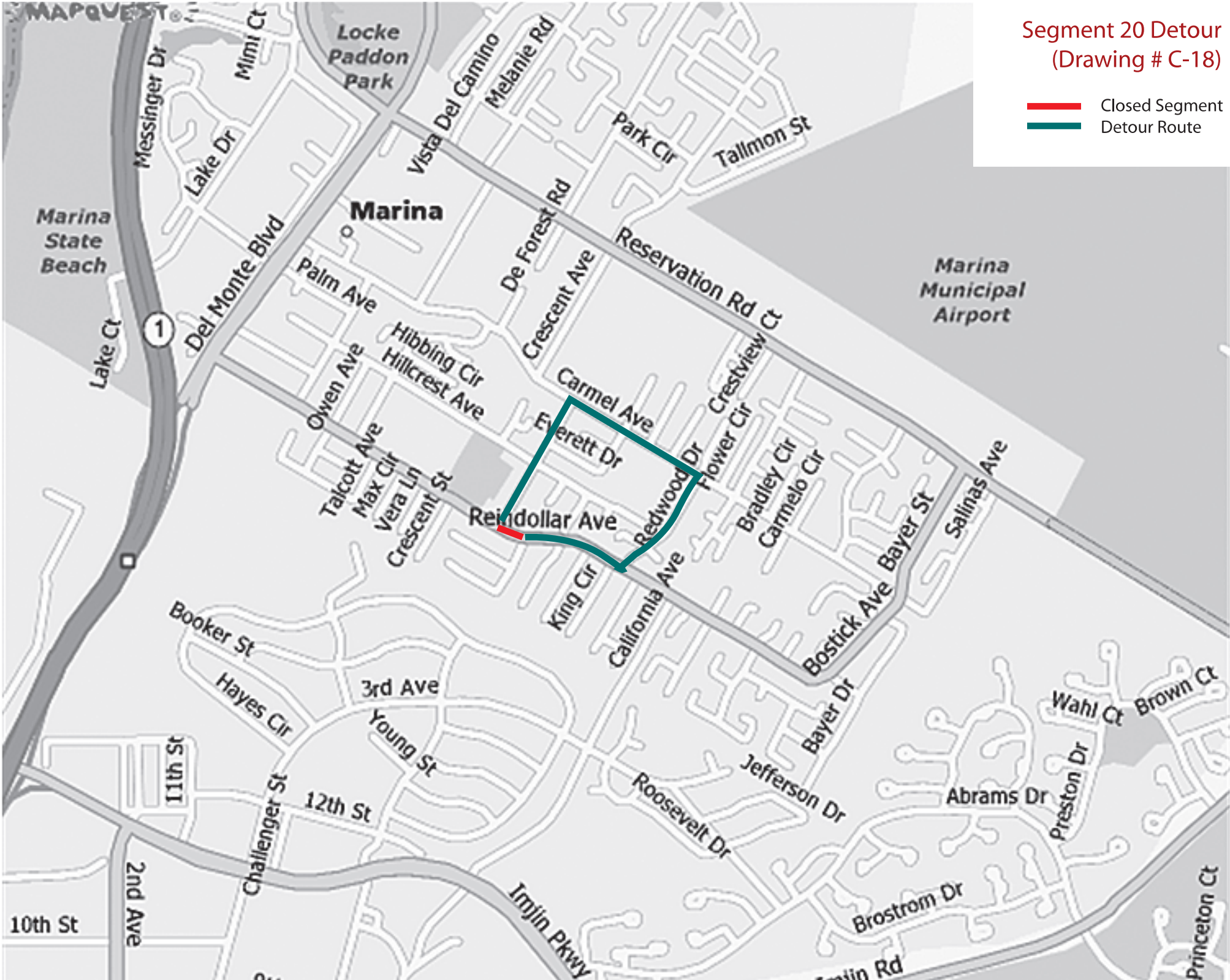
- Closed Segment
- Detour Route



Segment 19 Detour
(Drawing # C-17 & C-18)

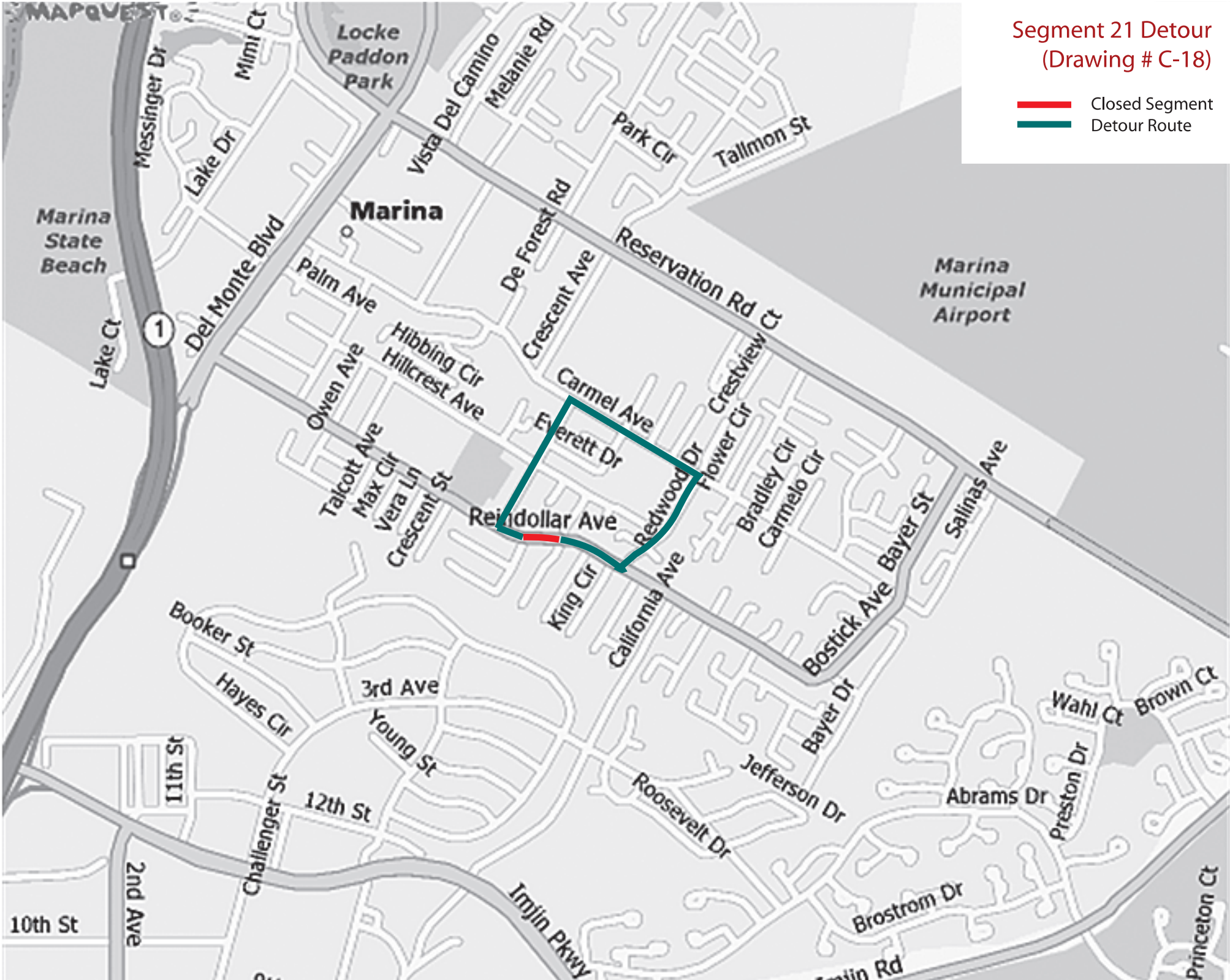
-  Closed Segment
-  Detour Route





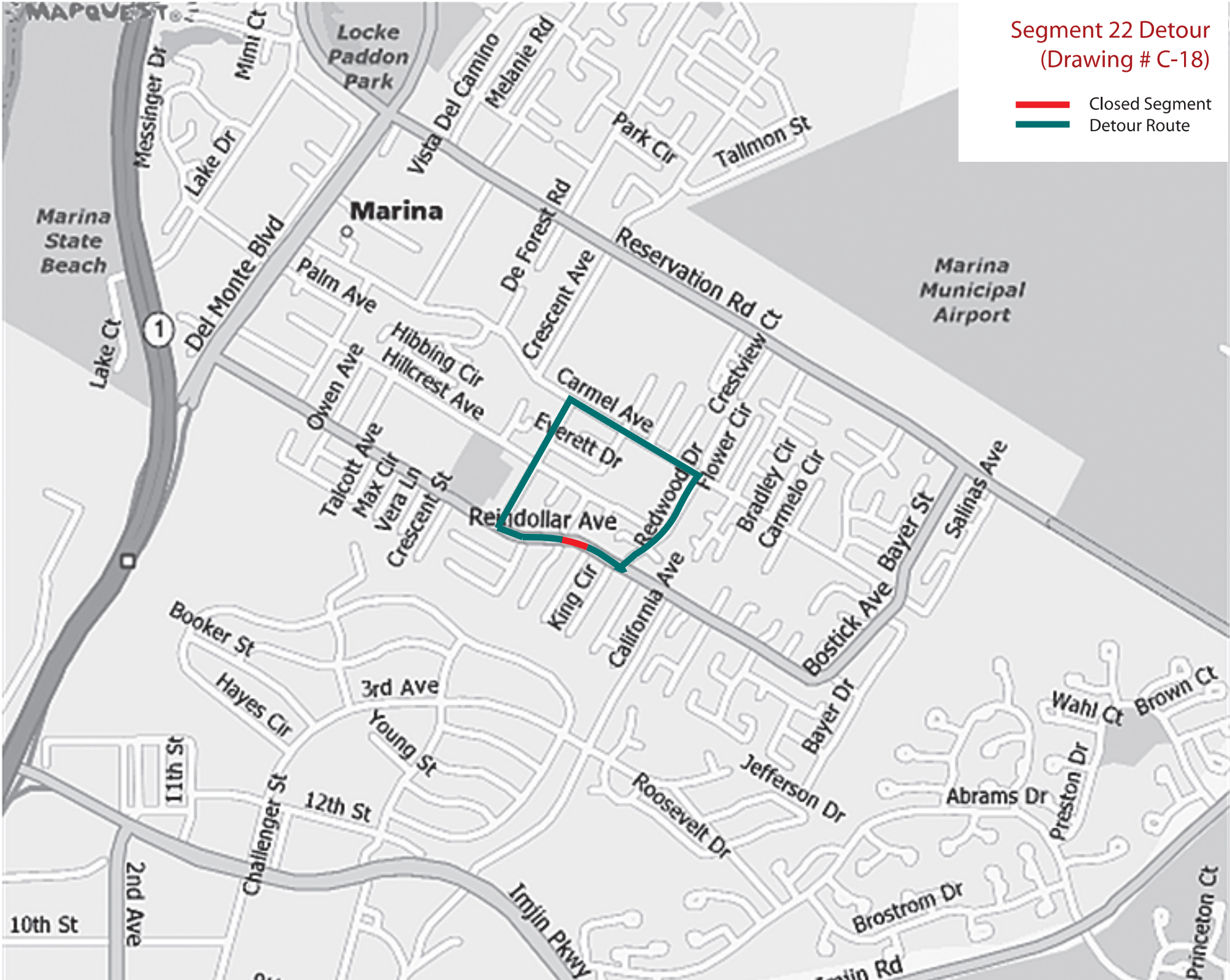
Segment 20 Detour
(Drawing # C-18)

- Closed Segment
- Detour Route



Segment 21 Detour
(Drawing # C-18)



- Closed Segment
- Detour Route

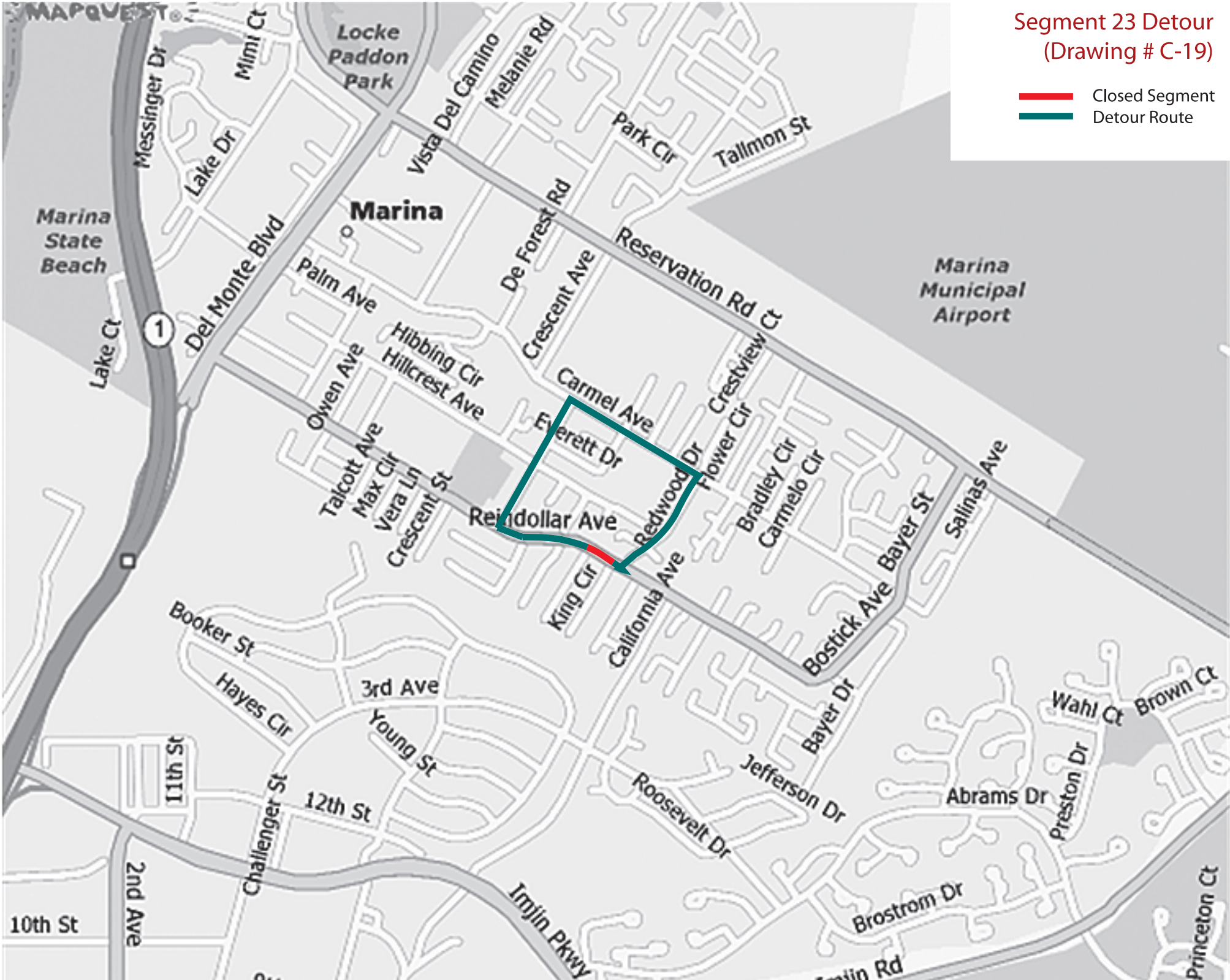


Segment 22 Detour
(Drawing # C-18)



- Closed Segment
- Detour Route

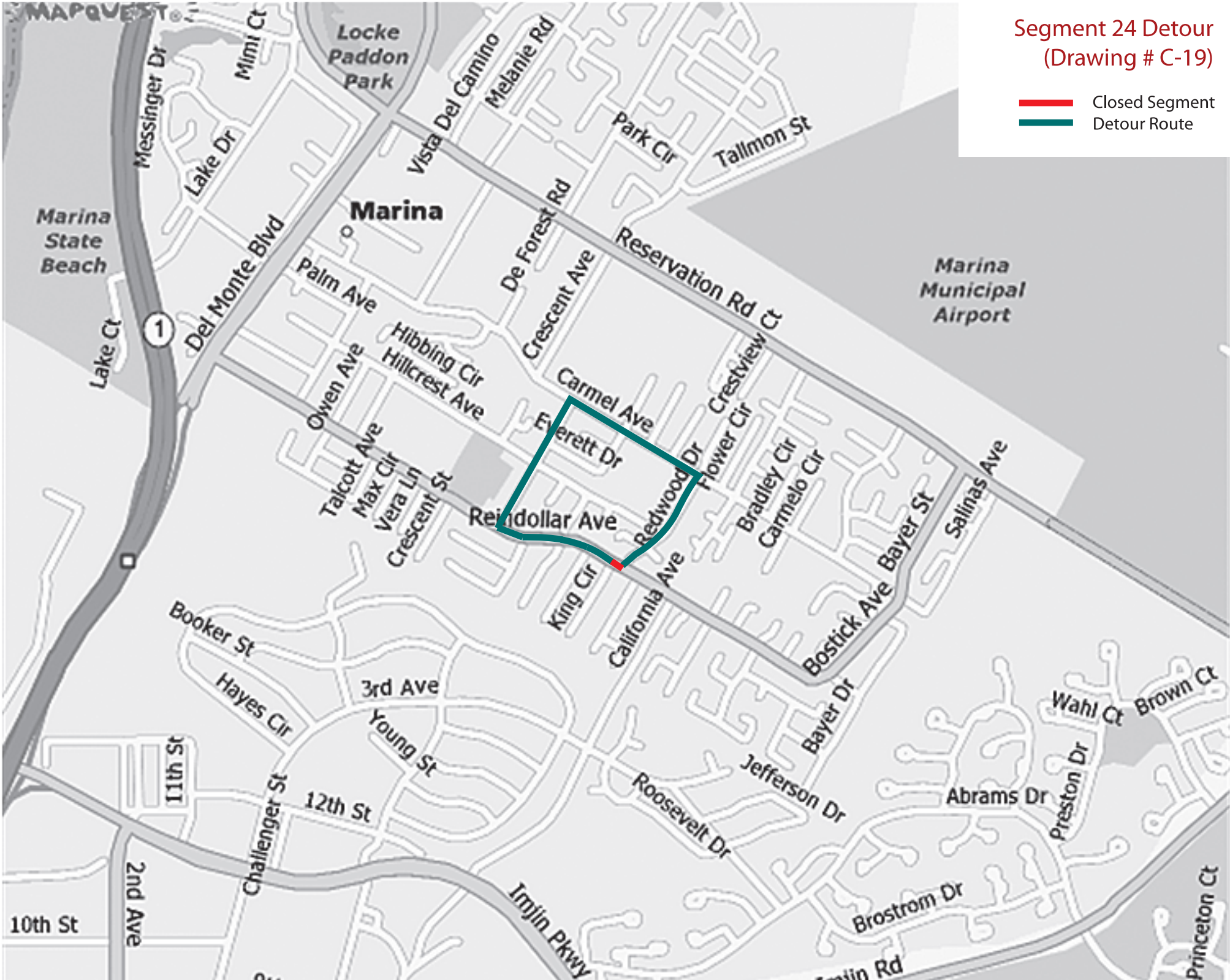
Segment 23 Detour (Drawing # C-19)

-  Closed Segment
-  Detour Route





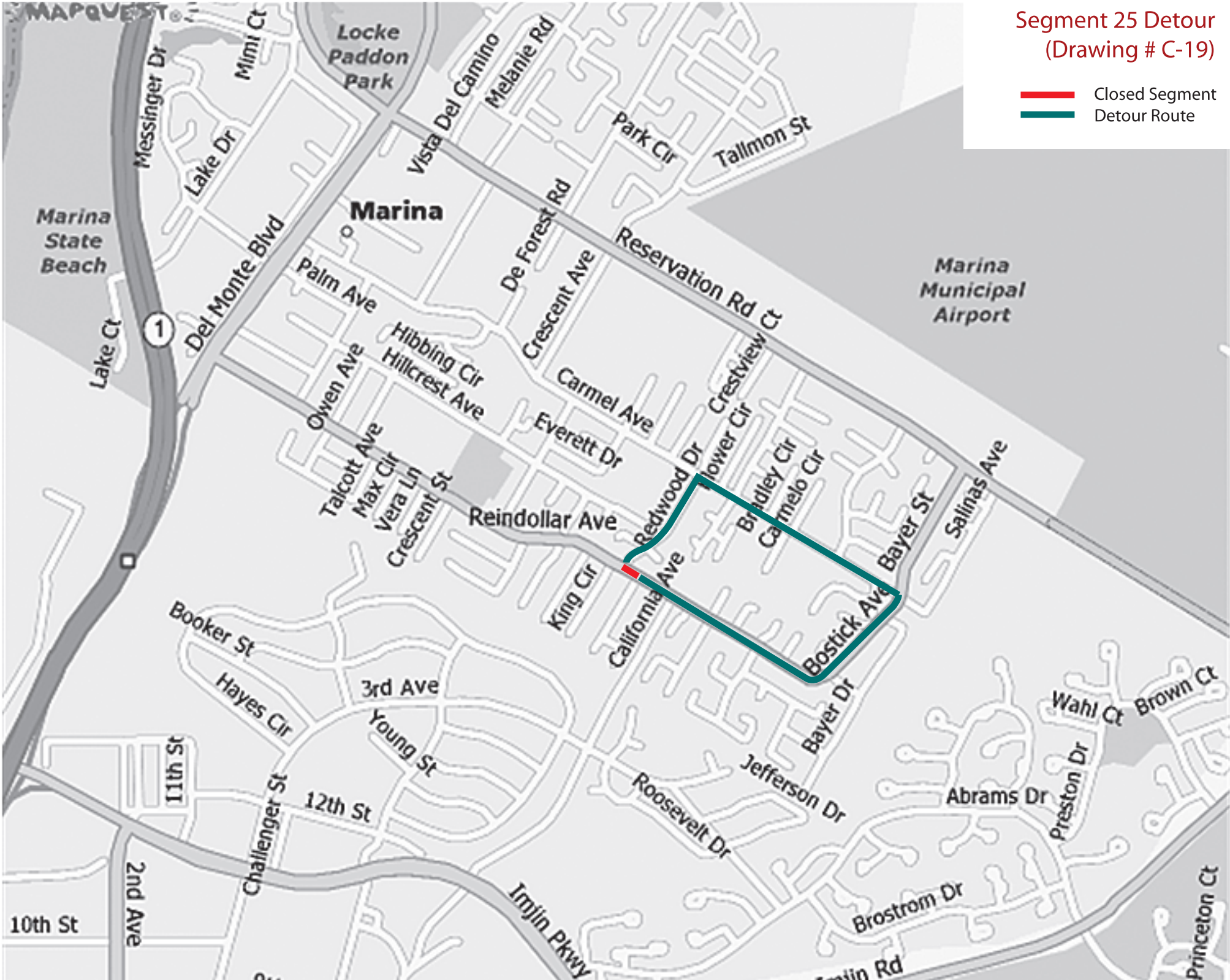
Segment 24 Detour
(Drawing # C-19)

-  Closed Segment
-  Detour Route





Segment 25 Detour
(Drawing # C-19)

-  Closed Segment
-  Detour Route





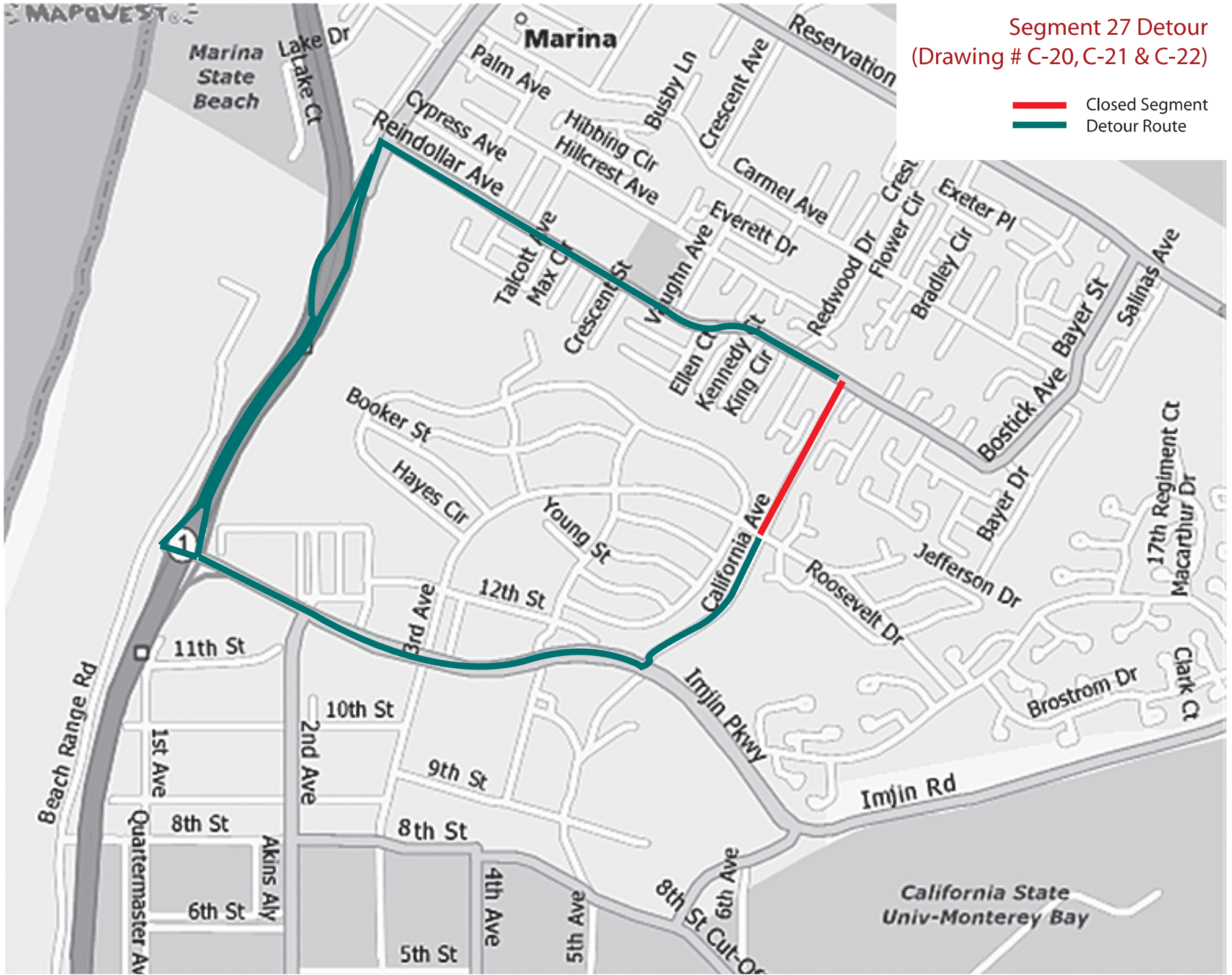
Segment 26 Detour
(Drawing # C-19 & C-20)

-  Closed Segment
-  Detour Route



Segment 27 Detour
(Drawing # C-20, C-21 & C-22)

-  Closed Segment
-  Detour Route

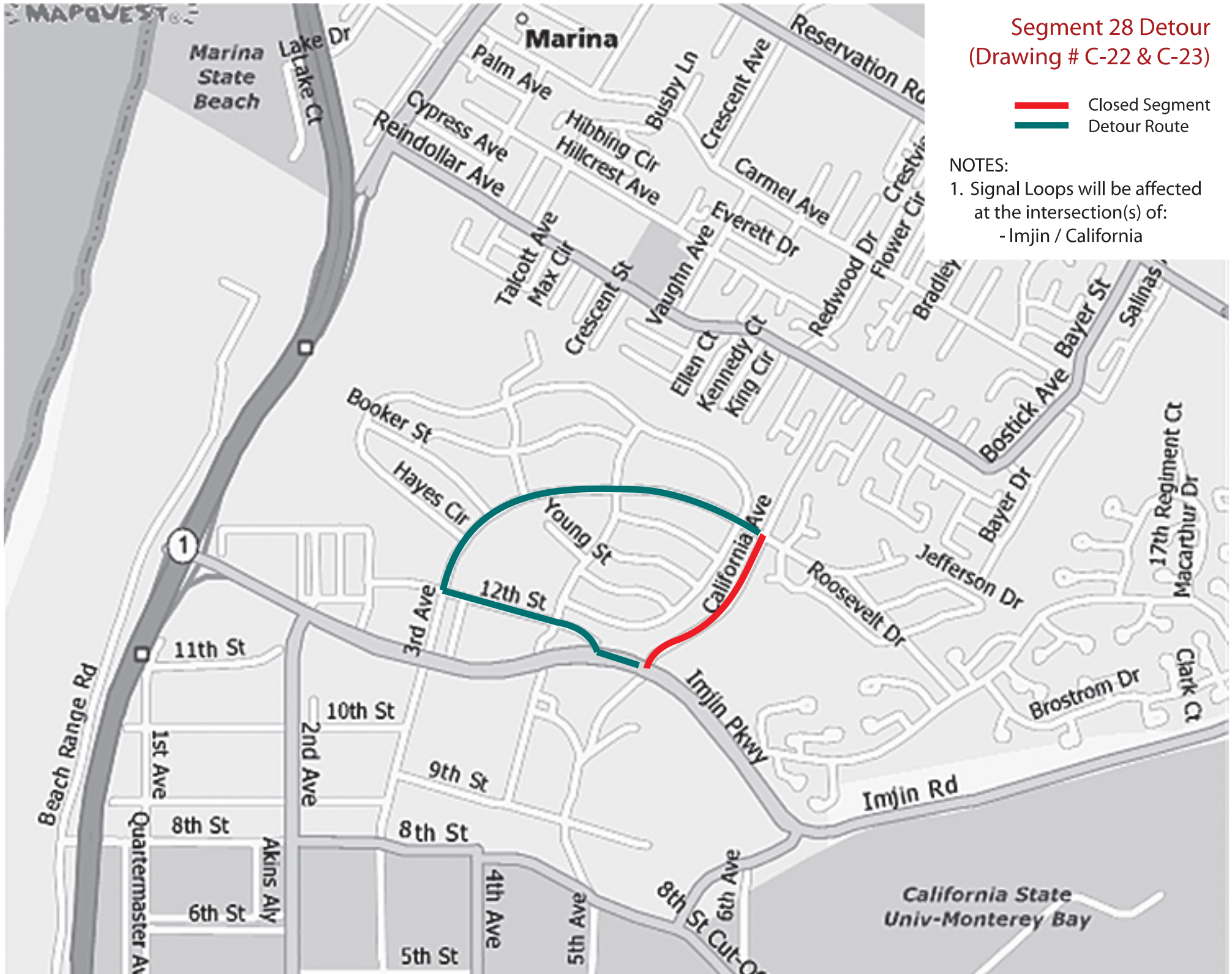


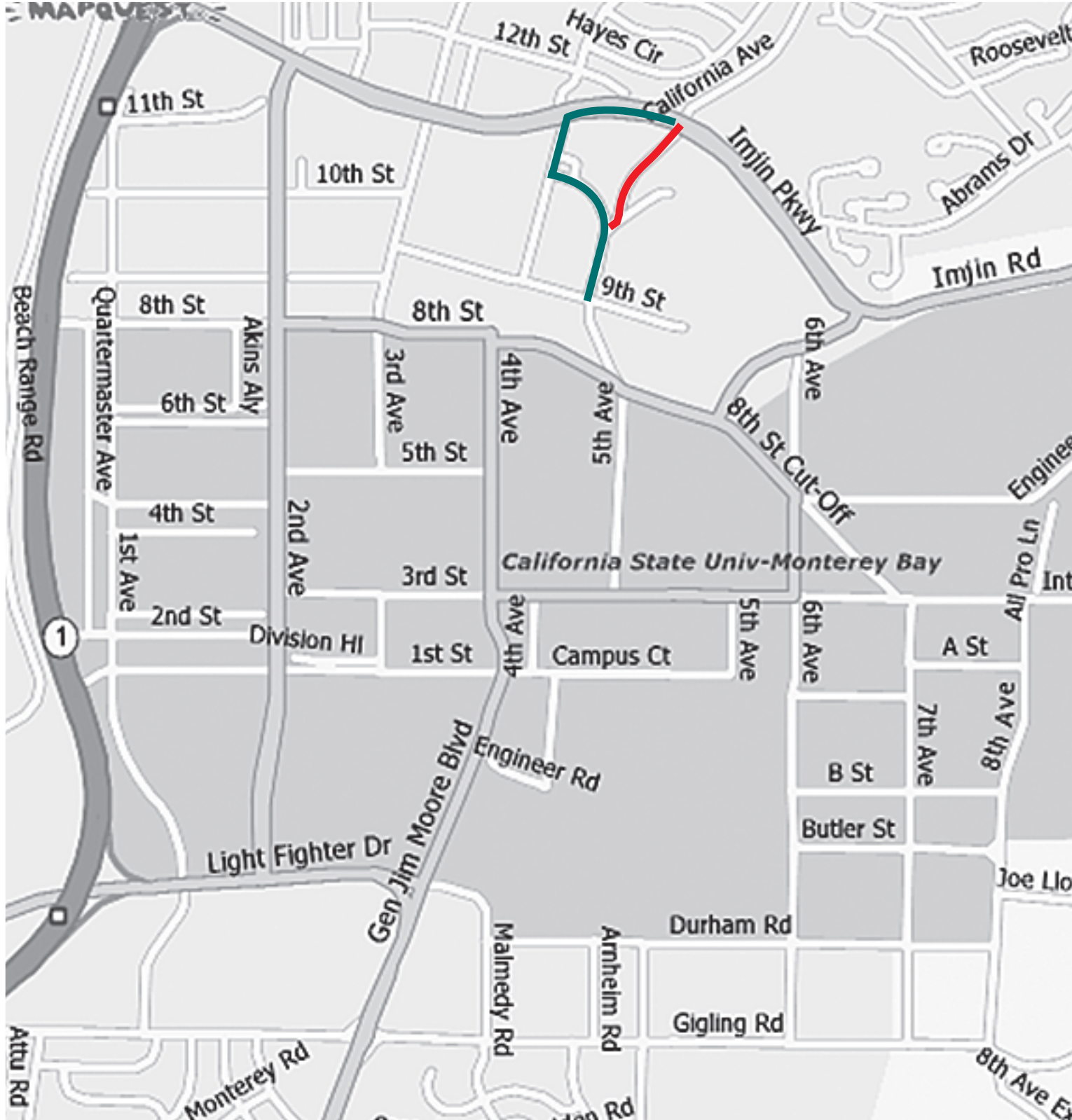
Segment 28 Detour (Drawing # C-22 & C-23)

- Closed Segment
- Detour Route

NOTES:

1. Signal Loops will be affected at the intersection(s) of:
 - Imjin / California

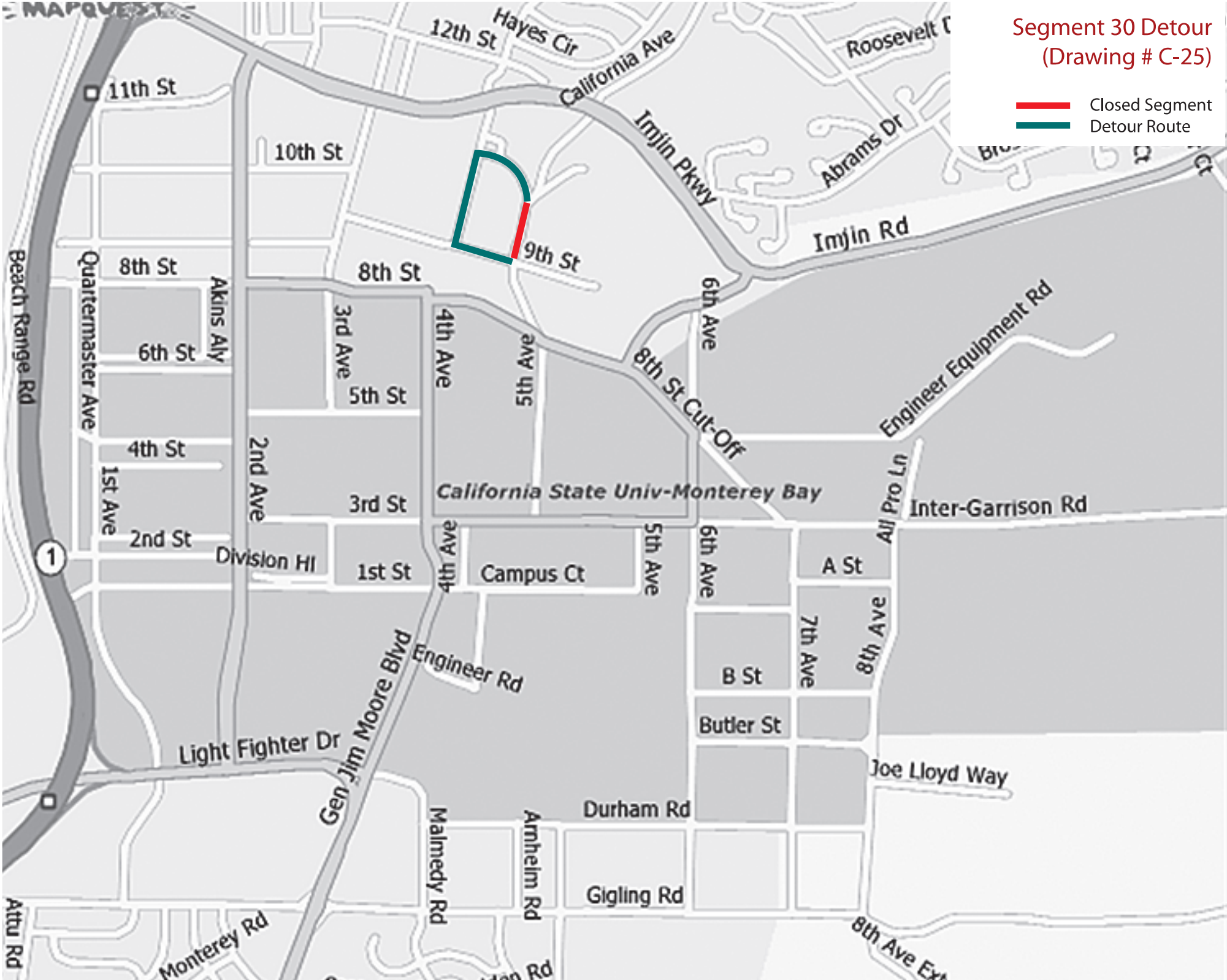




Segment 29 Detour (Drawing # C-24)

- Closed Segment
- Detour Route



NOTES:
 1. Signal Loops will be affected at the intersection(s) of:
 - Imjin / California

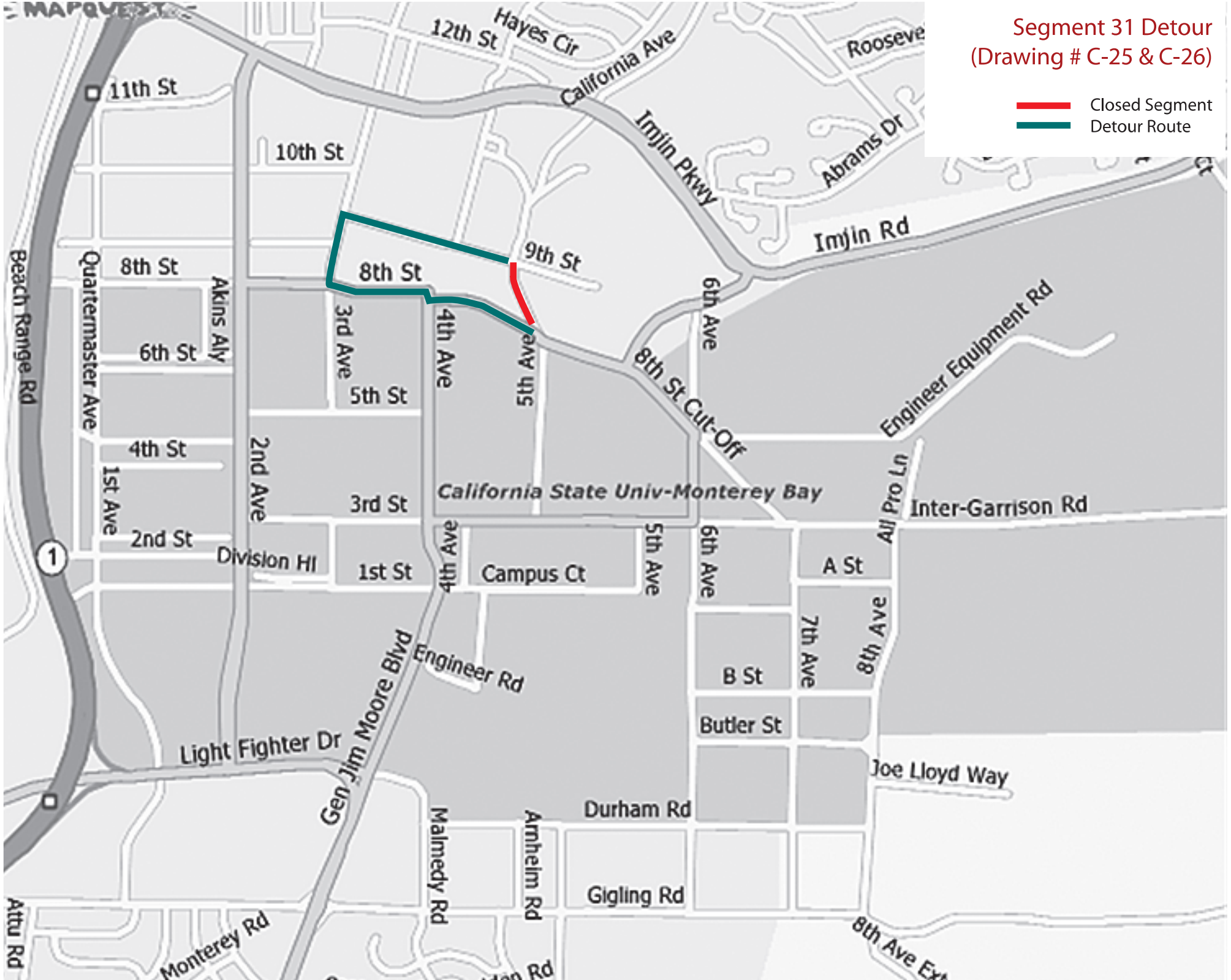


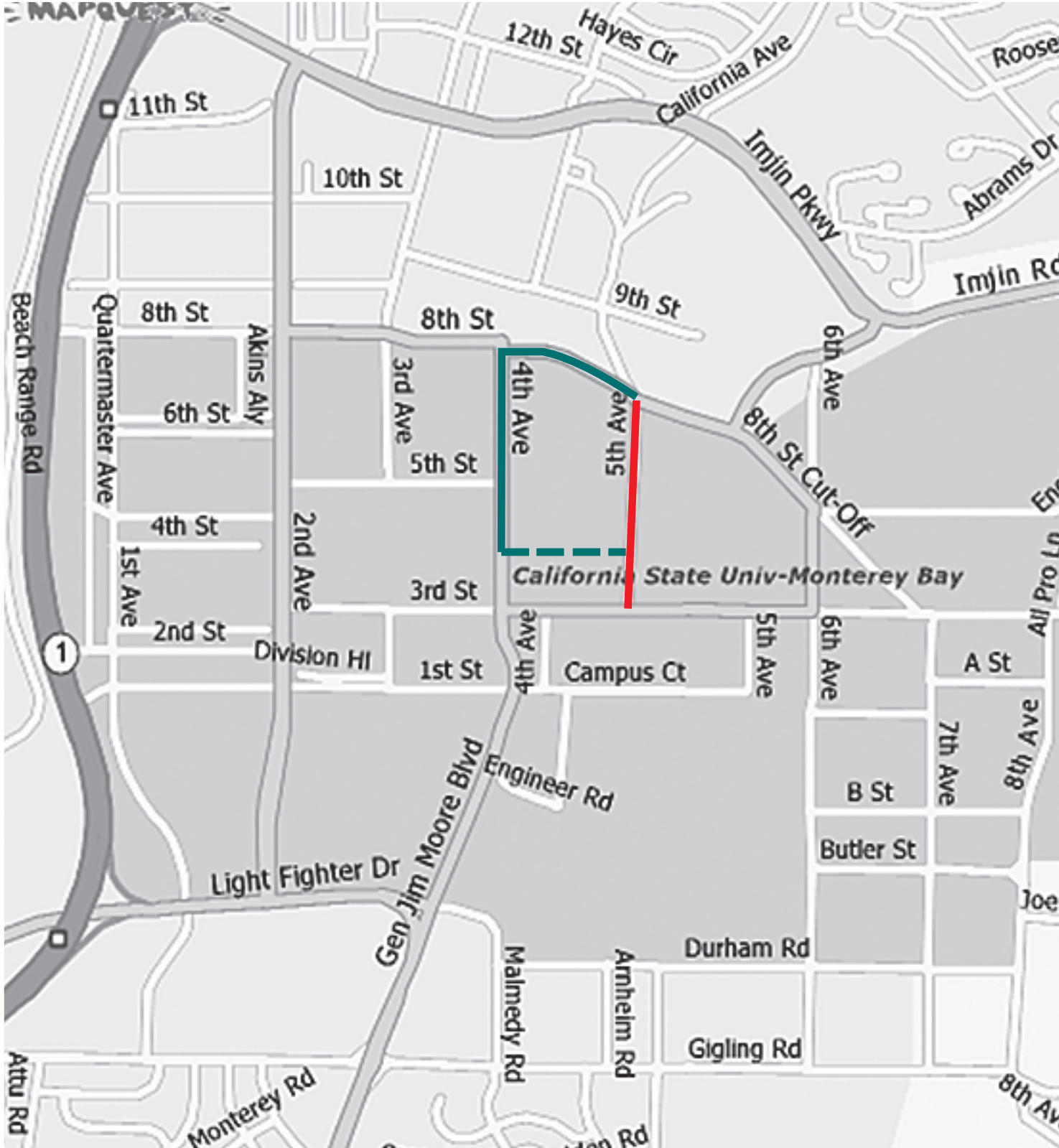
Segment 30 Detour
(Drawing # C-25)

- Closed Segment
- Detour Route

Segment 31 Detour
(Drawing # C-25 & C-26)

-  Closed Segment
-  Detour Route



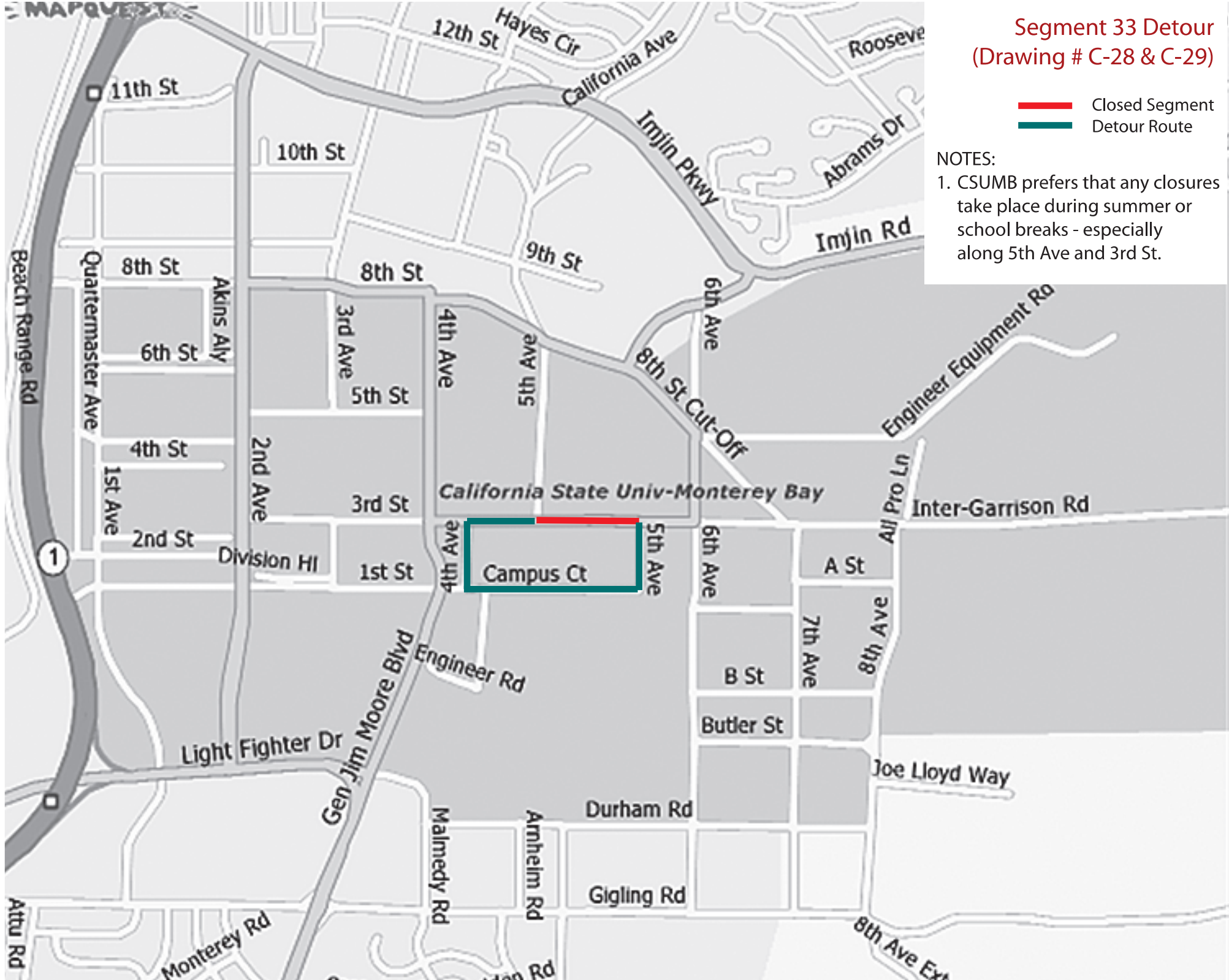


Segment 32 Detour (Drawing # C-26, C-27 & C-28)

- Closed Segment
- - - Detour Route

NOTES:

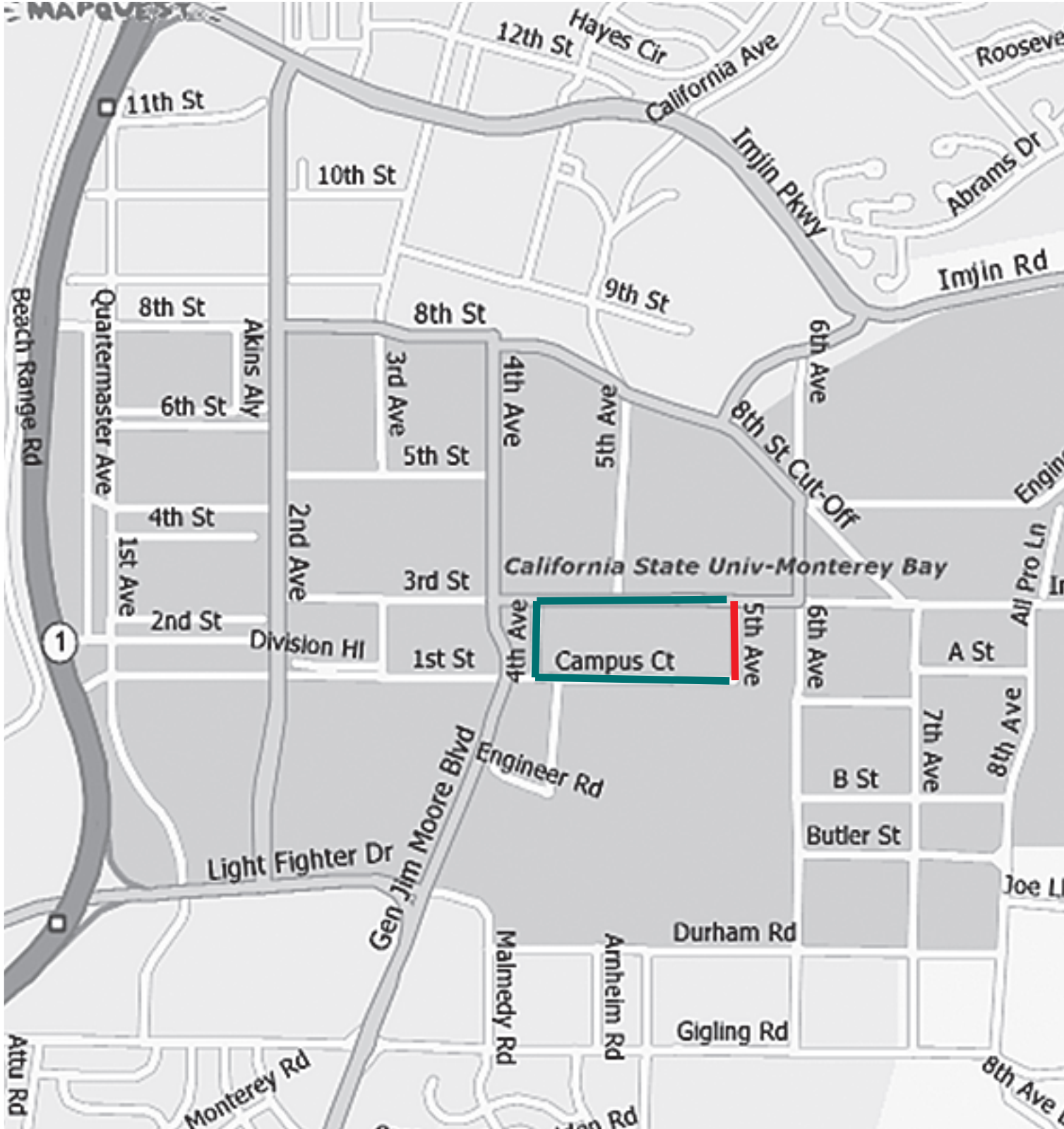
1. CSUMB prefers that any closures take place during summer or school breaks - especially along 5th Ave and 3rd St.



Segment 33 Detour (Drawing # C-28 & C-29)

- Closed Segment
- Detour Route

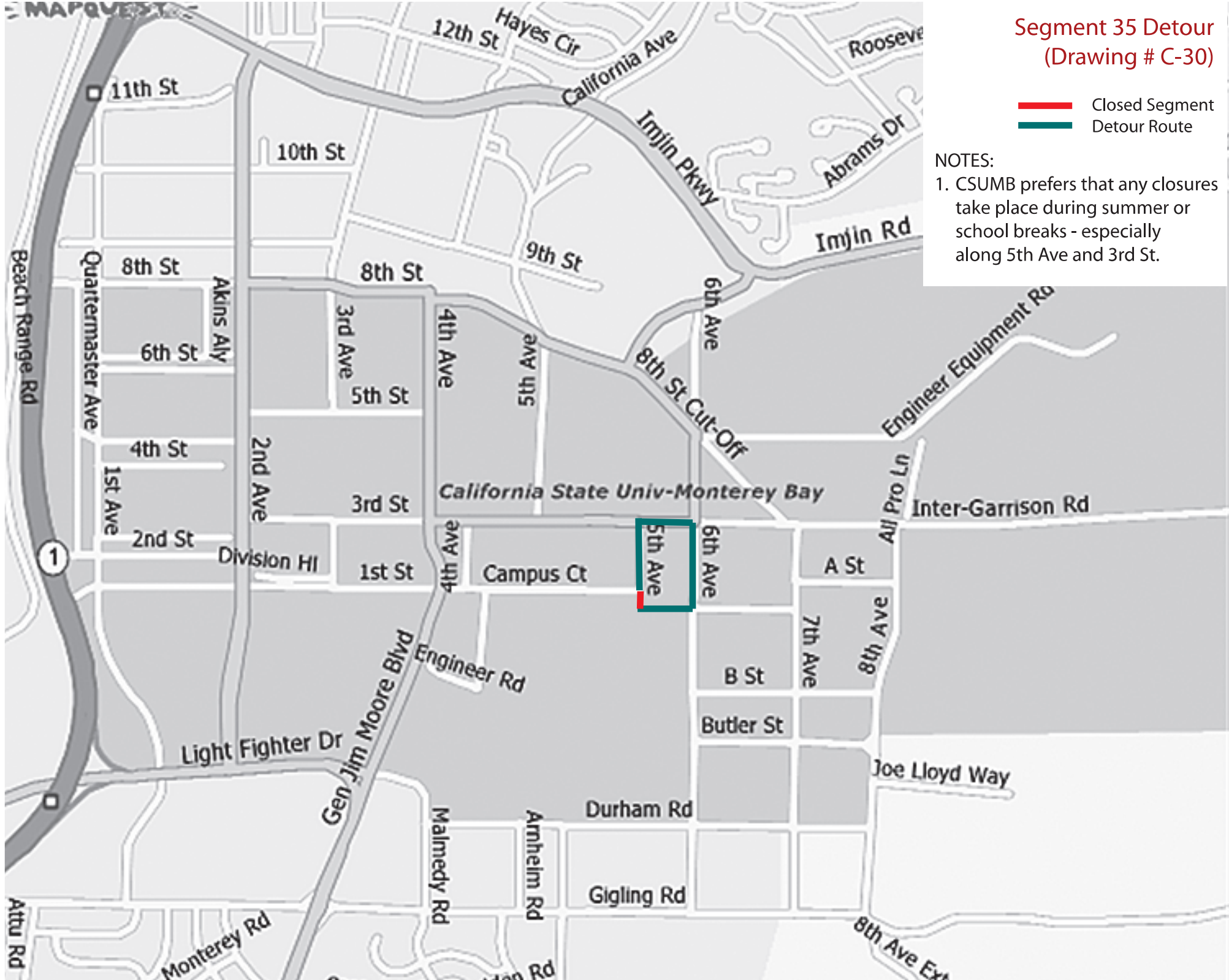
NOTES:
 1. CSUMB prefers that any closures take place during summer or school breaks - especially along 5th Ave and 3rd St.



Segment 34 Detour (Drawing # C-29 & C-30)

- █ Closed Segment
- █ Detour Route

NOTES:
 1. CSUMB prefers that any closures take place during summer or school breaks - especially along 5th Ave and 3rd St.





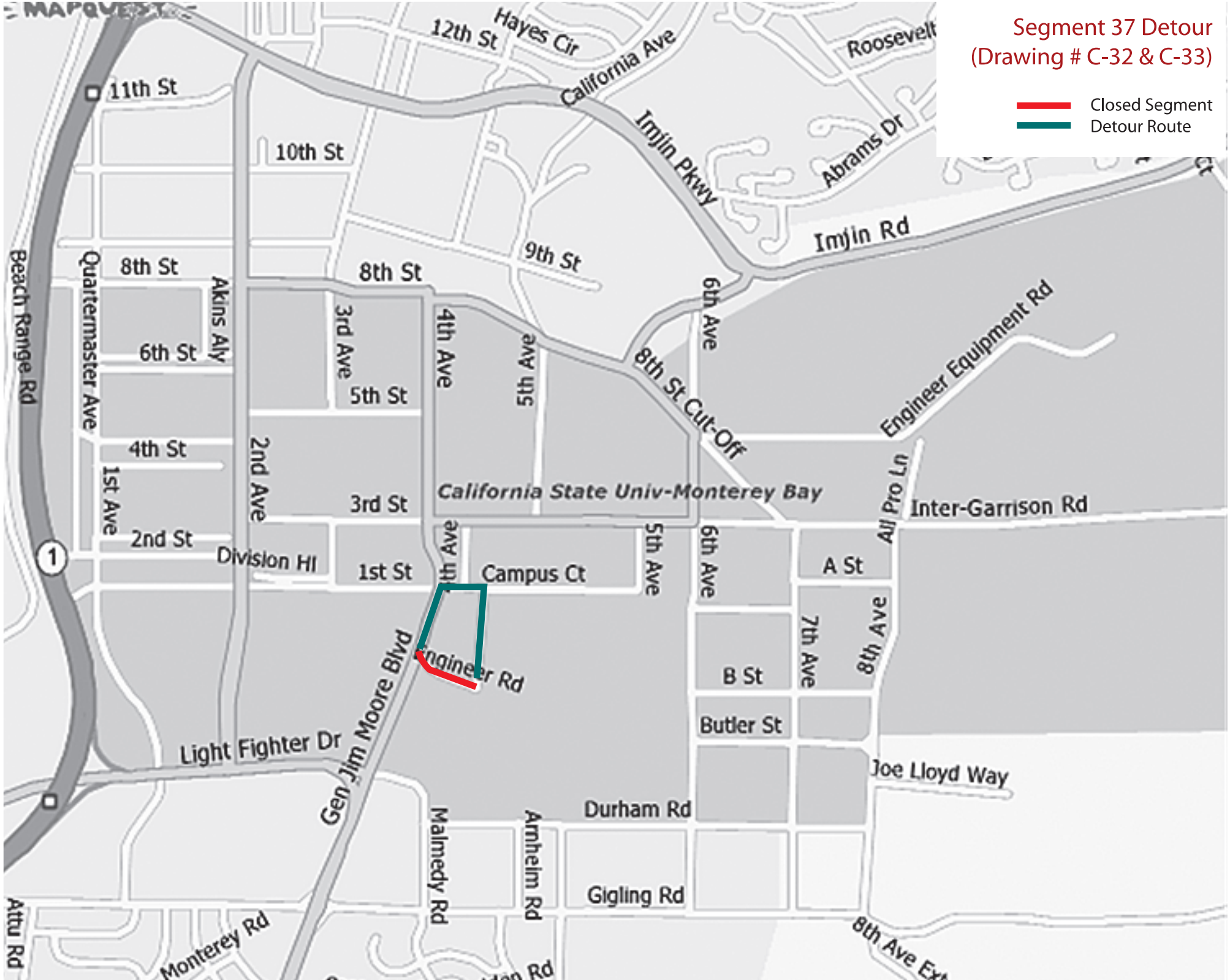
Segment 35 Detour (Drawing # C-30)

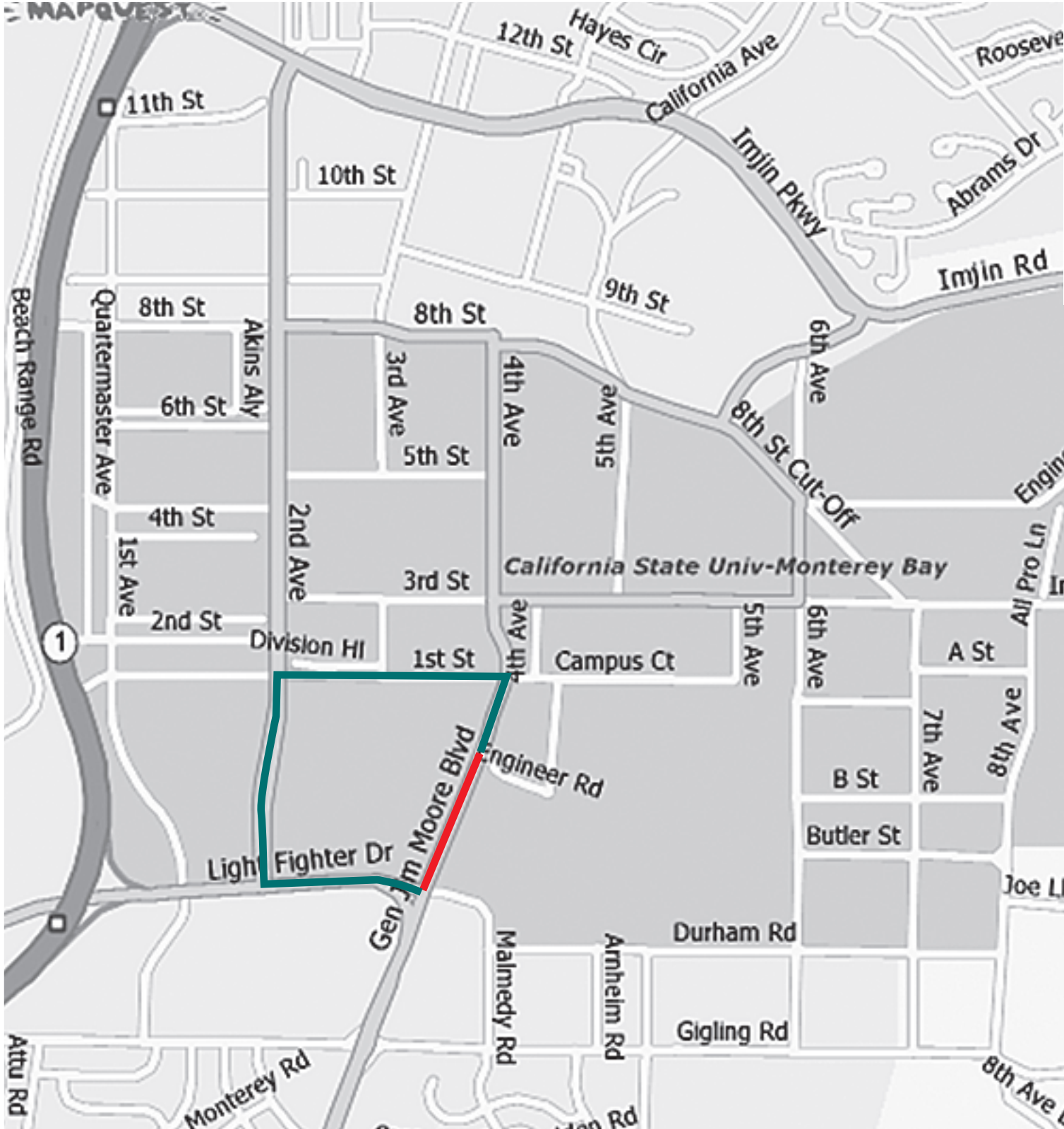
- Closed Segment
- Detour Route

NOTES:
 1. CSUMB prefers that any closures take place during summer or school breaks - especially along 5th Ave and 3rd St.

Segment 37 Detour
(Drawing # C-32 & C-33)

-  Closed Segment
-  Detour Route



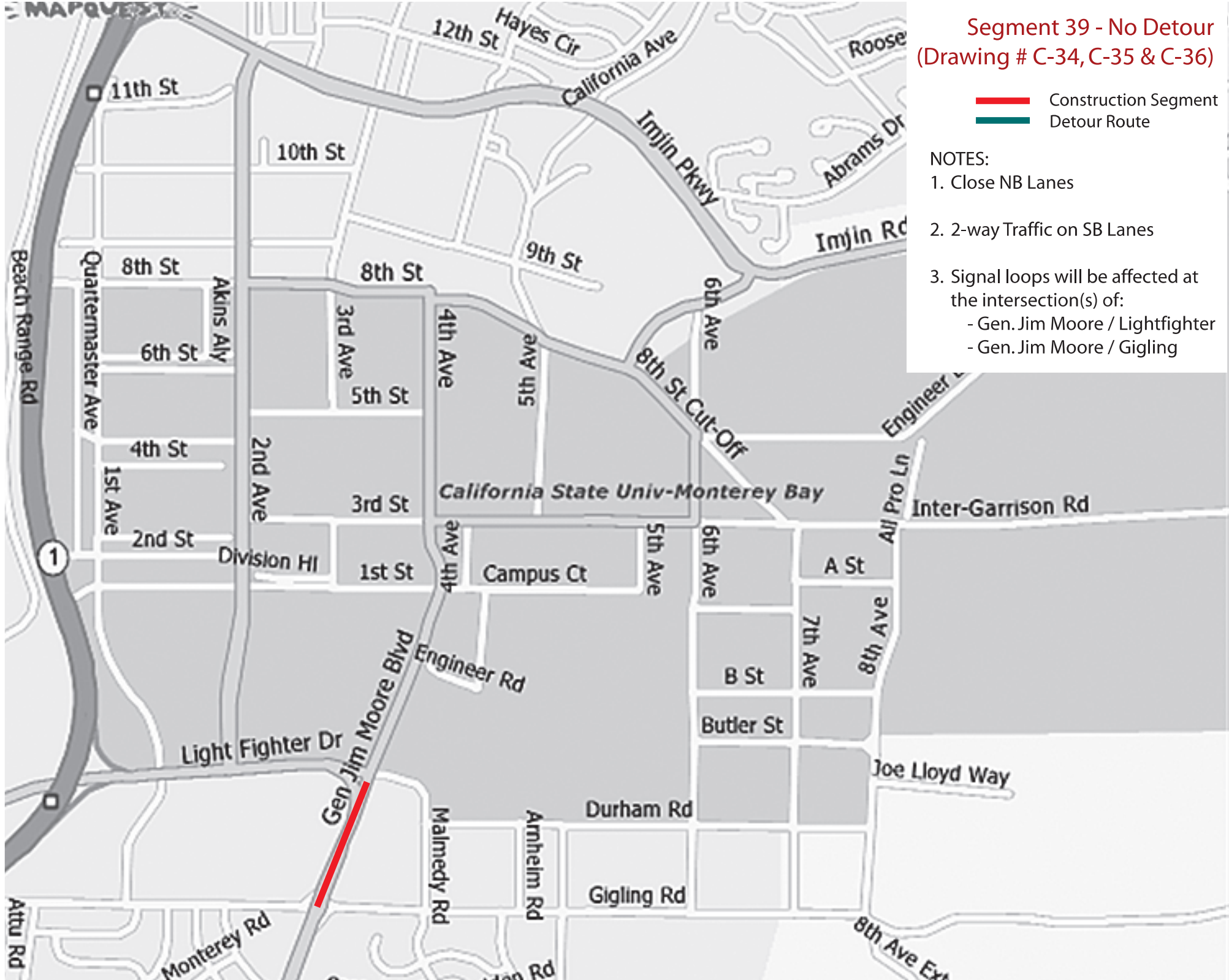


Segment 38 Detour (Drawing # C-33 & C-34)

- Closed Segment
- Detour Route

NOTES:

1. Signal loops will be affected at the intersection(s) of:
 - Gen. Jim Moore / Lightfighter



Segment 39 - No Detour
 (Drawing # C-34, C-35 & C-36)

- Construction Segment
- Detour Route

- NOTES:
1. Close NB Lanes
 2. 2-way Traffic on SB Lanes
 3. Signal loops will be affected at the intersection(s) of:
 - Gen. Jim Moore / Lightfighter
 - Gen. Jim Moore / Gigling



Segment 40 - No Detour
(Drawing # C-36, C-37 & C-38)

- Construction Segment
- Detour Route

- NOTES:
1. Close NB Lanes
 2. 2-way Traffic on SB Lanes
 3. Signal loops will be affected at the intersection(s) of:
 - Gen. Jim Moore / Gigling
 - Gen. Jim Moore / Normandy

**EXHIBIT 1
TABULAR DESCRIPTION OF THE PIPELINE ROADWAYS**

Road	Begin	End	Jurisdiction	Pipe Type	Pipeline Route Class	Status	Road Class	Edge Treatment			No. Of Lanes	AM Hour	AM ² Seg Vol	PM Hour	PM ² Seg Vol	Recommended Traffic Control	Hours of Construction	Alternate Traffic Control	
								Curb/Gutter/Sidewalk	Shoulder ¹	On-Street Parking?									
Del Monte Blvd	S/O Charlie Benson Ln ³	Marina City Limit	Monterey County	Main	Alternate	FI	2-lane arterial	None	8'	No	2		447		559	Flagger Operations	7:00 AM - 7:00 PM	Full Closure/Detour	
	Marina City Limit	Beach Rd		Main	Alternate	FI	2-lane arterial	Some CGS	None	Yes	2	7:15	433	4:45	506	Flagger Operations	7:00 AM - 7:00 PM	Full Closure/Detour	
	Beach Rd	Vince Dimaggio Park		Lateral	Alternate	FI	4-lane arterial	CGS	None	No	4	7:30	427	4:15	523	Lane Closure	7:00 AM - 7:00 PM		
Beach Rd	Del Monte Blvd	Olson Elementary School	Marina	Lateral	Alternate	FI	2-lane collector	CGS	No	Yes	2	7:15	438	4:45	363	Flagger Operations	9:00 AM - 4:30 PM		
	Olson Elementary School	DeForest Rd		Lateral	Preferred	FI	2-lane collector	CGS	No	Yes	2	7:15	438	4:45	363	Flagger Operations	8:30 AM - 4:30 PM		
	Del Monte Blvd	Reservation Rd		Main	Alternate	FI	2-lane arterial	CGS	8' Bike	No	2	7:15	392	4:45	400	Flagger Operations	7:00 AM - 7:00 PM		
Reservation Rd	Cardoza Ave	Lake Dr	Marina	Main	Alternate	FI	2-lane arterial	CGS(ES)	5'-8'	No	2	7:15	642	5:00	716	Flagger Operations	8:30 AM - 4:30 PM		
	Seacrest Ave	Crescent Ave		Lateral	Preferred	FI	4-lane divided	CGS	None	No	5-6	7:45	2076	5:00	2686	Lane Closure	Night-time Construction		
Lake Dr	Reservation Rd	Palm Ave	Marina	Main	Alternate	FI	2-lane collector	CGS	None	Yes	2	-	-	-	Flagger Operations	8:30 AM - 4:30 PM			
Palm Ave	Lake Dr	Del Monte Blvd	Marina	Main	Alternate	FI	2-lane local	CGS	None	Yes	2	-	-	-	Flagger Operations	8:30 AM - 4:30 PM			
Del Monte Blvd	Palm Ave	Reindollar Ave	Marina	Main	Alternate	FI	4-lane arterial	CGS	None	No	4	7:15	1671	5:00	1982	Lane Closure	9:00 AM - 4:00 PM		
Reindollar Ave	Del Monte Blvd	Vaughn Ave	Marina	Main	Alternate	FI	2-lane collector	CGS	None	Yes	2	7:15	594	5:00	551	Flagger Operations	9:00 AM - 4:30 PM	Full Closure/Detour	
	Vaughn Ave	California Ave		Main	Preferred	FI	2-lane collector	CGS	None	Yes	2	7:15	594	5:00	551	Flagger Operations	9:00 AM - 4:30 PM	Full Closure/Detour	
Vaughn Ave	Reindollar Ave	Carmel Ave	Marina	Lateral	Preferred	FI	2-lane local	CGS	None	Yes	2	-	-	-	Flagger Operations	9:00 AM - 4:30 PM	Full Closure/Detour		
Carmel Ave	Crescent Ave	Crumpton School	Marina	Lateral	Preferred	FI	2-lane collector	CGS	None	Yes	2		360		350	Flagger Operations	9:00 AM - 4:30 PM		
Crescent Ave	North Terminus	Reservation Rd	Marina	Main	Preferred	FI	2-lane collector	CGS	None	Yes	2	7:30	239	4:30	244	Flagger Operations	8:30 AM - 4:30 PM		
	Reservation Rd	Carmel Ave		Main	Preferred	FI	2-lane collector	CGS	6' Bike	Yes	2	7:30	445	4:30	494	Flagger Operations	8:30 AM - 4:30 PM		
California Ave	Reindollar Ave	Imjin Parkway	Marina	Main	Preferred	FI	2-lane arterial	CGS(WS)/CG(ES)	6' Bike	No	2	7:15	393	5:00	297	Flagger Operations	8:30 AM - 4:30 PM		
Imjin Parkway	California Ave	Imjin Rd	Marina	Lateral	Preferred	FI	4-lane expressway	CGS	None	No	4	7:15	1888	4:45	1841	Lane Closure	9:00 AM - 4:00 PM		
Imjin Rd	Imjin Parkway	Abrams Dr	Marina	Lateral	Preferred	FI	2-lane arterial	None	1'-10' Gravel	No	2	7:15	2507	4:45	2157	Install pipeline in conjunction with Imjin Road 4-laning project.			
	Abrams Dr	Preston Dr	Marina	Lateral	Preferred	FI	2-lane arterial	C	2'	No	2		2338		2424				
	Preston Dr	Reservation Rd	Marina	Lateral	Preferred	FI	2-lane arterial	C	4'	No	2	7:15	2383	5:00	2483				
	Reservation Rd	Marina Airport	Marina	Lateral	Preferred	I	2-lane arterial	C	6' Bike	No	2	7:15	53	5:00	78	NA	NA		
Abrams Dr	3rd Ave	Mc Arthur Dr	Marina	Lateral	Alternate	FI	-	-	-	-	-	-	-	-	-	Flagger Operations	8:30 AM - 4:30 PM		
	Mc Arthur Dr	Imjin Rd	Marina	Lateral	Preferred	FI	2-lane collector	CGS	None	No	2		268		252	Flagger Operations	8:30 AM - 4:30 PM		
	Imjin Rd	Schoonover Rd	Marina	Lateral	Preferred	FI	2-lane collector	CGS	None	No	2		369		473	Flagger Operations	8:30 AM - 4:30 PM		
Marina Heights Dr (formerly 3rd Ave)	California Ave	Abrams Dr	Marina	Lateral	Alternate	FI	-	-	-	-	-	-	-	-	Segment is currently closed.	Flagger Operations	8:30 AM - 4:30 PM	Install with road reconstruction.	
Preston Dr	Imjin Rd	Preston Park	Marina	Lateral	Preferred	FI	2-lane collector	CGS	None	No	2		103		181	Flagger Operations	8:30 AM - 4:30 PM		
2nd Ave	Imjin Parkway	9th St	Marina	Lateral	Preferred	FI	-	-	-	-	-	-	-	-	Segment is currently closed.	Lane Closure	7:00 AM - 7:00 PM	Install with road reconstruction.	
9th St	2nd Ave	3rd Ave	Marina	Lateral	Preferred	FI	-	-	-	-	-	-	-	-	Segment is currently closed.	Flagger Operations	7:00 AM - 7:00 PM	Install with road reconstruction.	
	3rd Ave	5th Ave		Lateral	Preferred	FI	2-lane local	Some C, AC Dike, S	None	No	2		-	-	-	Flagger Operations	7:00 AM - 7:00 PM		
5th Ave	Imjin Parkway	3rd St	Marina/CSUMB	Main	Preferred	FI	2-lane local	None	None	No	2	7:00	85	4:45	114	Flagger Operations	7:00 AM - 7:00 PM		
3rd St	5th Ave (west)	5th Ave (east)	CSUMB	Main	Preferred	FI	2-lane	CGS	None	No	2	7:15	205	5:00	301	Flagger Operations	7:00 AM - 7:00 PM		
Gnl Jim Moore Blvd	Engineer Ln	Lightfighter Dr	CSUMB	Main	Preferred	FI	4-lane arterial	Some CGS	6'	No	4	7:15	885	5:00	942	Lane Closure	7:00 AM - 7:00 PM		
	Lightfighter Dr	Normandy Rd		Main	Preferred	FI	4-lane arterial	Some CGS	0'-6'	No	4	7:15	1217	4:45	1141	Lane Closure	7:00 AM - 7:00 PM		
	Normandy Rd	Ardennes Cir		Main	Preferred	I	4-lane arterial	Some CGS	0'-6'	No	4	7:15	1217	4:45	1141	NA	NA		
	Ardennes Cir	Mc Clure Way		FORA	Main	Preferred	I	2-lane arterial	Some C&G	None	No	2		1053		818	NA	NA	
	Mc Clure Way	Coe Ave		Seaside/FORA	Main	Preferred	IP	2-lane arterial	Some C&G	None	No	2	7:30	1055	4:45	903	NA	NA	
	Coe Ave	Broadway Ave		Seaside	Main	Preferred	FI	2-lane arterial	Some C&G	2'-4'	No	2	7:30	1087	4:45	874	Flagger Operations	7:00 AM - 7:00 PM	
	Broadway Ave	Kimball Ave		Seaside	Main	Preferred	FI	2-lane arterial	Some C&G	2'-4'	No	2	7:15	848	4:30	706	Flagger Operations	7:00 AM - 7:00 PM	
	Kimball Ave	Pulmas Ave		Seaside	Lateral	Preferred	FI	2-lane arterial	Some C&G	2'-4'	No	2		-	-	-	Flagger Operations	7:00 AM - 7:00 PM	
	Pulmas Ave	S. Boundary Rd		Del Rey Oaks	Lateral	Preferred	FI	2-lane arterial	Some C&G	2'-4'	No	2		-	-	-	Flagger Operations	7:00 AM - 7:00 PM	
	Ardennes Cir																		

Road	Begin	End	Jurisdiction	Pipe Type	Pipeline Route Class	Status	Road Class	Edge Treatment			No. Of Lanes	AM Hour	AM ² Seg Vol	PM Hour	PM ² Seg Vol	Recommended Traffic Control	Hours of Construction	Alternate Traffic Control
								Curb/Gutter/Sidewalk	Shoulder ¹	On-Street ¹ Parking?								
Ardennes Cir Metz Rd		Metz Rd Blackhorse Reservoir	Seaside	Main	Preferred	FI	2-lane collector	CG(NS)/CGS(SS)	None	No	2	-	-	-	Flagger Operations	9:00 AM - 7:00 PM		
			Seaside	Main	Preferred	FI	2-lane collector	CGS	None	Yes(NS)	2	-	-	-	Flagger Operations	9:00 AM - 7:00 PM		
Coe Ave	General Jim Moore Blvd East of Buttercup Blvd Pacific Crest Dr	East of Buttercup Blvd Pacific Crest Dr High School	Seaside	Lateral	Preferred	IP	2-lane collector	Some CG	None	No	2	7:30	340	4:45	203	NA	NA	
			Seaside	Lateral	Preferred	FI	2-lane collector	Some CG	None	No	2	7:30	340	4:45	203	Flagger Operations	8:30 AM - 4:30 PM	
			Seaside	Lateral	Preferred	FI	2-lane collector	CGS(NS)/CG(SS)	6' Bike	No	2	-	-	-	-	Flagger Operations	8:30 AM - 4:30 PM	
Kimball Ave	Gnl Jim Moore	Fremont St	Seaside	Main	Preferred	FI	2-lane collector	CGS	None	Yes	2	-	-	Flagger Operations	8:30 AM - 4:30 PM			
Fremont St	Kimball Ave Canyon Del Rey Blvd	Canyon Del Rey Blvd Airport Rd	Seaside	Main	Preferred	FI	4-lane arterial	CGS	None	No	4	7:30	1464	4:30	2180	Lane Closure	Night-time Construction	
			Seaside	Main	Preferred	FI	4-lane arterial	CGS	None	Some	4	7:30	1783	4:30	2473	Lane Closure	Night-time Construction	
SR218 (Canyon Del Rey Blvd)	Fremont St	Harcourt Ave	Caltrans	Lateral	Preferred	FI	4-lane arterial	CGS	5' Bike	No	4	7:30	787	4:30	1077	Lane Closure	7:00 AM - 7:00 PM	
Airport Rd	Fremont St	Fairground Rd	Monterey	Main	Preferred	FI	2-lane collector	CGS	None	No	2	7:30	386	5:00	535	Flagger Operations	8:30 AM - 4:30 PM	
Fairground Rd	Airport Rd	Mark Thomas Dr	Monterey	Main	Preferred	FI	2-lane local	Some CGS	None	Yes	2	7:30	418	4:45	570	Flagger Operations	7:00 AM - 7:00 PM	
Mark Thomas Dr	Fairground Rd Del Monte Golf Course Sloat Ave	Del Monte Golf Course Sloat Ave Aguajito Rd	Monterey	Main	Preferred	FI	2-lane rural	CGS	6' WS/4' ES	No	2	-	-	-	Flagger Operations	8:30 AM - 4:30 PM		
			Monterey	Main	Preferred	FI	2-lane rural	CGS	6' WS/4' ES	No	2	-	-	-	Flagger Operations	8:30 AM - 4:30 PM		
			Monterey	Lateral	Preferred	FI	2-lane rural	CGS	6' WS/4' ES	No	2	-	-	-	Flagger Operations	8:30 AM - 4:30 PM		
Aguajito Rd	Mark Thomas Dr	Glenwood Cir	Monterey	Lateral	Preferred	FI	2-lane arterial	CG(NS)/CGS(SS)	None	No	2	948	1262	Flagger Operations	9:00 AM - 4:00 PM	Night-time Construction		
Glenwood Cir	Aguajito Rd	MPC Stadium	Monterey	Lateral	Preferred	FI	2-lane collector	CG(W)/CGS(ES)	None	Yes	2	7:45	196	5:00	272	Flagger Operations	8:30 AM - 4:30 PM	
Sloat Ave	Mark Thomas Dr	3rd St	Monterey	Lateral	Preferred	FI	2-lane arterial	CGS	12' Park/Bike	Yes	2	-	-	-	Flagger Operations	8:30 AM - 4:30 PM		
3rd St	Sloat Ave Camino Aguajito	Camino Aguajito El Estero Park	Monterey	Lateral	Preferred	FI	2-lane local	CGS	None	Yes	2	-	-	-	Flagger Operations	8:30 AM - 4:30 PM		
			Monterey	Lateral	Preferred	FI	2-lane local	CGS	4' Bike	No	2	-	-	-	Flagger Operations	8:30 AM - 4:30 PM		
Park Ave	3rd St	Del Monte Ave	Monterey	Lateral	Alternate	FI	2-lane collector	CGS	None	Yes	2	-	-	Flagger Operations	8:30 AM - 4:30 PM			
Camino Aguajito	3rd St	Del Monte Ave	Monterey	Lateral	Alternate	FI	2-lane collector	CGS	None	Yes	2	7:30	469	4:30	631	Flagger Operations	8:30 AM - 4:30 PM	
Del Monte Ave	Park Ave Camino Aguajito	Camino Aguajito Figueroa St	Monterey	Lateral	Alternate	FI	4-lane arterial	CGS	None	No	4	7:30	2262	4:30	3003	Lane Closure	Night-time Construction	
			Monterey	Lateral	Preferred	FI	4-lane arterial	CGS	None	No	4	7:30	2706	4:30	3895	Lane Closure	Night-time Construction	
Figueroa St	Del Monte Ave	Jacks Ball Park	Monterey	Lateral	Preferred	FI	2-lane collector	CGS	None	Yes	2	7:30	317	4:30	535	Flagger Operations	8:30 AM - 4:30 PM	Full closure or night-time const.

Notes:

1. NS, SS, ES, WS = North side, South side, East side, West side
2. "-" = no current volumes available
3. Volumes are estimated based on an 8% ADT for the AM peak hour and 10% ADT for the PM peak hour on Del Monte Boulevard between Charlie Benson Way and Marina City Limits.
4. Status: I = Installed; IP = Installation in Progress; FI = Future Installation; NA = Not applicable.
5. Recommended traffic control and construction hours based upon existing volumes, where available, and worst-case assumption regarding pipeline location within the travelway.

**EXHIBIT 2
TABULAR DESCRIPTION OF THE PIPELINE INTERSECTIONS**

	N-S Street	E-W Street	Existing Lane Configuration	Existing Intersection Control	Existing Conditions				Recommended Intersection Control During Construction Hours ⁹	Recommended Intersection Control During non-Construction Hours ⁵	Hours of Construction
					AM Peak Hr		PM Peak Hr				
					Delay (sec)	LOS	Delay (sec)	LOS			
1	Reservation Road	Beach Road	NB 1-L, 1-L/R EB 1-T, 1-R WB 1-L, 1-T	Signal	17.3	B	17.1	B	Flagger	Temporary Traffic Signal	8:30 AM - 4:30 PM
2	Del Monte Boulevard	Beach Road	NB 1-L, 2-T, 1-R SB 1-L, 1-T, 1-T/R EB 1-L/T/R WB 1-L, 1-T/R	All-way Stop	12.1	B	10.8	B	Flagger	Existing Control	8:30 AM - 4:30 PM
3	Michael Drive	Beach Road	SB 1-L/R EB 1-L/T WB 1-T/R	One-way Stop Worst Approach	2.0 10.6	A B	1.5 9.7	A A	Flagger	Existing Control	8:30 AM - 4:30 PM
4	De Forest Road	Beach Road	NB 1-L EB 1-R	None Worst Approach	0.0 0.0	A A	0.0 0.0	A A	Flagger	All-way Stop Control	8:30 AM - 4:30 PM
5	Crescent Avenue	Reservation Road	NB 1-L, 1-T/R SB 1-L/T, 1-R EB 1-L, 2-T, 1-R WB 1-L, 1-T, 1-T/R	Signal	17.8	B	17.5	B	Flagger	Temporary Traffic Signal	8:30 AM - 4:30 PM
6	De Forest Road	Reservation Road	NB 1-L/T, 1-R SB 1-L/T, 1-R EB 1-L, 2-T, 1-R WB 1-L, 1-T, 1-T/R	Signal	17.4	B	22.2	C	Flagger	Temporary Traffic Signal	8:30 AM - 4:30 PM
7	Seacrest Plaza & Reservation Shopping Center Driveway	Reservation Road	NB 1-L/T/R SB 1-L/T, 1-R EB 1-L, 1-T, 1-T/R WB 1-T, 1-T/R	Signal	11.8	B	13.1	B	Flagger	Temporary Traffic Signal	8:30 AM - 4:30 PM
8	Seacrest Avenue	Reservation Road	NB 1-L, 1-R EB 2-T, 1-R WB 1-L, 2-T	Signal	11.9	B	18.6	B	Flagger	Temporary Traffic Signal	8:30 AM - 4:30 PM
9	Del Monte Boulevard	Palm Avenue	NB 1-L, 2-T, 1-R SB 1-L, 2-T EB 1-L, 1-L/T/R	Signal	NA		NA		Flagger	Temporary Traffic Signal	9:00 AM - 4:00 PM
10	Del Monte Boulevard	Reindollar Avenue	NB 1-L, 2-T, 1-R SB 1-L, 2-T WB 1-L, 1-L/T/R	Signal	17.1	B	11.4	B	Flagger	Temporary Traffic Signal	9:00 AM - 4:00 PM
11	Crescent Avenue	Reindollar Avenue	NB 1-L/R EB 1-T/R WB 1-L/T	One-way Stop Worst Approach	0.4 10.7	A B	0.4 11.7	A B	Flagger	Existing Control	8:30 AM - 4:30 PM
12	Redwood Avenue	Reindollar Avenue	SB 1-L/R EB 1-L/T WB 1-T/R	One-way Stop Worst Approach	4.0 11.6	A B	2.8 10.7	A B	Flagger	Existing Control	8:30 AM - 4:30 PM
13	California Avenue	Reindollar Avenue	NB 1-L/T/R SB 1-L/T/R EB 1-L/T/R WB 1-L/T/R	All-way Stop	9.2	A	9.2	A	Flagger	Existing Control	8:30 AM - 4:30 PM
14	California Avenue	Carmel Avenue	NB 1-L, 1-T/R SB 1-L, 1-T/R EB 1-L/T, 1-R WB 1-L/T, 1-R	All-way Stop	8.7	A	8.3	A	Flagger	Existing Control <small>(A minimum of one travel lane per direction shall remain open)</small>	8:30 AM - 4:30 PM
15	California Avenue	Third Avenue	NB 1-L/T/R SB 1-L/T/R EB 1-L/T/R WB 1-L/T/R	All-way Stop	10.2	B	7.9	A	Flagger	Existing Control	8:30 AM - 4:30 PM
16	Second Avenue	Imjin Parkway	NB 1-L, 1-T, 1-R SB 1-L, 1-T, 1-R EB 1-L, 1-T, 1-T/R WB 1-L, 1-T, 1-T/R	Signal	9.7	A	7.3	A	Flagger	Temporary Traffic Signal	8:30 AM - 4:30 PM
17	California Avenue	Imjin Parkway	NB 1-L/T/R SB 1-L/T/R EB 1-L, 1-T, 1-T/R WB 1-L, 1-T, 1-T/R	Signal	17.3	B	9.4	A	Flagger	Temporary Traffic Signal	9:00 AM - 4:00 PM
18	Abrams Drive (South)	Imjin Parkway	SB 1-L/R EB 1-L, 2-T WB 1-T, 1-T/R	One-way Stop Worst Approach	0.9 15.0	A B	0.9 13.1	A B	Flagger	Existing Control	9:00 AM - 4:00 PM
19	Imjin Road	Imjin Parkway	NB 1-L, 1-L/R, 1-R EB 1-T, 1-T/R WB 1-L, 2-T	Signal	17.4	B	19.5	B	Work to be conducted during the construction of of the Imjin Road 4-laning project.		

N-S Street	E-W Street	Existing Lane Configuration	Existing Intersection Control	Existing Conditions				Recommended Intersection Control During Construction Hours ⁶	Recommended Intersection Control During non-Construction Hours ⁶	Hours of Construction	
				AM Peak Hr		PM Peak Hr					
				Delay (sec)	LOS	Delay (sec)	LOS				
20	Abrams Drive (North)	Imjin Road	NB 1-L/T, 1-R SB 1-L/T, 1-R EB 1-L, 1-T, 1-R WB 1-L, 1-T, 1-R	Signal	33.4	C	45.6	D	Work to be conducted during the construction of of the Imjin Road 4-laning project.		
21	Imjin Road	Preston Drive	NB 1-L, 1-T SB 1-T, 1-R EB 1-L/R	Signal	10.4	B	9.8	A	Work to be conducted during the construction of of the Imjin Road 4-laning project.		
22	Imjin Road	Reservation Road	NB 2-L, 1-T/R, 1-R SB 1-L, 1-T, 1-R EB 2-L, 2-T, 1-R WB 2-L, 2-T, 1-R	Signal	40.2	D	53.0	D	N/A	N/A	N/A
23	General Jim Moore Boulevard	Light Fighter Drive	NB 2-L, 1-T/R SB 1-L, 1-T, 1-T/R EB 1-L, 1-T, 1-R WB 1-L, 1-T/R	Signal	23.4	C	26.8	C	Flagger/Temporary Traffic Signal	Temporary Traffic Signal	7:00 AM - 7:00 PM
24	General Jim Moore Boulevard	Gigling Road	NB 1-L, 2-T, 1-R SB 1-L, 2-T, 1-R EB 1-L, 1-T/R WB 1-L, 1-T, 1-R	Signal	16.4	B	17.5	B	Flagger/Temporary Traffic Signal	Temporary Traffic Signal	7:00 AM - 7:00 PM
25	General Jim Moore Boulevard	Normandy Road	NB 1-L, 1-T, 1-T/R SB 1-L, 2-T, 1-R EB 1-L/T/R WB 1-L/T/R	Signal	14.4	B	12.1	B	Flagger/Temporary Traffic Signal	Temporary Traffic Signal	7:00 AM - 7:00 PM
26	General Jim Moore Boulevard	McClure Way - Arloncourt Road	NB 1-L/T/R SB 1-L/T/R EB 1-L/T, 1-R WB 1-L/T/R	All-way Stop	64.3	F	15.7	C	N/A	N/A	N/A
27	General Jim Moore Boulevard	Coe Avenue - Eucalyptus Road	NB 1-L, 1-T SB 1-T, 1-R EB 1-L, 1-R WB 1-L/T/R**	Two-way Stop Worst Approach	3.7 22.9	A C	1.8 16.4	A C	N/A	N/A	N/A
28	General Jim Moore Boulevard	Broadway Avenue	NB 1-L/T SB 1-L, 1-R EB 1-L, 1-R	All-way Stop	25.9	D	24.5	C	Flagger	Existing Control	8:30 AM - 4:30 PM
29	Fremont Street	Kimball Avenue	NB 2-T, 1-R SB 1-L, 2-T WB 1-L, 1-R	Signal	NA		NA		Flagger/Temporary Traffic Signal	Temporary Traffic Signal	9:00 PM - 5:00 AM
30	Fremont Street	Highway 218 (Canyon Del Rey Blvd.)	NB 1-L, 2-T, 1-R SB 1-L, 2-T, 1-R EB 1-L, 1-T, 1-T/R WB 1-L, 1-T, 1-T/R	Signal	30.4	C	36.0	D	Flagger/Temporary Traffic Signal	Temporary Traffic Signal	9:00 PM - 5:00 AM
31	Cassanova Avenue	Fremont Street	NB 1-L/T, 1-R SB 1-L, 1-T/R EB 1-L, 2-T, 1-R WB 1-L, 2-T, 1-R	Signal	10.7	B	53.7	D	Flagger/Temporary Traffic Signal	Temporary Traffic Signal	9:00 PM - 5:00 AM
32	Ramona Avenue	Fremont Street	NB 1-L/T, 1-R SB 1-L/T/R EB 1-L, 2-T, 1-R WB 1-L, 2-T, 1-R	Signal	NA		NA		Flagger/Temporary Traffic Signal	Temporary Traffic Signal	9:00 PM - 5:00 AM
33	Dela Vina Ave.- Airport Road	Fremont Street	NB 1-L/T, 1-R SB 1-L/T/R EB 1-L, 2-T, 1-R WB 1-L, 1-T, 1-T/R	Signal	12.4	B	15.8	B	Flagger	Temporary Traffic Signal	9:00 PM - 5:00 AM
34	Sloat Avenue	Mark Thomas Drive	NB 1-L/T, 1-R SB 1-L/T, 1-R EB 1-L/T, 1-R WB 1-L, 1-T, 1-R	Signal	NA		NA		Flagger/Temporary Traffic Signal	Temporary Traffic Signal	8:30 AM - 4:30 PM
35	Aguajito Road	Mark Thomas Drive	NB 1-T, 1-T/R SB 1-L, 2-T EB 1-L, 1-T/R WB 1-L, 1-R	Signal	NA		NA		Flagger/Temporary Traffic Signal	Temporary Traffic Signal	8:30 AM - 4:30 PM
36	Aguajito Road	Cut-thru Street	NB 1-L, 2-T SB 1-T, 1-T/R EB 1-L, 1-R	Signal	8.1	A	16.0	B	Flagger	Temporary Traffic Signal	9:00 AM - 4:00 PM
37	Glenwood Circle Via Lavandera	Cut-thru Street	NB 1-T/R SB 1-L/T WB 1-L, 1-R	Two-way Stop Worst Approach	16.1 19.2	C C	9.5 10.5	A B	Flagger	Temporary Traffic Signal	8:30 AM - 4:30 PM
38	Figueroa Street	Franklin Street	NB 1-L/T/R SB 1-L/T/R EB 1-L/T, 1-T/R	Signal	NA		NA		Flagger	Temporary Traffic Signal	8:30 AM - 4:30 PM
39	Figueroa Street	Del Monte Avenue	NB 1-L, 1-T, 1-R SB 1-L, 1-T, 1-R EB 1-L, 2-T, 1-T/R WB 1-L, 2-T, 1-T/R	Signal	10.1	B	17.2	B	Flagger	Temporary Traffic Signal	9:00 PM - 5:00 AM

	N-S Street	E-W Street	Existing Lane Configuration	Existing Intersection Control	Existing Conditions				Recommended Intersection Control During Construction Hours ⁶	Recommended Intersection Control During non-Construction Hours ⁶	Hours of Construction
					AM Peak Hr		PM Peak Hr				
					Delay (sec)	LOS	Delay (sec)	LOS			
40	Camino El Estero	Del Monte Avenue	NB 2-L, 1-R EB 1-L, 2-T, 1-R WB 1-L, 3-T	Signal	27.1	C	41.8	D	Flagger/Temporary Traffic Signal	Temporary Traffic Signal	9:00 PM - 5:00 AM
41	Camino Aguajito	Del Monte Avenue	NB 1-L, 1-LR EB 1-T, 1-TR WB 1-L, 2-T	Signal	9.4	A	51.5	D	Flagger	Temporary Traffic Signal	9:00 PM - 5:00 AM

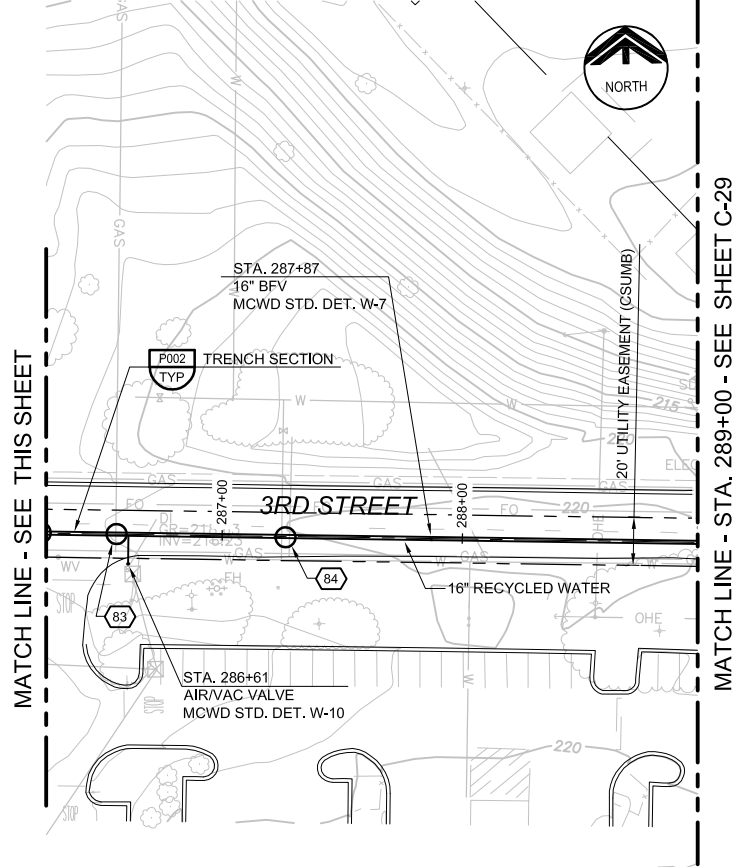
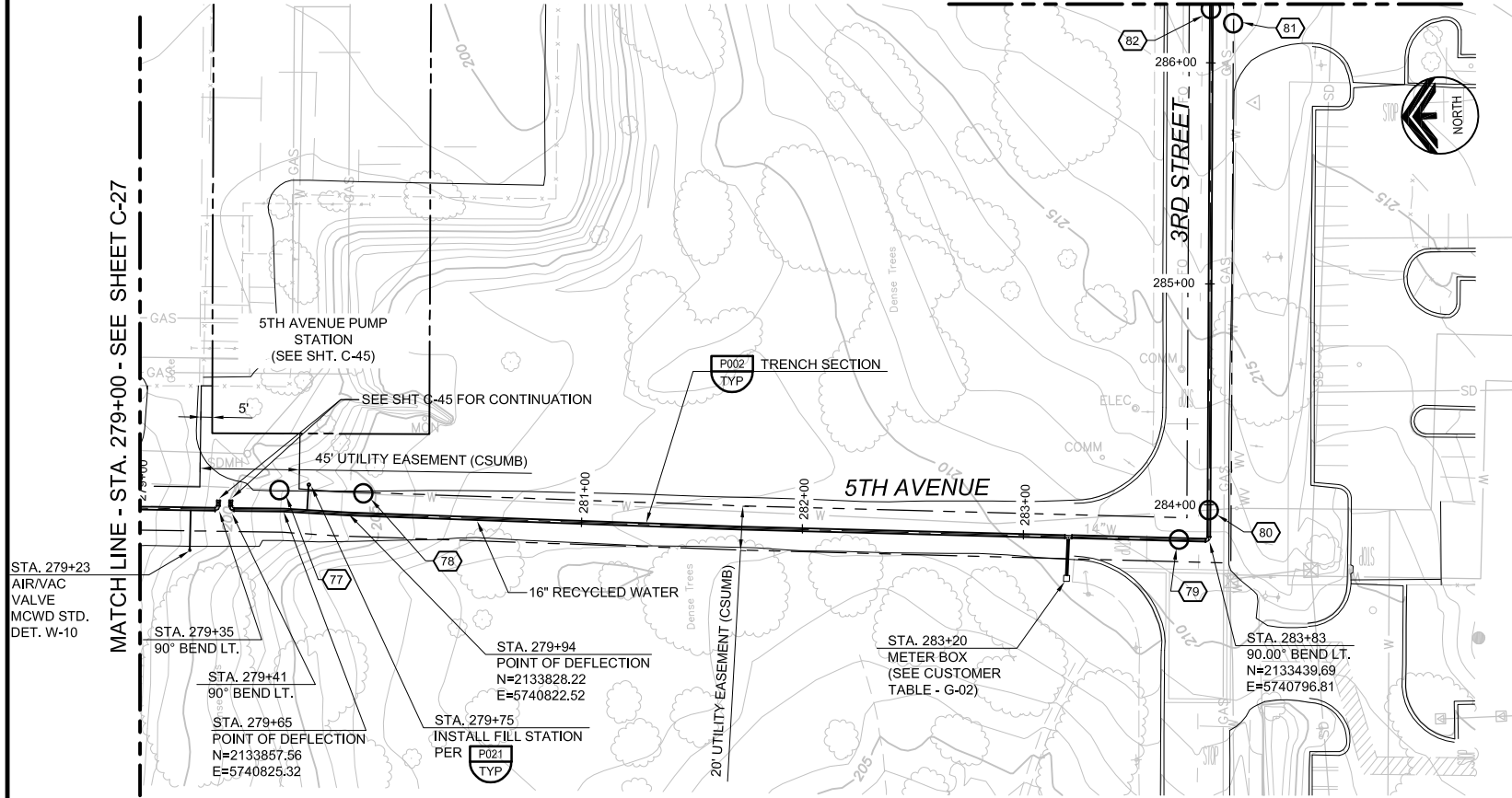
Notes:

1. L, T, R = Left, Through, Right.
2. NB, SB, EB, WB = Northbound, Southbound, Eastbound, Westbound.
3. Level of Service (LOS) and control delay are shown for both overall intersection and worst approach when intersection is controlled by one/two-way stop.
4. Level of Service (LOS) and control delay is for overall average of all approaches when intersection control is by all-way stop or traffic signals.
5. * = Delay exceeds 300 seconds (5 minutes).
6. Where construction thru an intersection will last for more than one days time and turning movements restricted, a detour will be required. Proper channelization will be required to guide traffic during both construction and non-construction hours. In case of damage to existing traffic signal equipment (i.e. conduit, detector loop, traffic signal pole, etc.) during construction, temporary traffic signals should be installed prior to construction.
7. NA = Not Applicable. No existing data available.
8. All intersection LOS referenced from previous traffic study reports by Higgins Associates.

APPENDIX D

AS-BUILT DRAWINGS

MATCH LINE - SEE THIS SHEET

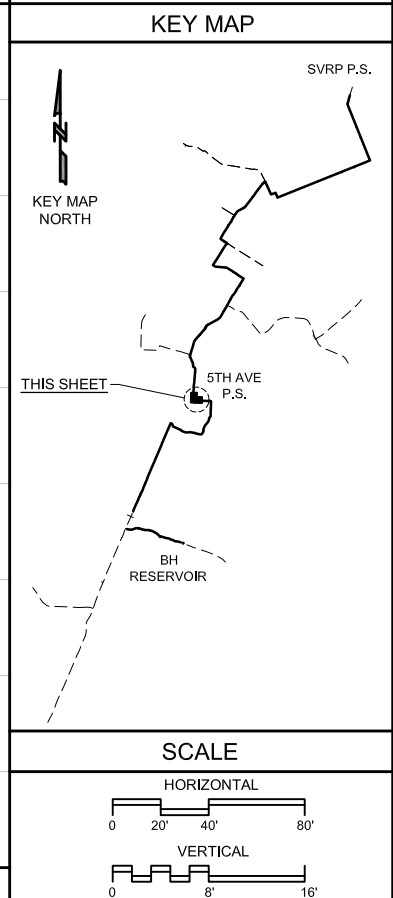
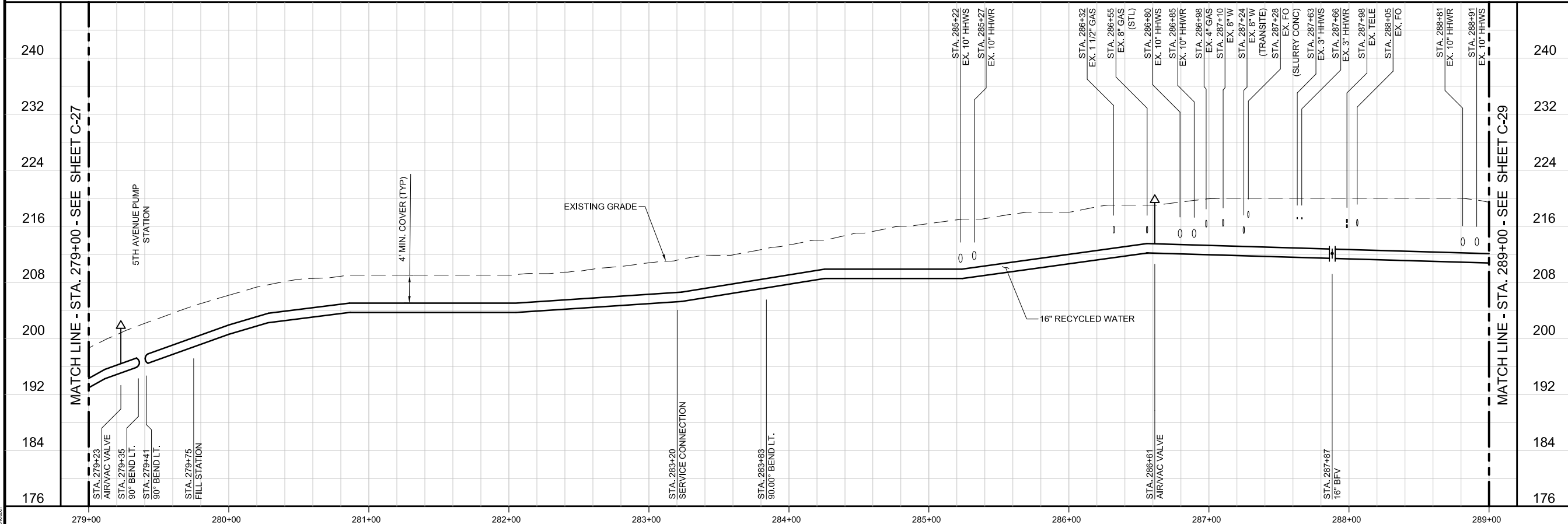


GENERAL NOTES

- CONSTRUCT PIPELINE WITH A MINIMUM 4' OF COVER UNLESS SHOWN OTHERWISE IN THE PROFILE TO AVOID EXISTING UTILITIES OR ACCOMMODATE FUTURE GRADES.

These are
as-built drawings
for the recycled
water pipeline in
CSUMB

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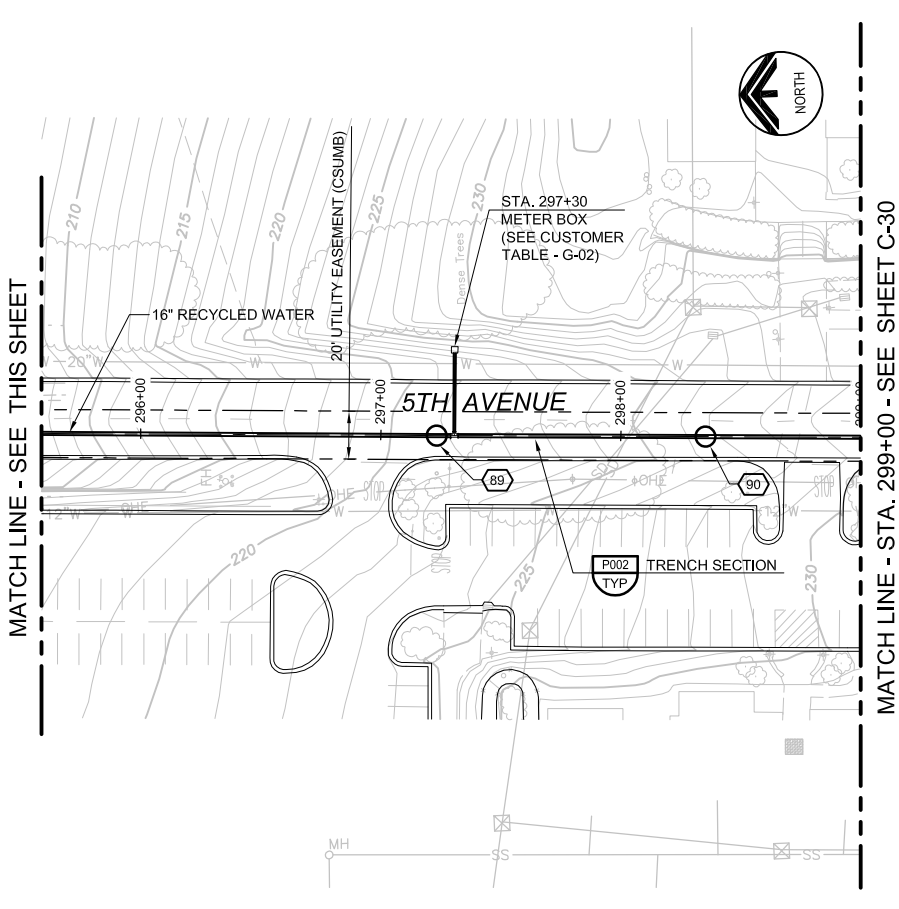
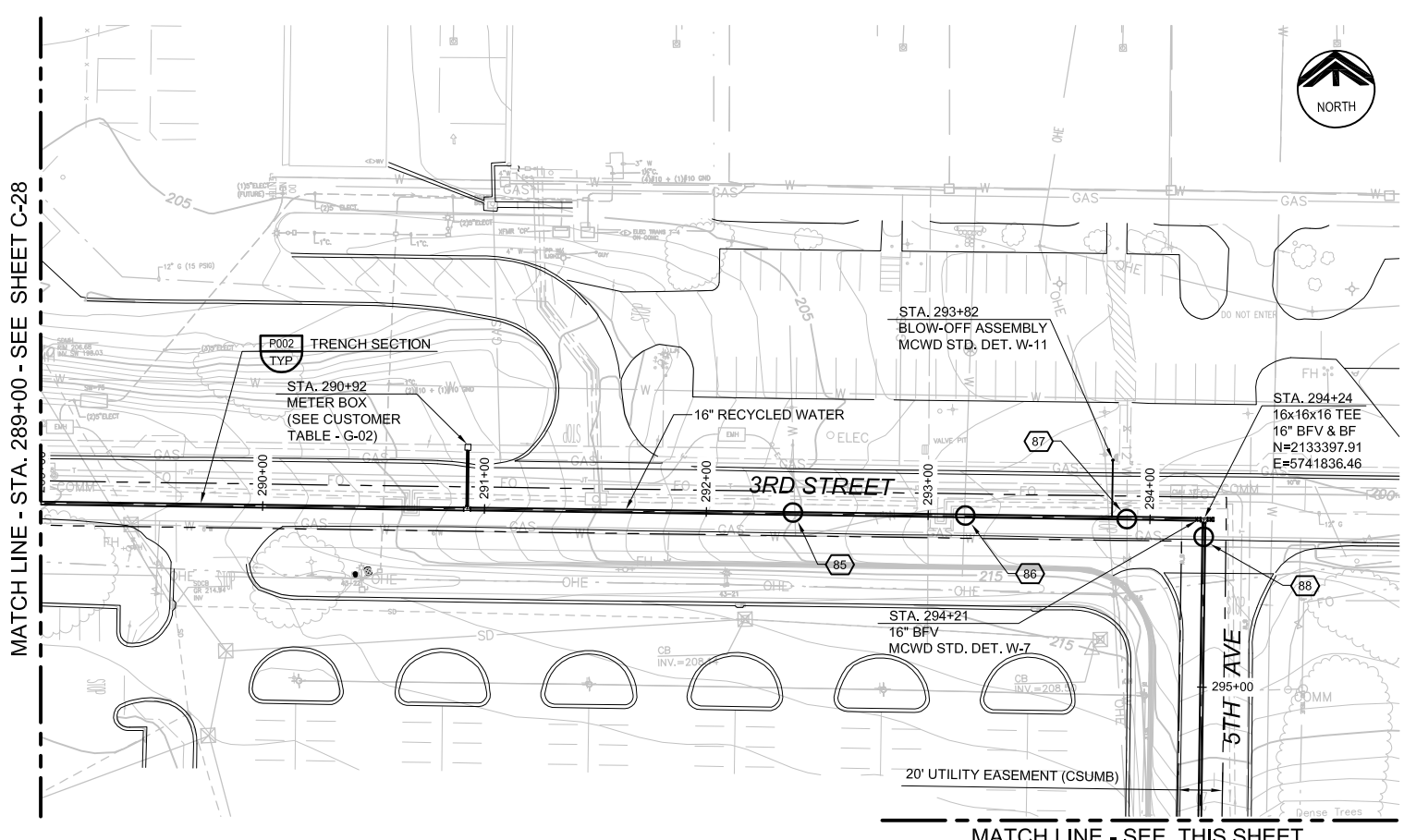
REV	DATE	BY	DESCRIPTION

DESIGNED AP / AS	DISCIPLINE ENGINEER
DRAWN LGD	
CHECKED	
DATE MARCH 5, 2007	PROJECT ENGINEER
	PARTNER

Marina Coast Water District
Carollo Engineers

REGIONAL URBAN WATER AUGMENTATION PROJECT
RECYCLED WATER PIPELINE
CIVIL
PLAN AND PROFILE
STA. 279+00 TO STA. 289+00

VERIFY SCALES BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" 16"	JOB NO. 7568A.10
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	DRAWING NO. C-28
	SHEET NO. 36 OF 87



GENERAL NOTES

- CONSTRUCT PIPELINE WITH A MINIMUM 4' OF COVER UNLESS SHOWN OTHERWISE IN THE PROFILE TO AVOID EXISTING UTILITIES OR ACCOMMODATE FUTURE GRADES.

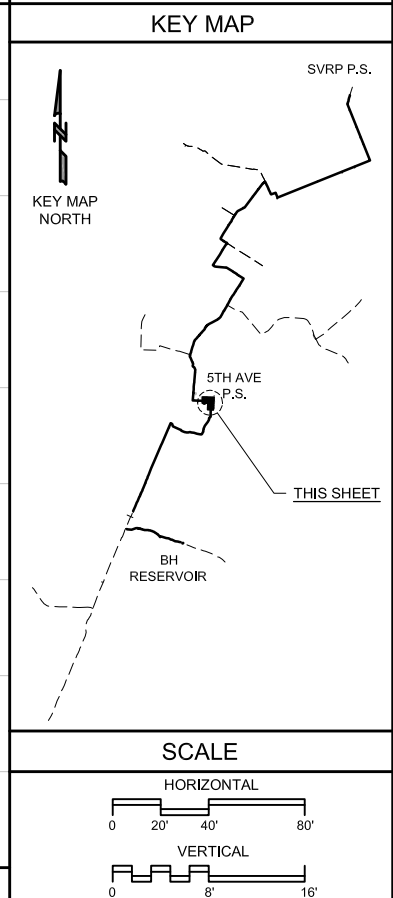
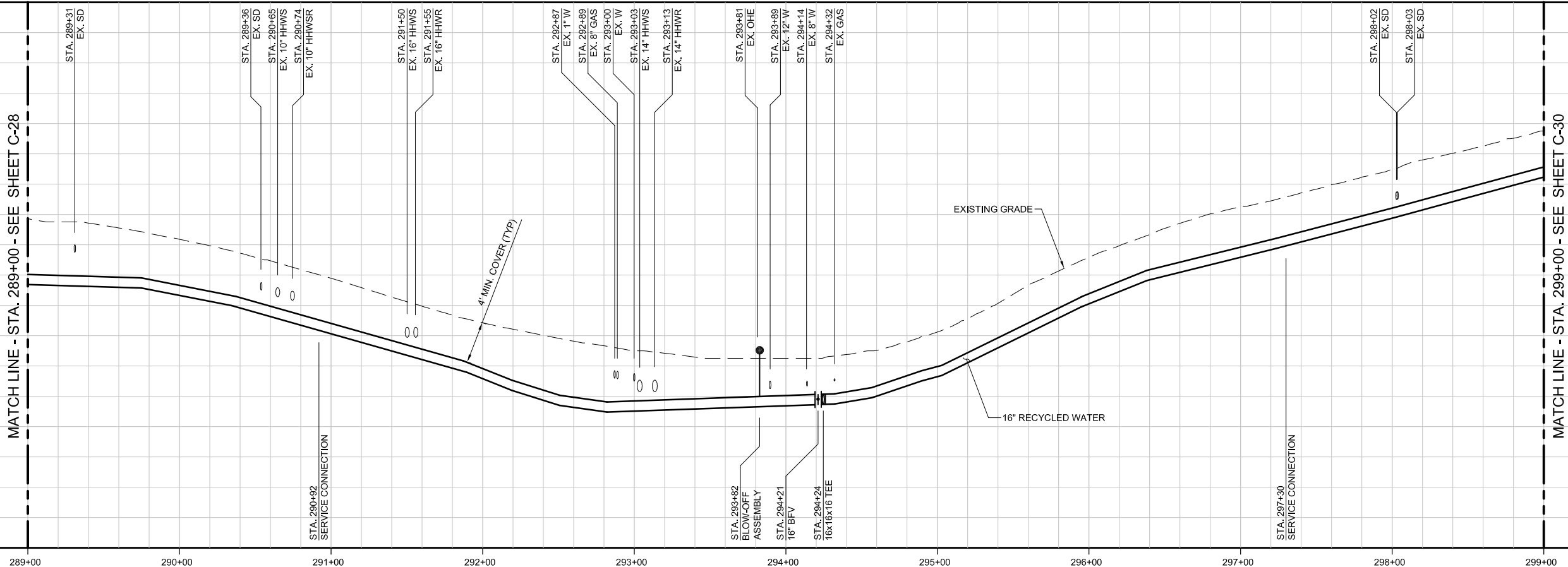
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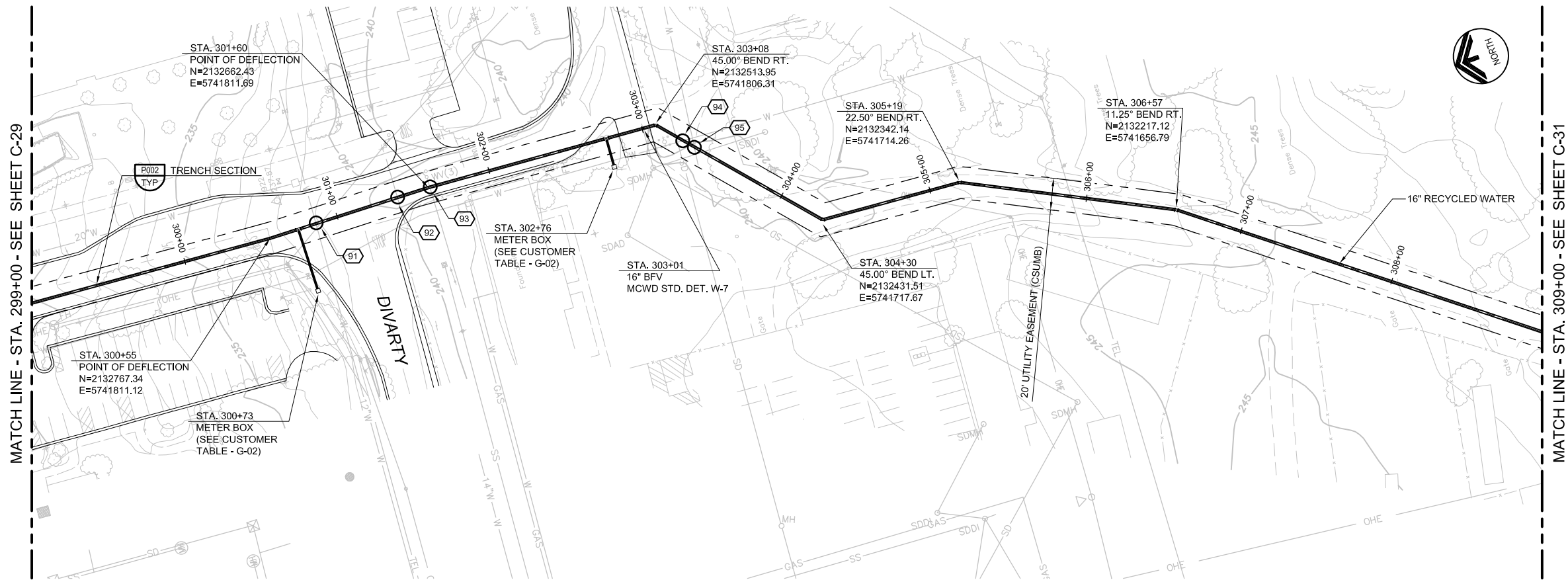
REV	DATE	BY	DESCRIPTION

DESIGNED AP / AS	DISCIPLINE ENGINEER
DRAWN LGD	
CHECKED	
DATE MARCH 5, 2007	PROJECT ENGINEER
	PARTNER

Carollo
ENGINEERS

Marina Coast
Water
District

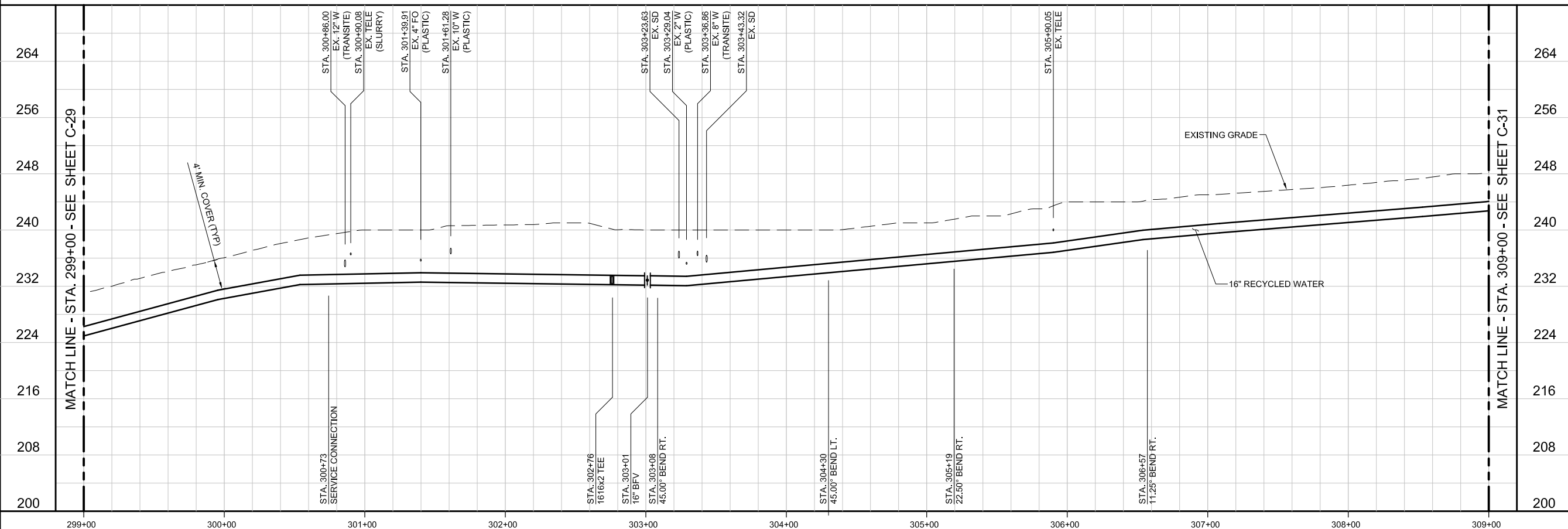
REGIONAL URBAN WATER AUGMENTATION PROJECT RECYCLED WATER PIPELINE CIVIL PLAN AND PROFILE STA. 289+00 TO STA. 299+00	VERIFY SCALES BAR IS ONE INCH ON ORIGINAL DRAWING 0 1" 16' IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	JOB NO. 7568A.10 DRAWING NO. C-29 SHEET NO. 37 OF 87
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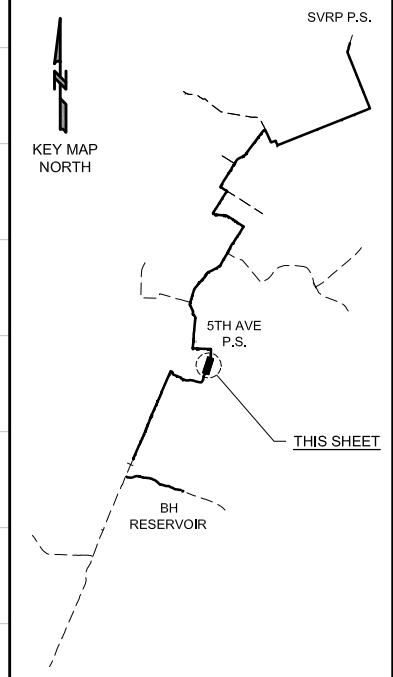
GENERAL NOTES

- CONSTRUCT PIPELINE WITH A MINIMUM 4' OF COVER UNLESS SHOWN OTHERWISE IN THE PROFILE TO AVOID EXISTING UTILITIES OR ACCOMMODATE FUTURE GRADES.

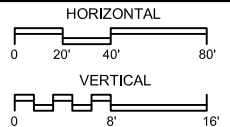
**These are
as-built drawings
for the recycled
water pipeline in
CSUMB**



KEY MAP



SCALE



100% SUBMITTAL

REV	DATE	BY	DESCRIPTION

DESIGNED AP / AS	DISCIPLINE ENGINEER
DRAWN LGD	
CHECKED	
DATE MARCH 5, 2007	PROJECT ENGINEER
	PARTNER

Marina Coast Water District

REGIONAL URBAN WATER AUGMENTATION PROJECT

RECYCLED WATER PIPELINE

CIVIL
PLAN AND PROFILE
STA. 299+00 TO STA. 309+00

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

JOB NO.
7568A.10

DRAWING NO.
C-30

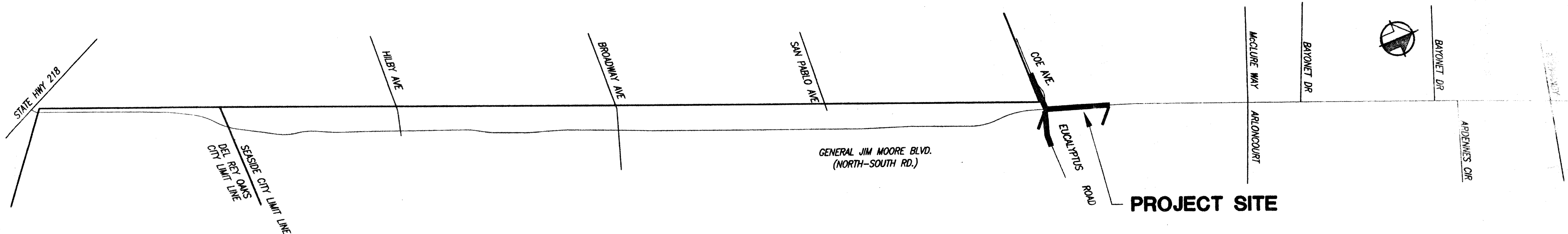
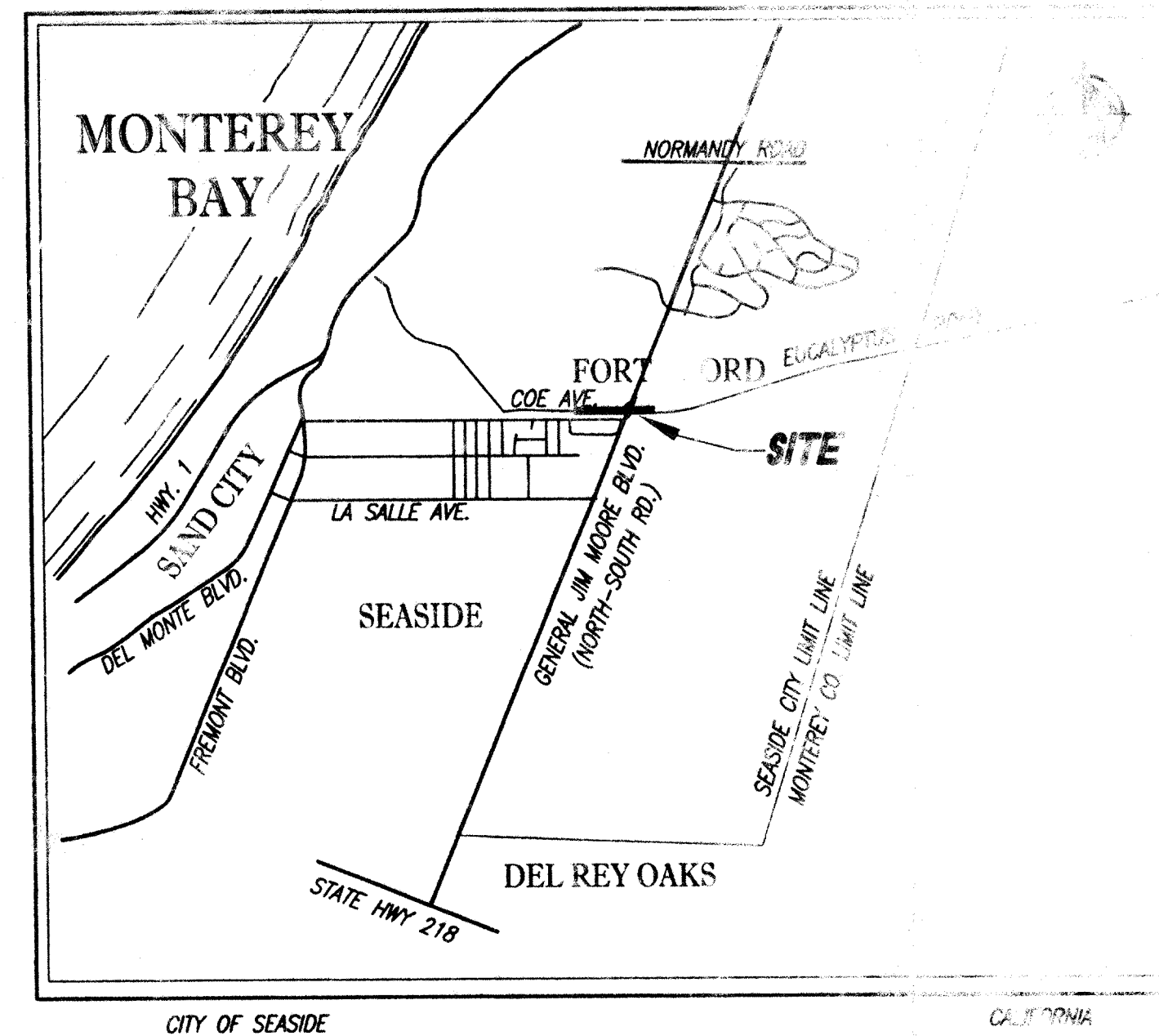
SHEET NO.
38 OF 87

ABBREVIATIONS

AB	ARCHIBALD BASE	INV, IE	INVERT ELEVATION
AC	ASPHALT CONCRETE	IRR	IRRIGATION
APPROX	APPROXIMATELY	JT	JOINT
ARCH	ARCHITECTURAL	LAT	LATERAL
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS	LF	LINEAL FEET
BC	BEGIN CURVE	MAX	MAXIMUM
BLDG	BUILDING	MECH	MECHANICAL
BOW	BACK OF SIDEWALK	MJ	MECHANICAL JOINT
CB	CATCH BASIN	MH	MANHOLE
CIP	CAST IRON PIPE	MIN	MINIMUM
CL	CLASS	N	NORTH
Q	CENTERLINE	NIC	NOT INCLUDED IN CONTRACT
CLR	CLEAR	NO., #	NUMBER
CMP	CORRUGATED METAL PIPE	NTS	NOT TO SCALE
CO	CLEAN OUT	OC	ON CENTER
CONC	CONCRETE	OD	OUTSIDE DIAMETER
COR	CORNER	OG	ORIGINAL GROUND
CP	CONCRETE PIPE	PBMH	PAC BELL MANHOLE
CR	CURB RETURN	PCC	PORTLAND CONCRETE CEMENT
C & G	CURB AND GUTTER	PIV	POST INDICATOR VALVE
DEPT	DEPARTMENT	POC	POINT OF CONNECTION
DI, Ø	DIAMETER	PVC	POLY VINYL CHLORIDE
DIP	DUCTILE IRON PIPE	PVMT	PAVEMENT
DW	DOMESTIC WATER	R	RADIUS
DWG	DRAWING	RCP	REINFORCED CONCRETE PIPE
D/W, DWY	DRIVEWAY	REINF	REINFORCED
E	EAST	RPV	REDUCED PRESSURE VALVE
EC	END CURVE	R/W	RIGHT OF WAY
ELEV	ELEVATION	RWD	REDWOOD
EP	EDGE OF PAVEMENT	SSFM	SANITARY SEWER FORCE MAIN
EW	EACH WAY	S	SOUTH
EX, EXIST	EXISTING	S =	SLOPE EQUALS
FG, FOC	FACE OF CURB	SD	STORM DRAIN
FD	FOUND	SPECS	SPECIFICATIONS
FDC	FIRE DEPARTMENT CONNECTION	SQ	SQUARE
FF	FINISH FLOOR	SS	SANITARY SEWER
FG	FINISH GROUND	STD	STANDARD
FH, HYD	FIRE HYDRANT	SW	SIDEWALK
FL	FLOW LINE	T, TELE	TELEPHONE, COMMUNICATION
FW	FIRE WATER	TC	TOP OF CURB
G	GAS	TEMP	TEMPORARY
GALV	GALVANIZED	THK	THICK
GB	GRADE BREAK	TYP	TYPICAL
GR	GRATE	UNO	UNLESS NOTED OTHERWISE
GRD	GRADE	UTIL	UTILITY
HB	HOSE BIB	W	WEST
HG, H/C	HANDICAPPED	W/	WITH
HI PT, HP	HIGH POINT	WV	WATER VALVE
HGT, HT	HEIGHT		
HWY	HIGHWAY		
ICV	IRRIGATION CONTROL VALVE		
ID	INSIDE DIAMETER		

GENERAL JIM MOORE BLVD FORT ORD REUSE AUTHORITY

CITY OF SEASIDE, CALIFORNIA
JUNE 2006
PHASE III



KEY MAP
SCALE: 1" = 800'

LEGEND

EXISTING	PROPOSED
SANITARY SEWER FORCE MAIN	24" SD
STORM DRAIN and MANHOLE	8" SS
CATCH BASIN	8" W
CLEAN OUT	
WATER LINE	
DOMESTIC WATER	
FIRE WATER	
REDUCED PRESSURE BACKFLOW DEVICE	
CHECK VALVE	
VALVE	
FIRE HYDRANT	
BLOW OFF	
POST INDICATOR VALVE	
FIRE DEPARTMENT CONNECTION	
WATER METER	
HOSE BIB	
IRRIGATION PIPE	
IRRIGATION CONTROL VALVE	
GAS LINE	
GAS VALVE	
GAS METER	
ELECTRIC LINE	
POWER POLE	
UTILITY VAULT	
TELEPHONE LINE	
ELECTROPLIER	
HANDICAP RAMP	
DRIVEWAY	
CURB, GUTTER and SIDEWALK	
AIR RELEASE VALVE (ARV)	
LIMIT OF GRADING (CUT OR FILL)	

SHEET INDEX

C-01	COVER SHEET	E1.0	ELECTRICAL KEY MAP, SYMBOLS & ABBREVIATIONS
C-02	GENERAL NOTES & TYPICAL SECTIONS	E2.0	ELECTRICAL SITE PLAN
C-03	INFILTRATOR DESIGN	E3.0	ELECTRICAL SINGLE LINE DIAGRAM & DETAILS
C-04 TO C-06	PLAN & PROFILE - GENERAL JIM MOORE BLVD.	E3.1	ELECTRICAL DETAILS
C-07	PLAN & PROFILE - COE AVENUE	L-1	LANDSCAPE NOTES AND LEGENDS
C-08	PLAN & PROFILE - COE AVENUE BY-PASS	L-2 TO L-4	LANDSCAPE & IRRIGATION PLAN
C-09	PLAN & PROFILE - EUCALYPTUS ROAD	L-5	IRRIGATION DETAILS
C-10 TO C-13	CROSS SECTION - STA:115+00 TO STA:139+50	L-6	LANDSCAPE/IRRIGATION DETAILS
C-14	CROSS SECTION - COE AVENUE	T-1	TRAFFIC SIGNAL CONDUIT AT COE AVENUE
C-15	CROSS SECTIONS - EUCALYPTUS ROAD		
C-16 TO C-17	DETAILS - MCWD		
C-18 TO C-19	SIGNING, STRIPING & HORIZONTAL CONTROL		

These are as-built drawings for the recycled water pipeline in General Jim Moore Blvd. Although the drawings state 24" HDPE pipeline, a change order was issued for installation of a 20" Ductile Iron pipeline, Class 52.

RECEIVED
JUL 10 2006
BY: #2042

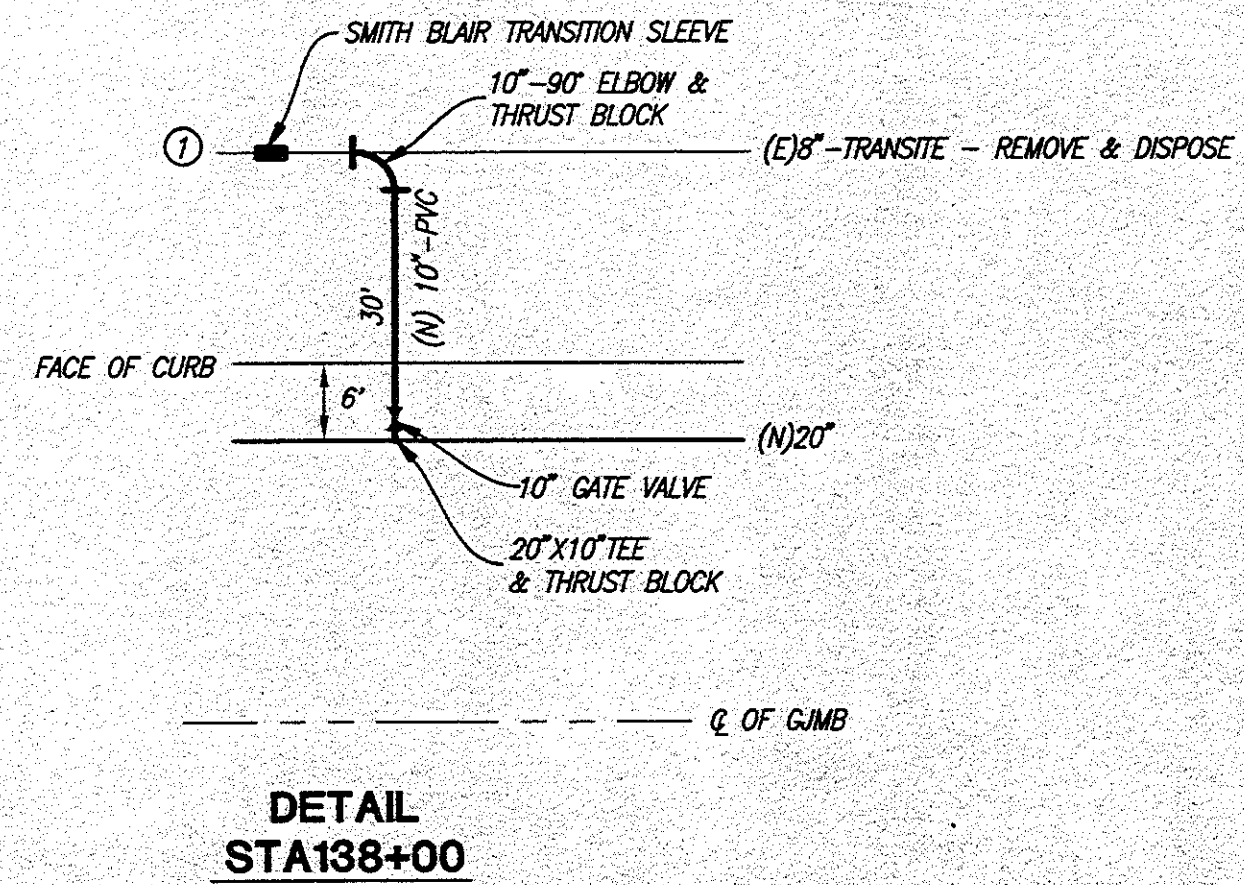
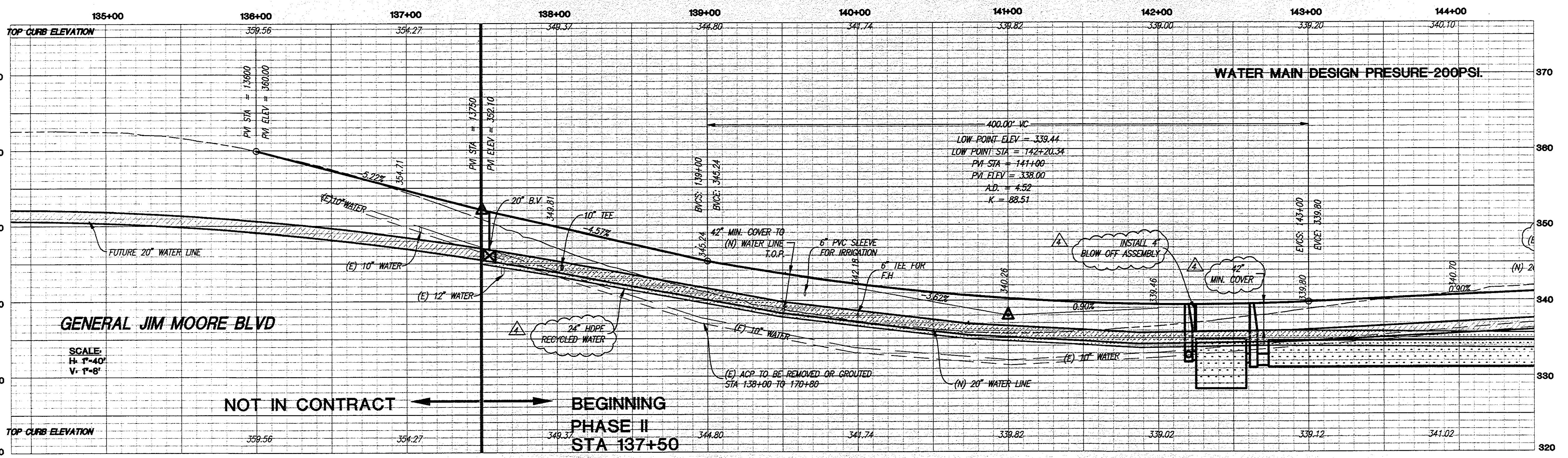
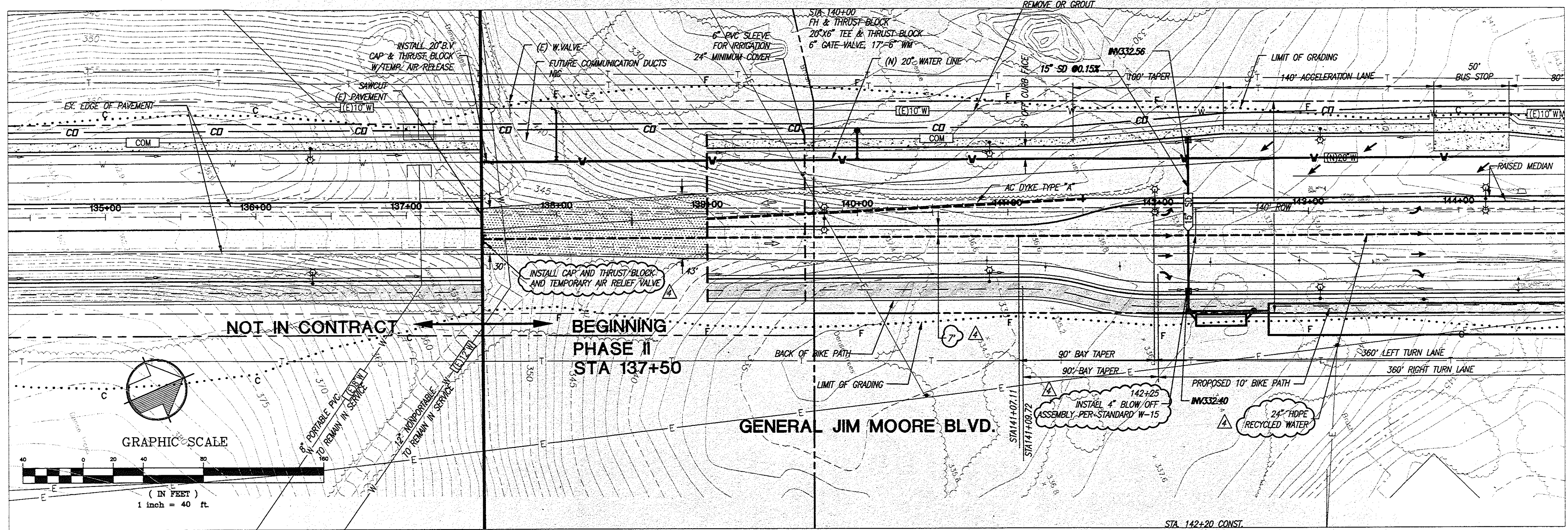
BENCHMARK

A MAGNETIC NAIL AND BRASS WASHER STAMPED "BESTOR ENGINEERS" SET IN THE EASTERN PAVED SHOULDER OF GENERAL JIM MOORE BLVD, APPROXIMATELY 280' SOUTHERLY OF THE CENTERLINE OF EUCALYPTUS ROAD, HAVING AN ESTABLISHED NGVD 29 ELEVATION OF 322.31 FEET.

45MPH

<p>CITY OF SEASIDE</p> <p>APPROVED: <i>Diana Ingersoll</i> DATE: 06/30/06 DIANA INGERSOLL, PE DIRECTOR OF PUBLIC WORKS</p>	<p>MARINA COAST WATER DISTRICT</p> <p>APPROVED FOR CONSTRUCTION: <i>Andrew A. Sterbenz</i> DATE: _____ ANDREW A. STERBENZ, PE DISTRICT ENGINEER</p>	<p>FORT ORD REUSE AUTHORITY</p> <p>APPROVED: <i>James A. Feeney</i> JAMES A. FEENEY, PE ASSISTANT EXECUTIVE OFFICER</p>
---	--	--

DRAWING: S:\LAND PROJECTS\703019-JIM MOORE BLVD\DWG\PLAN-C-04-GM-PP15.DWG
 SHEETS: 703019-MASTER.P2 DESIGN.P2 12/14/05 P. BONY 703019-01.DWG 703019-1000-CM
 DATE: 07/27/06 12:03:12 PM



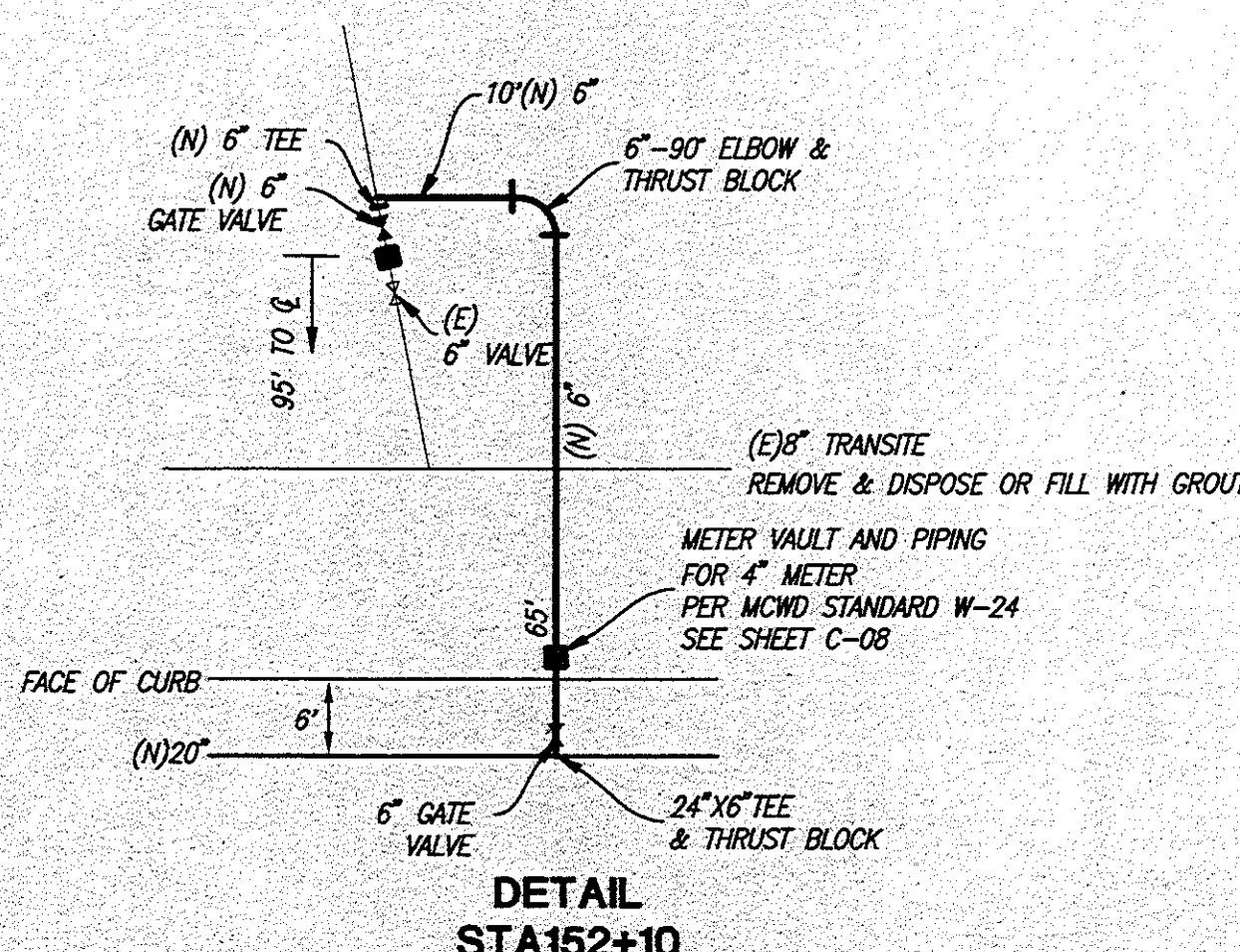
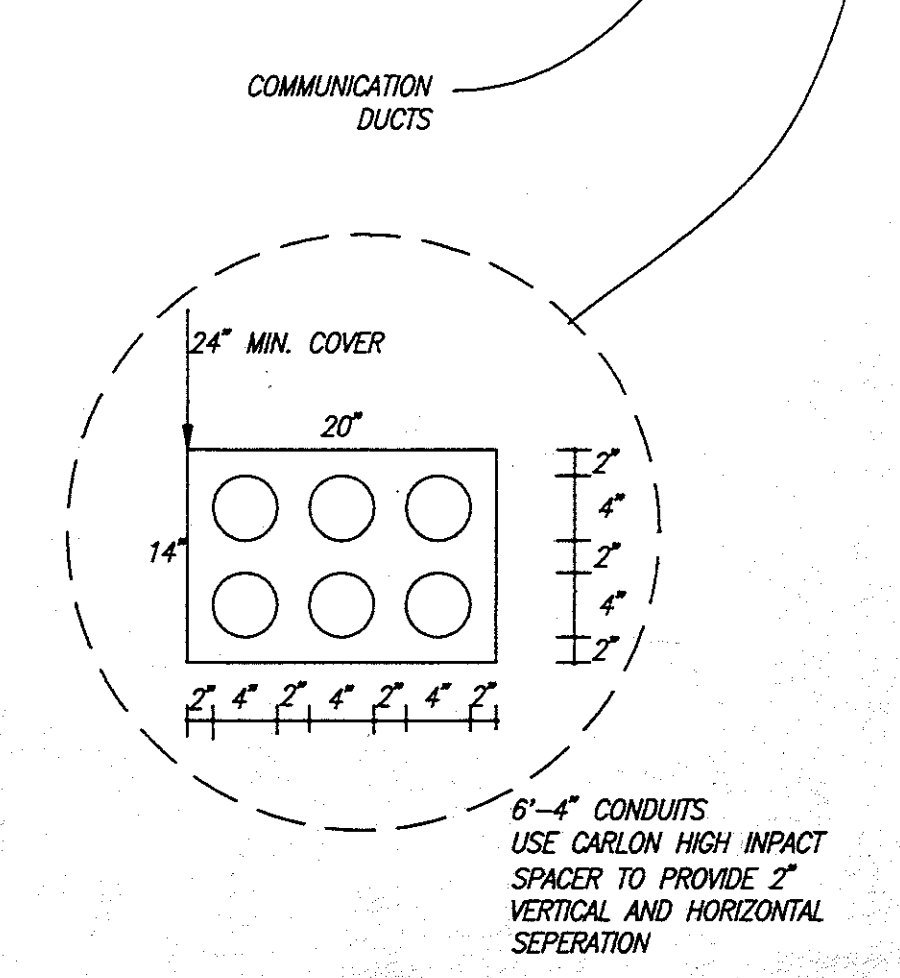
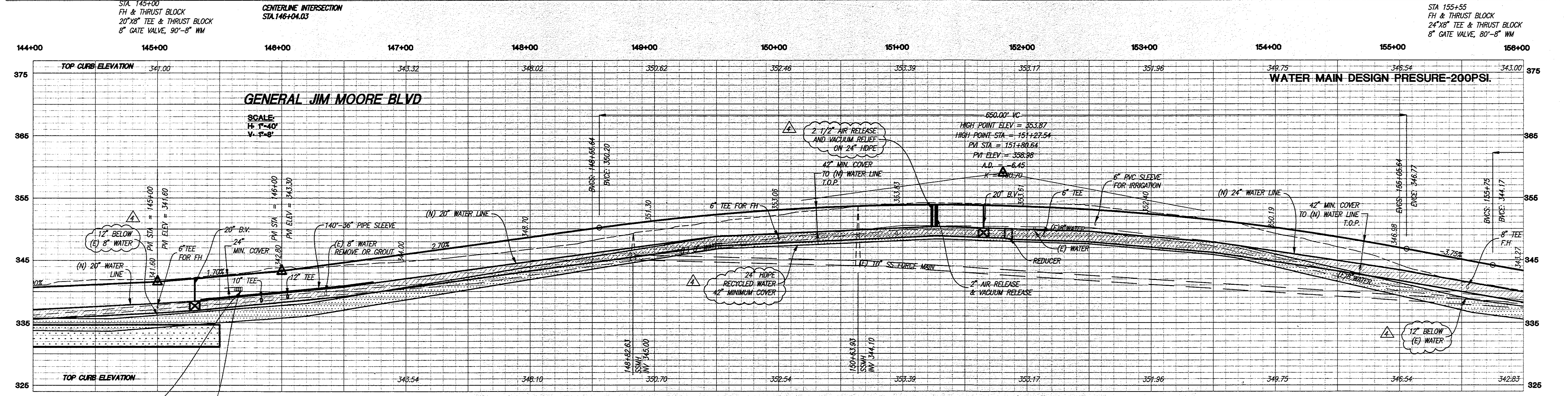
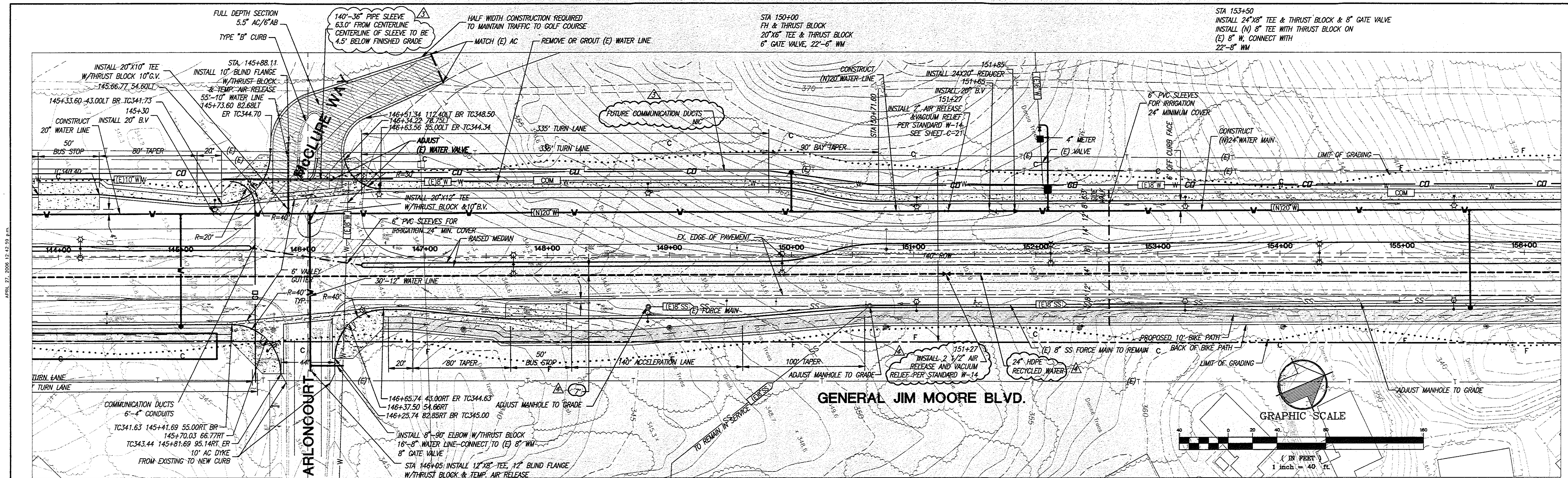
These are as-built drawings for the recycled water pipeline in General Jim Moore Blvd. Although the drawings state 24" HDPE pipeline, a change order was issued for installation of a 20" Ductile Iron pipeline, Class 52.

DESIGNED BY: C-H DRAWN BY: SK CHECKED BY: SK/MPB DATE: APRIL 2006 SCALE: AS NOTED	DESIGNED BY: C-H DRAWN BY: SK CHECKED BY: SK/MPB DATE: APRIL 2006 SCALE: AS NOTED	REVISIONS: 1. 12/14/05 2. 12/14/05 3. 12/14/05	REVISIONS: 1. 12/14/05 2. 12/14/05 3. 12/14/05	REVISIONS: 1. 12/14/05 2. 12/14/05 3. 12/14/05	REVISIONS: 1. 12/14/05 2. 12/14/05 3. 12/14/05
Consulting Civil and Structural Engineers 225 CANNERY ROW, SUITE H MONTEREY, CALIFORNIA 93940 TEL: (831)373-1333 FAX: (831)373-0733 FAIRFIELD • MONTEREY • PLEASANTON • SAN FRANCISCO • SAN JOSE, CALIFORNIA					
FORT ORD REUSE AUTHORITY GENERAL JIM MOORE BLVD. PLAN AND PROFILE STA. 137+50 TO 144+00 Monterey California					
SHEET NUMBER C-04 OF 38 SHEETS DRAWING NO. 703019					

45MPH

ADDENDUM NO. 2
 JULY 11, 2005

G.M.B.: Ph II Water Line Addenda



These are as-built drawings for the recycled water pipeline in General Jim Moore Blvd. Although the drawings state 24" HDPE pipeline, a change order was issued for installation of a 20" Ductile Iron pipeline, Class 52.

DESIGNED BY: C-HD	DATE: 04/11/06	DESCRIPTION: 24" RECYCLED WATER LINE ADDED
DRAWN BY: SW	DATE: 07/05/06	DESCRIPTION: ADD SLEEVES FOR RECYCLED WATER
CHECKED BY: SK/MPB	DATE: 07/05/06	DESCRIPTION: WATER LINE ADDED WITH ADDITIONAL CONNECTION
DATE: APRIL 2006	SCALE: 1"=40'	DESCRIPTION: 10' BIKE PATH
AS NOTED	REV. DATE	DESCRIPTION

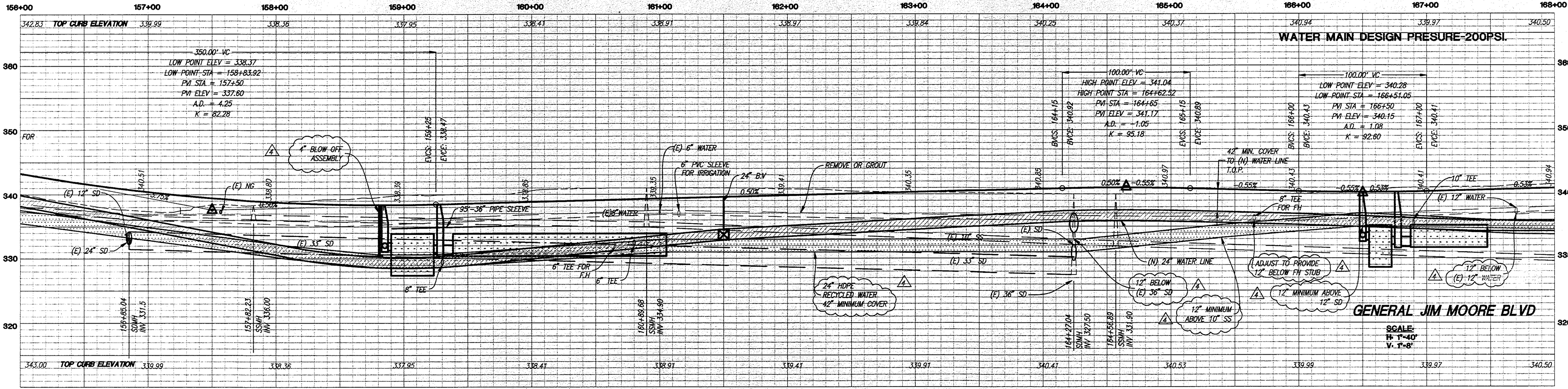
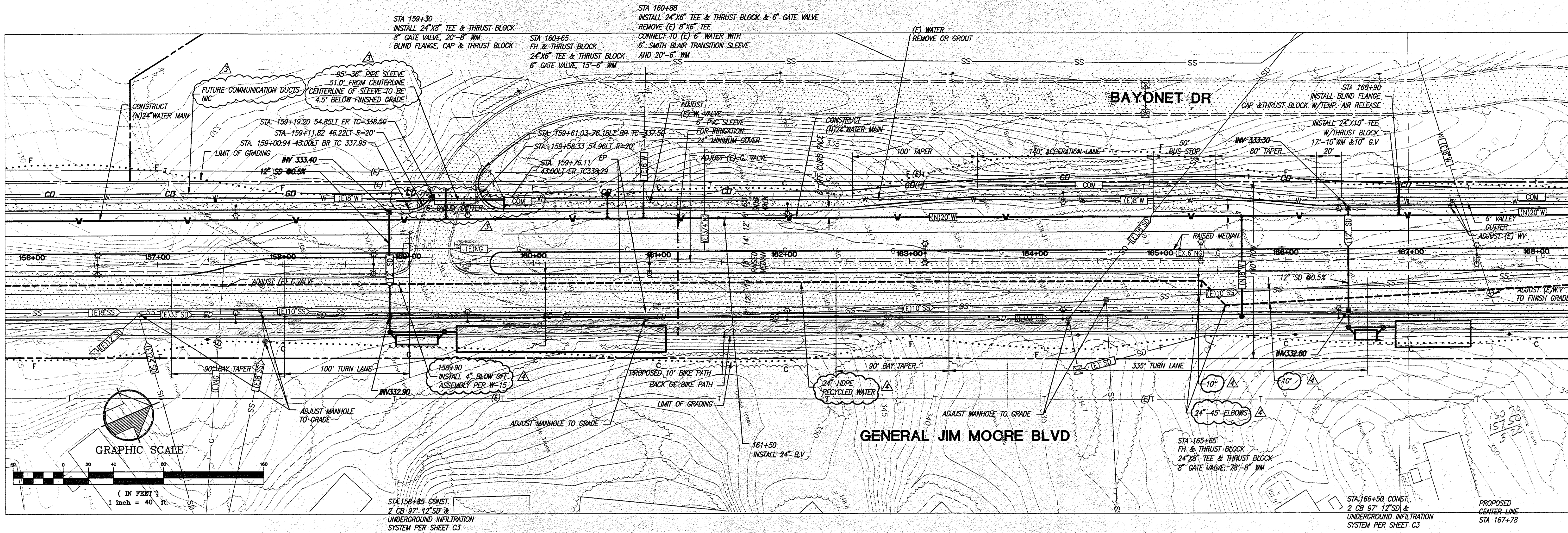
CONSULTING ENGINEER & ARCHITECT
 CONSULTING CIVIL AND STRUCTURAL ENGINEERS
 225 CANNERY ROW, SUITE H
 MONTEREY, CALIFORNIA 93940
 TEL: (831) 923-1333 FAX: (831) 373-0733
 FAIRFIELD • MONTEREY • PLEASANTON • SAN FRANCISCO • SAN JOSE, CALIFORNIA

FORT ORD REUSE AUTHORITY
 GENERAL JIM MOORE BLVD.
 PLAN AND PROFILE
 STA. 144+00 TO 156+00
 Monterey, California

SHEET NUMBER C-05
 OF 38 SHEETS
 DRAWING NO. 703019

ADDENDUM NO. 2
 JULY 11, 2005

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DATE: 04/27/05 12:56:35 PM
REVIS: ELS01-P1 12/4/05 P-BRW 703019-MASTER-P1 703019-MAIN 703019-1000-GA



These are as-built drawings for the recycled water pipeline in General Jim Moore Blvd. Although the drawings state 24" HDPE pipeline, a change order was issued for installation of a 20" Ductile Iron pipeline, Class 52.

DESIGNED BY: CHD	DATE: 04/14/05	DESCRIPTION: 24" RECYCLED WATER LINE ADDED
DRAWN BY: SW	DATE: 04/14/05	DESCRIPTION: 24" RECYCLED WATER LINE ADDED
CHECKED BY: SK/MPB	DATE: 04/14/05	DESCRIPTION: 24" RECYCLED WATER LINE ADDED
DATE: APRIL 2005	DATE: 04/14/05	DESCRIPTION: 24" RECYCLED WATER LINE ADDED
AS NOTED	DATE: 04/14/05	DESCRIPTION: 24" RECYCLED WATER LINE ADDED

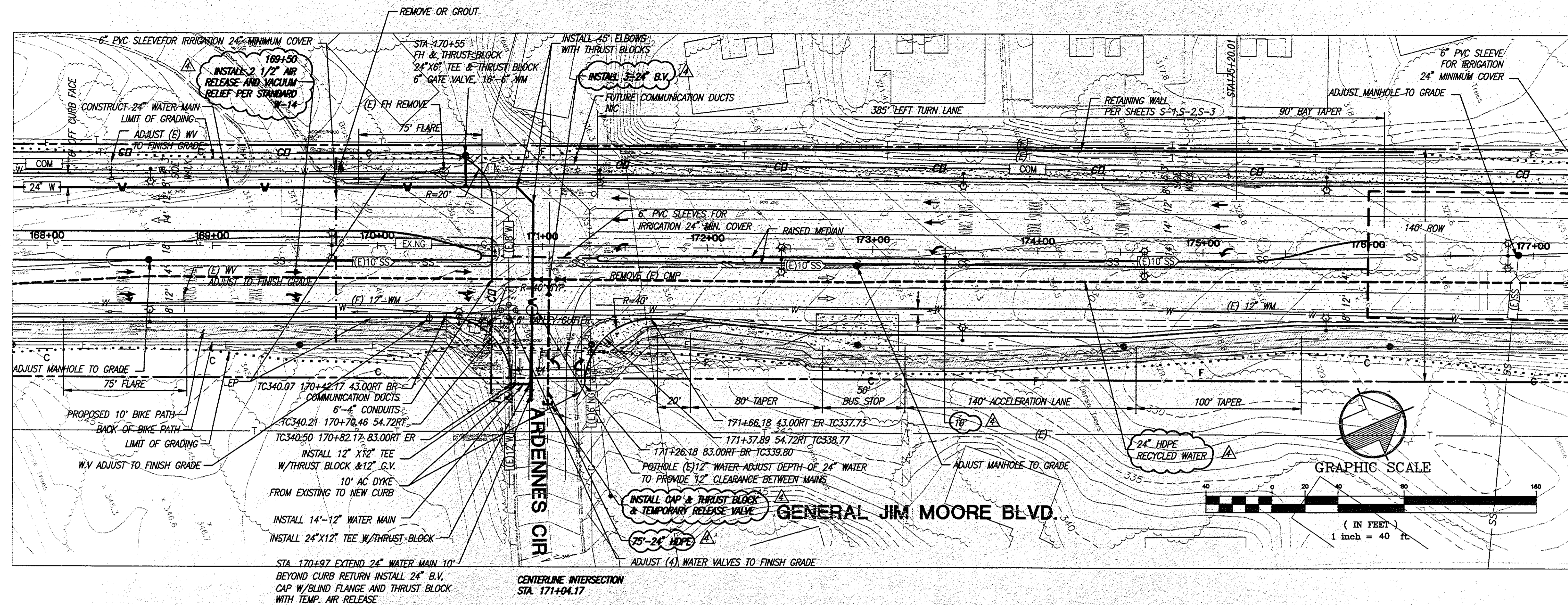
NO. C 45372	EXP. 9-9-06
FAIRFIELD	MONTEREY
PLACENTIA	PLACENTIA
SAN FRANCISCO	SAN FRANCISCO
SAN JOSE, CALIFORNIA	SAN JOSE, CALIFORNIA

Consulting Civil and Structural Engineers
225 CANNERY ROW, SUITE 110
MONTEREY, CALIFORNIA 93940
TEL: (831) 375-1333 FAX: (831) 375-0733

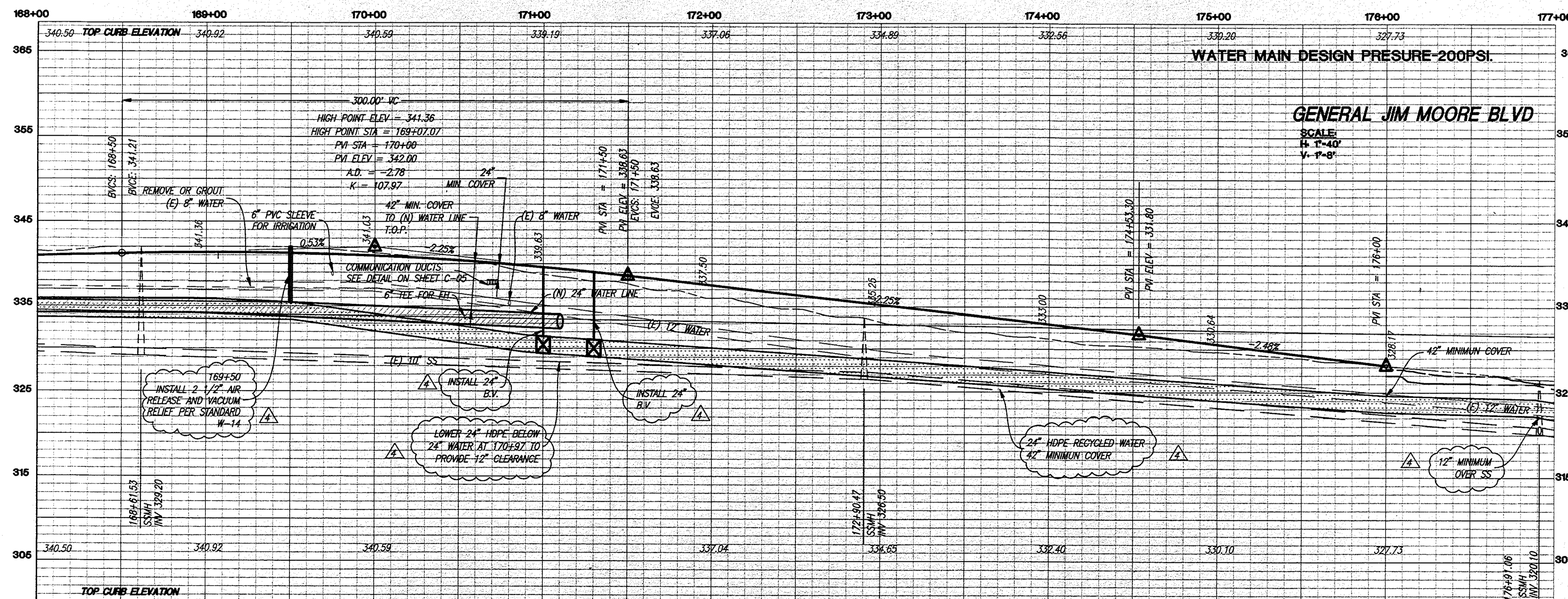
FORT ORDE REUSE AUTHORITY
GENERAL JIM MOORE BLVD.
PLAN AND PROFILE
STA. 156+00 TO 168+00
Monterey California

SHEET NUMBER C-06 OF 38 SHEETS DRAWING NO. 703019

These are as-built drawings for the recycled water pipeline in General Jim Moore Blvd. Although the drawings state 24" HDPE pipeline, a change order was issued for installation of a 20" Ductile Iron pipeline, Class 52.



176+75
170+50
6
24



REV.	DATE	DESCRIPTION
1	07/05/06	24" RECYCLED WATER LINE ADDED
2	07/05/06	WATER LINE ADDED WITH ADDITIONAL CONNECTION
3	07/10/06	RIGHT-OF-WAY REVISION
4	07/10/06	AS NOTED

BY	DATE	DESCRIPTION
MPB		
MPB		
MPB		
MPB		
MPB		

DESIGNED BY: CHD	DROWN BY: SW	CHECKED BY: SK/MPB	DATE: APRIL 2006
SCALE: 1" = 40'			
PROJECT: 0313133-1333 FAX: (651)373-0733			
ENGINEER: J. W. BROWN, INC. No. C 48972 EXP. 8-8-08			
CONSULTING CIVIL ENGINEER & ARCHITECT			

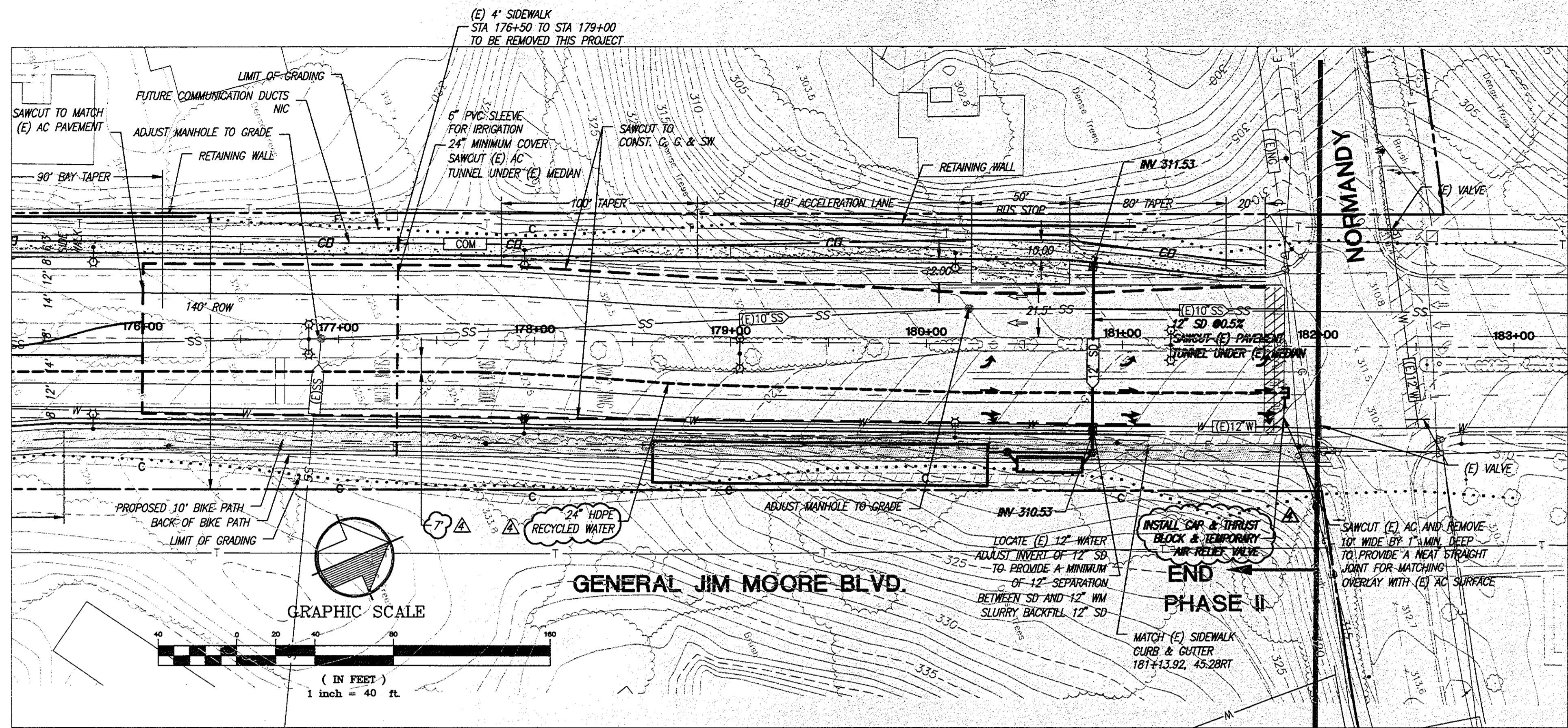
FORT ORD REUSE AUTHORITY	California
GENERAL JIM MOORE BLVD.	Monterey
PLAN AND PROFILE	
STA. 168+00 TO 177+00	

SHEET NUMBER	C-07
OF 38 SHEETS	
DRAWING NO.	703019

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45MPH

ADDENDUM NO. 2
JULY 11, 2005

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 XREFS: 703019-MASTER-P2 RESSON-P2 1424436 P-BBRY 703019-AUTL 703019-K10PC-G.M
 APRIL 27, 2006 2:55:39 P.M.



MATERIALS		
ITEM	QUANTITY	DESCRIPTION
1	EACH	SIZE X 4" TAPPING SLEEVE (USE PUSH-ON X FLG. TEE IF HOT TAP IS NOT REQUIRED).
1	EACH	4" PUSH-ON X FLG. TAPPING VALVE (USE RW OR GATE VALVE IF HOT TAP IS NOT REQUIRED).
AS REQ'D		4" PVC PIPE OR D.I. PIPE LATERAL, PUSH-ON JOINTS
1	EACH	4" D.I. 90° ELL, PUSH-ON X FLG.
2	EACH	F.S. X FLG. D.I. SPOOL - METER SIZE X 2'-6"
1	EACH	4" D.I. 90° ELL FLG. X FLG.
1	EACH	4" X 3" D.I. REDUCER FLG. X FLG. (FOR 3" SERVICE ONLY)
2	EACH	RW OR GATE VALVE FLG. X FLG.
2	EACH	F.S. X GROOVED END D.I. SPOOL, 6" LENGTH
1	EACH	GROOVED-END COUPLING
1	EACH	STRAINER
1	EACH	TURBINE METER
1	EACH	METER SIZE X 6" D.I. TEE - FLANGED
1	EACH	METER-SIZE D.I. COMPANION FLANGE FOR 2 1/2" I.P.
1	EACH	2" CORPORATION STOP - MIP X MIP
1	EACH	D.I. BLIND FLANGE
2	EACH	METER SIZE FLANGED D.I. TEE
4	EACH	ADAPTER - 2" M.I.P. BY S.J.
AS REQ'D		2" COPPER TUBING
2	EACH	2" 90° ELBOW - S.J. X S.J.
1	EACH	2" BALL VALVE WITH LOCKING WING - F.I.P. X F.I.P.
1	EACH	4" D.I. SPOOL - FLG. X FLG. (IF REQUIRED)
1	EACH	ADJUSTABLE GALV. PIPE SUPPORT, SEE MWD STD. PLAN W-22
2	EACH	PRECAST CONCRETE VAULT (5'-0" WIDE X 8'-6" LONG X 5'-0" HIGH) WITH SPRING ASSIST HINGED DIAMOND PLATE ALUMINUM COVER AND RECESSED LOCKING HASP. PROVIDE 6" X 12" HINGED READING LID INSTALLED OVER METER REGISTER.
4	EACH	BOLT AND FLANGE INSULATING KIT
1	EACH	GALV. STEEL LADDER (ALHAMBRA FOUNDRY A3400) W/LADDER - UP AND S.S. ANCHOR BOLTS.
2	EACH	METER SIZE BRONZE COMPANION FLANGE WITH 2" THREADED I.P. CUTLET

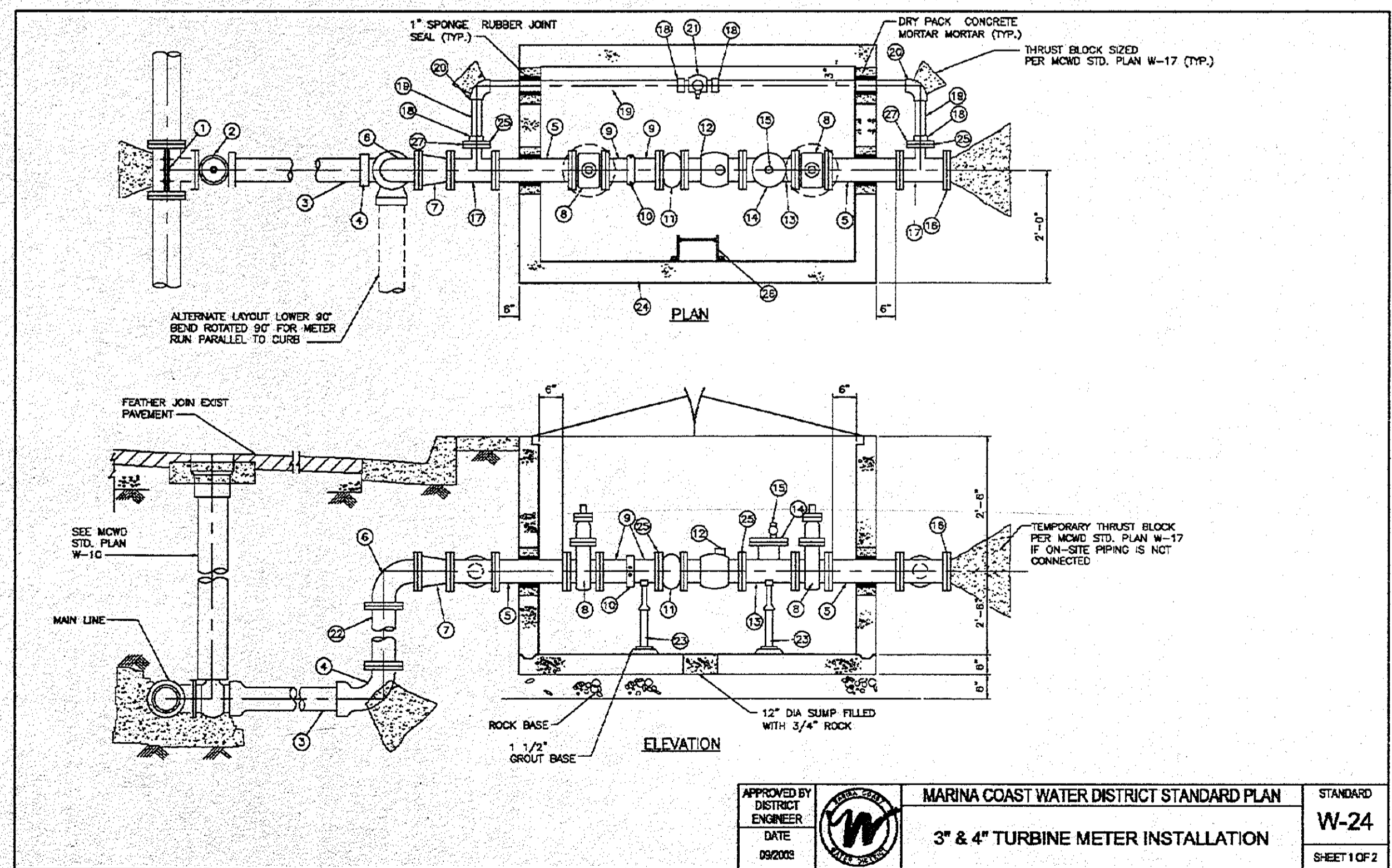
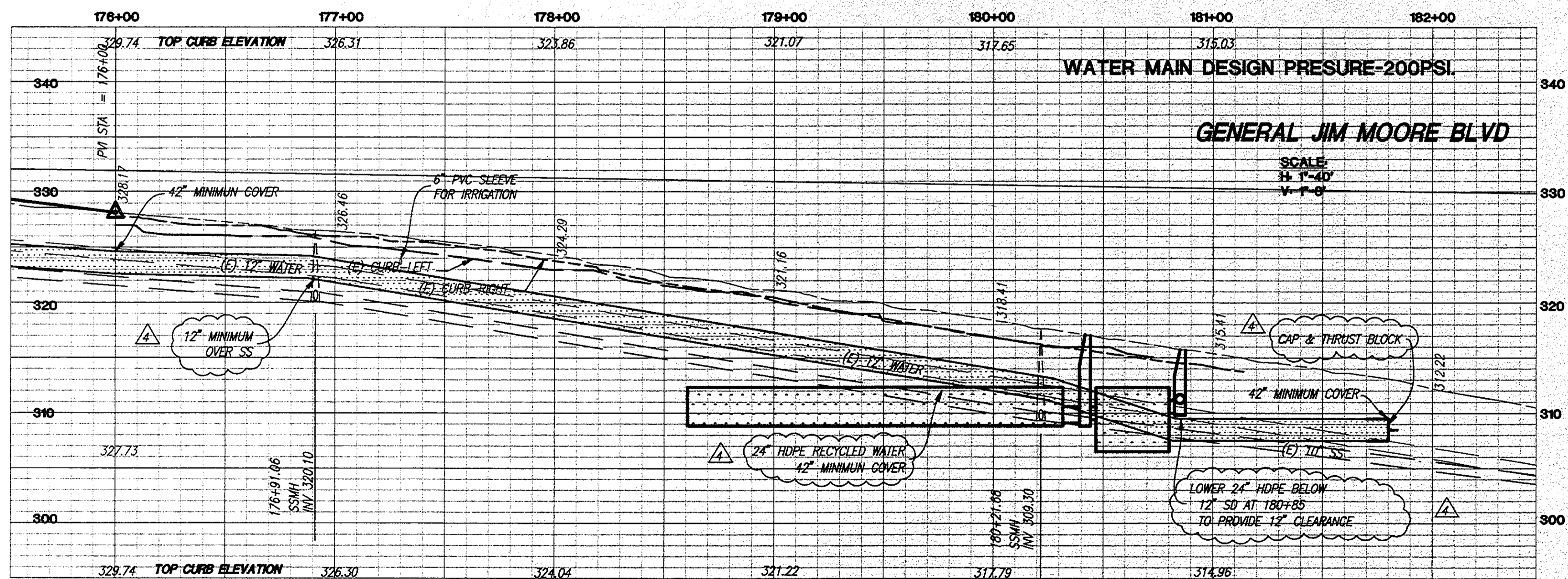
NOTES:

- VAULT SHOWN IS FOR PARKWAY USE ONLY. FOR TRAFFIC LOADING AND OTHER REQUIREMENTS, CONTACT DISTRICT REPRESENTATIVE.
- VAULT COVER TO BE SET TO CONFORM TO PARKWAY GRADE. WHEN A BY-PASS LINE IS NOT REQUIRED PER SECTION 15100.
- DELETE ITEMS 18, 19, 20, AND 21.

APPROVED BY DISTRICT ENGINEER DATE 09/20/05		MARINA COAST WATER DISTRICT STANDARD PLAN MATERIALS LIST	STANDARD W-24 SHEET 2 OF 2
--	--	--	---

(E) VEGETATION & IRRIGATION TO BE REMOVED IN
 (E) MEDIAN FROM STA 176+00 TO 181+85

STA. 180+85 CONST.
 2 CB, 100' 12" SD
 UNDERGROUND INFILTRATION
 SYSTEM PER SHEET C3



APPROVED BY DISTRICT ENGINEER DATE 09/20/05		MARINA COAST WATER DISTRICT STANDARD PLAN 3" & 4" TURBINE METER INSTALLATION	STANDARD W-24 SHEET 1 OF 2
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These are as-built drawings for the recycled water pipeline in General Jim Moore Blvd. Although the drawings state 24" HDPE pipeline, a change order was issued for installation of a 20" Ductile Iron pipeline, Class 52.

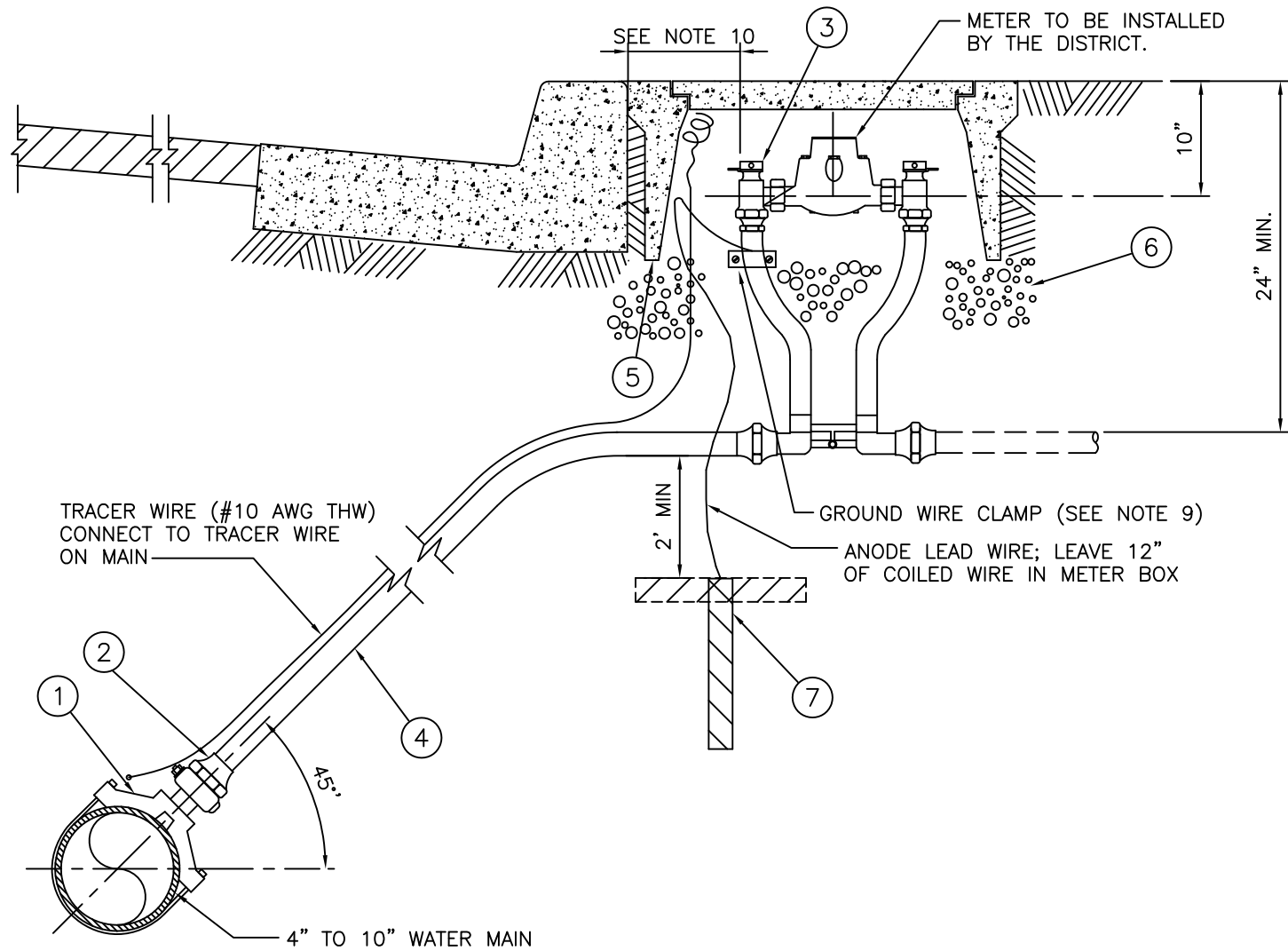
45MPH

ADDENDUM NO. 2
 JULY 11, 2005

DESIGNED BY C-HD	DRAWN BY SW	CHECKED BY SK/MPB	DATE APRIL 2006	SCALE AS NOTED	REVISION REV. DATE DESCRIPTION		
FORT ORD REUSE AUTHORITY GENERAL JIM MOORE BLVD. PLAN AND PROFILE STA. 177+00 TO 182+00 Monterey, California							
Consulting Civil and Structural Engineers 225 CANNERY ROW, SUITE H MONTEREY, CALIFORNIA 93940 TEL: (831) 373-1333 FAX: (831) 373-0733 FAIRFIELD • MONTEREY • PLEASANTON • SAN FRANCISCO • SAN JOSE, CALIFORNIA							
SHEET NUMBER C-08 OF 38 SHEETS DRAWING NO. 703019							

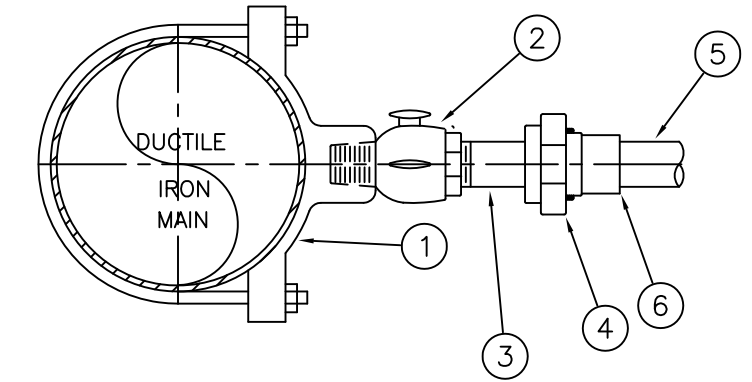
APPENDIX E

MCWD STANDARD DETAILS



- MATERIALS**
- | ITEM NO. | SIZE & DESCRIPTION* |
|----------|--|
| ① | DOUBLE STRAP IRON BODY SERVICE SADDLE 1" I.P. OUTLET (FOR DUCTILE IRON PIPE MAINS)
CAST BRONZE SERVICE SADDLE WITH 1" I.P. OUTLET (FOR C900 PVC PIPE MAIN) |
| ② | 3/4" BRONZE CORPORATION STOP I.P. THREAD X COMPRESSION (FOR DUCTILE IRON PIPE MAIN) |
| ③ | 1" METER SIZE COPPERSETTER W/ 3/4" TO 1" METER SIZE MALE ADAPTOR (REQUIRED FOR 3/4" METERS), 15" HIGH, 1" INLET/OUTLET |
| ④ | 1" COPPER OR POLYETHYLENE TUBING |
| ⑤ | METER BOX W/ CONCRETE LID CHRISTY BOX OR EQUAL |
| ⑥ | 6" BASE OF 3/4" ROCK |
| ⑦ | ZINC ANODE AND LEAD WIRE.
ANODE TO BE PLACED VERTICALLY OR HORIZONTALLY AT A MINIMUM SEPARATION OF 2 FEET FROM THE COPPER SERVICE. ANODE SHALL BE SIZED BASED ON METAL SURFACE AREA. ANODE SHALL BE BAGGED IN GYPSUM, BENTONITE AND SODIUM SULFATE. |

DIALECTRICAL INSULATION FOR DIP MAINS

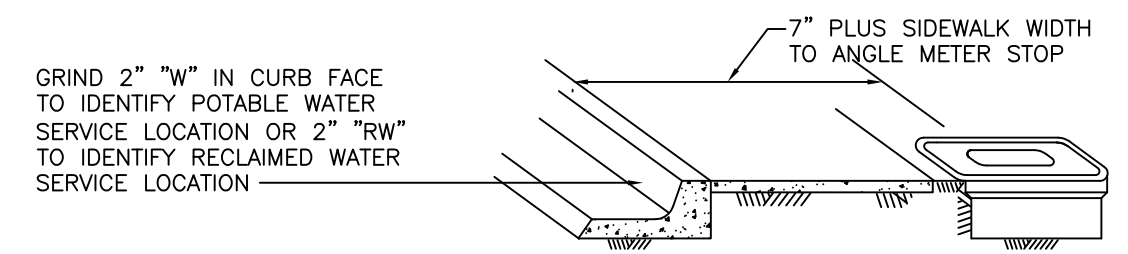


- MATERIALS*:**
- ① SERVICE SADDLE AND CORPORATION STOP
 - ② BRONZE CORPORATION STOP MALE I.P. X F.I.P.
 - ③ NIPPLE MALE I.P. X MALE I.P., BRONZE
 - ④ DIELECTRIC UNION F.I.P. X SWEAT
 - ⑤ TYPE K COPPER SERVICE TUBING
 - ⑥ COMPRESSION ADAPTER

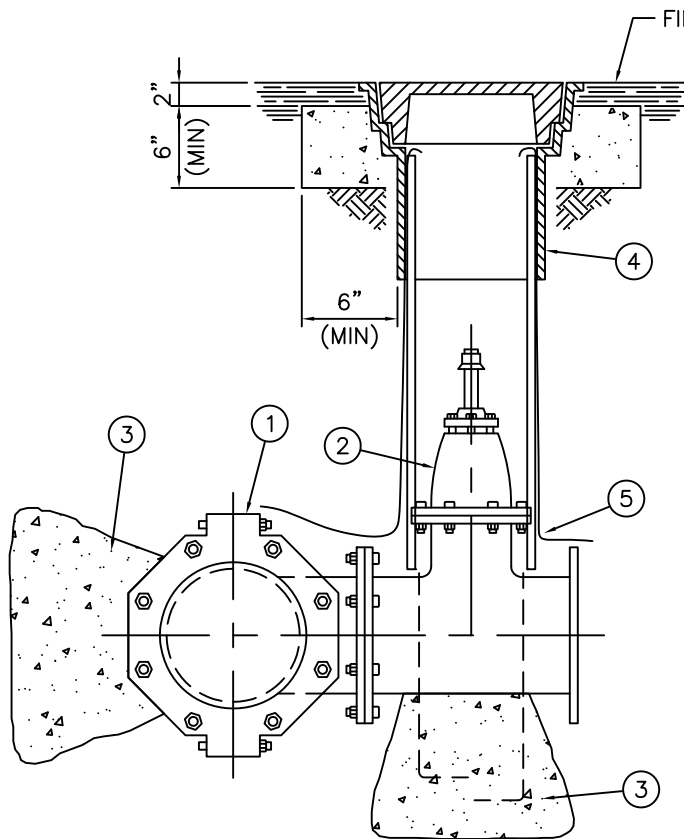
NOTES:

- 1- SERVICE SADDLE SHALL NOT BE INSTALLED WITHIN 18" OF VALVE, COUPLING, JOINT OR FITTING. TAPPED COUPLINGS ARE NOT PERMITTED.
- 2- INSTALL CORPORATION STOP WITH KEY IN OPEN POSITION.
- 3- SET TOP OF METER BOX FLUSH WITH SIDEWALK OR CURB AS SHOWN.
- 4- THE CORPORATION STOP TAP SHALL BE MADE AS SPECIFIED PER MANUFACTURER'S RECOMMENDATION. ALL TAPS SHALL BE MADE WITH MACHINE GUIDE OR PILOT TAP.
- 5- THE WATER SERVICE SHALL EXTEND PERPENDICULAR TO THE CENTERLINE OF THE STREET FROM THE WATER MAIN TO THE METER STOP.
- 6- METER BOX SHALL BE SET BEHIND SIDEWALK WHERE SIDEWALK IS ADJACENT TO CURB, OR IN PARKWAY BETWEEN CURB AND SIDEWALK.
- 7- ALL SPLICES OF COPPER TUBING SHALL BE COMPRESSION CONNECTIONS.
- 8- METER BOX LID FOR ALL RECYCLE WATER SERVICES SHALL BE PURPLE IN COLOR PER SPECIFICATIONS.
- 9- ANODE LEAD WIRE SHALL BE CLAMPED TO COPPER TUBING. CLAMP SHALL BE DIRECT BURIAL TYPE OF RED BRASS WITH BRASS SCREWS AS MANUFACTURED BY DOTTIE, OR APPROVED EQUAL.
- 10- COPPERSETTER SHALL BE CENTERED IN THE METER BOX. DISTANCE FROM THE CURB SHALL BE SPECIFIED IN THE CONTRACT DRAWINGS.
- 11- ANODE(S) SHALL BE INSTALLED WHEN REQUIRED BY CORROSION STUDY REPORT (SEE MASTER PLAN REQUIREMENT IN DEVELOPMENT PROCEDURE SECTION100).

* SEE SPECIFICATIONS FOR APPROVED MANUFACTURERS & MODELS.



APPROVED BY DISTRICT ENGINEER	DATE 11/2007	MARINA COAST WATER DISTRICT STANDARD PLAN 1" WATER SERVICE INSTALLATION	STANDARD W-1 SHEET 1 OF 1
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- ① TAPPING SLEEVE – CAST IRON, MJ
- ② GATE VALVE – RESILIENT WEDGE, FLANGED
- ③ CONSTRUCT CONCRETE THRUST BLOCK PER STD. PLAN W-13
- ④ VALVE RISER, BOX & LID PER STD. PLAN W-7
- ⑤ TRACER WIRE

NOTES

- 1. AIR TEST TAPPING SLEEVE PRIOR TO TAP
- 2. COAT ALL TAPPING SLEEVE BOLTS WITH KOPPERS BITSMASTIC
- 3. USE SHELL CUTTER ON ALL PVC TAPS

TAP OF ACP, PVC OR D.I.P. MAINS

APPROVED BY
DISTRICT
ENGINEER

DATE
11/2007



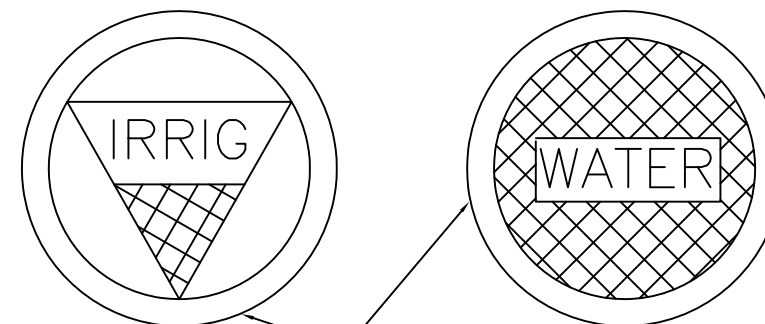
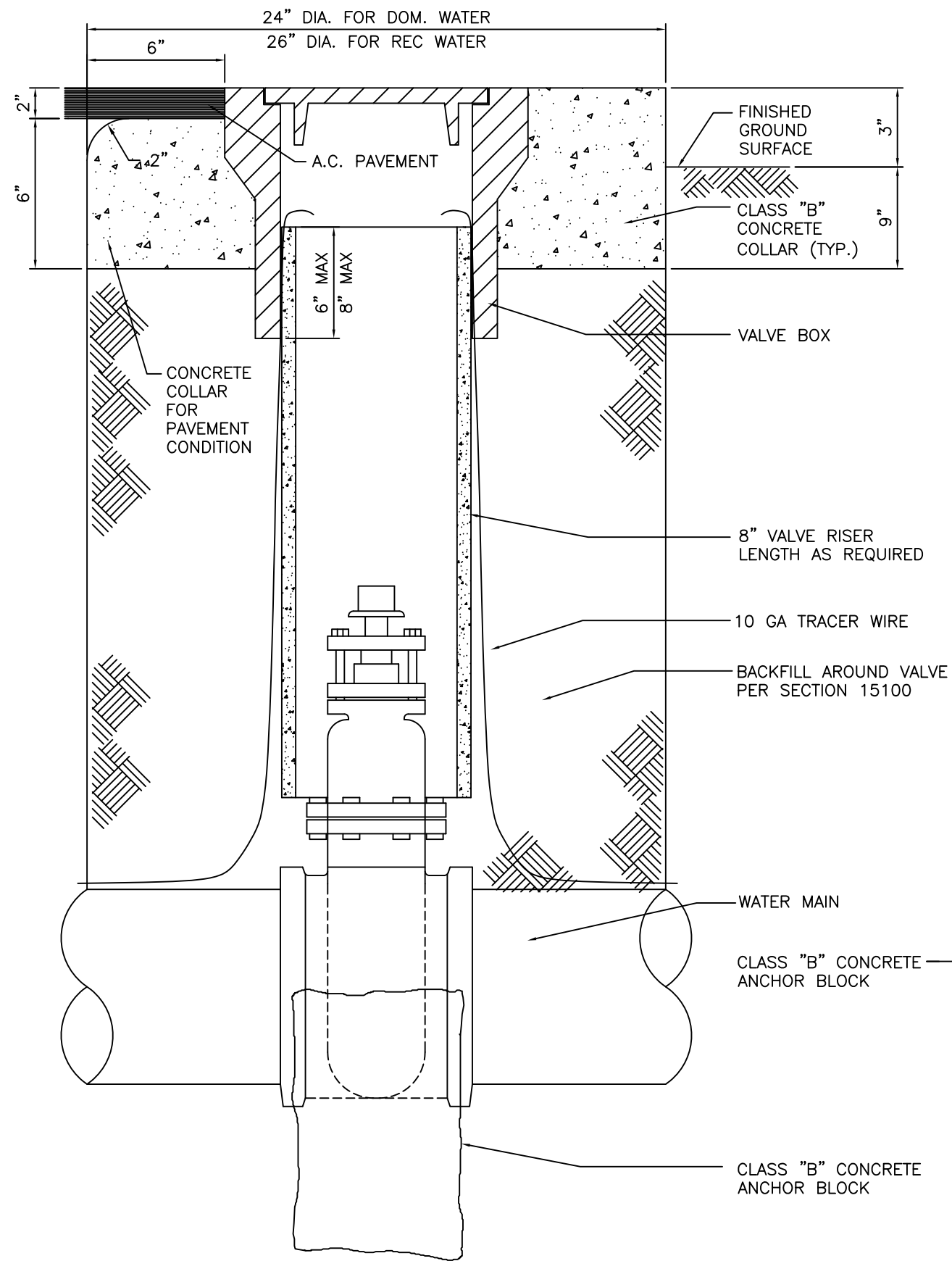
MARINA COAST WATER DISTRICT STANDARD PLAN

CONNECTION TO EXISTING PIPE

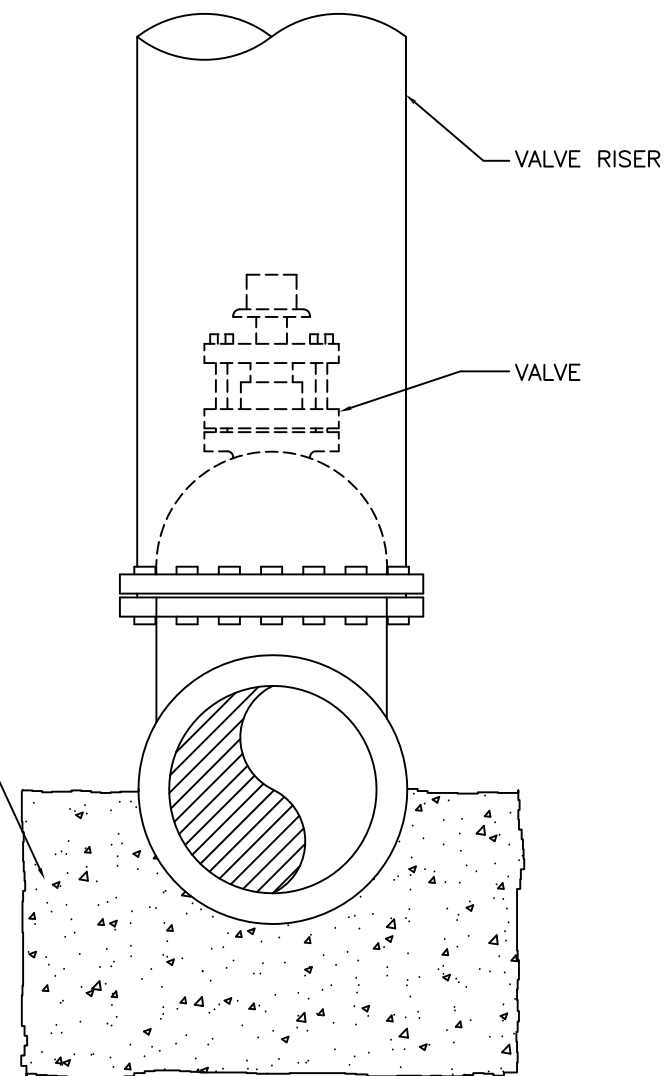
STANDARD

W-6

SHEET 1 OF 1



IRON COVER WITH WORD "WATER" CAST THEREON FOR DOMESTIC WATER LINES OR "IRRIG" FOR RECYCLED WATERLINES.



NOTES:

- 1- PROVIDE VALVE STEM EXTENSION IF DEPTH TO VALVE NUT EXCEEDS 4 FEET.
IN NEW TRACT DEVELOPMENTS EXTEND VALVE WELL PIPE 2' ABOVE GROUND ON "KEY VALVES" FOR EMERGENCY SHUTOFFS.
- 2- BUTTERFLY VALVE OPERATORS SHALL BE LOCATED ON THE LEFT-HAND SIDE OF THE VALVE (AT THE TEE OR CROSS), LOOKING THROUGH THE VALVE TOWARD THE PIPE END.
- 3- WHERE CONCRETE CROSS GUTTERS AT STREET INTERSECTIONS WILL INTERFERE WITH VALVE BOXES, THE PIPELINE SHALL BE MOVED TO A POSITION 7 FEET OFF THE CURB FACE TO CLEAR THE CROSS GUTTER.
- 4- VALVES TO BE LOCATED ADJACENT TO FITTINGS WHEREVER POSSIBLE.
- 5- VALVES BOLTED TO FITTINGS WILL NOT REQUIRE ANCHOR BLOCKS.

APPROVED BY
DISTRICT
ENGINEER

DATE
11/2007



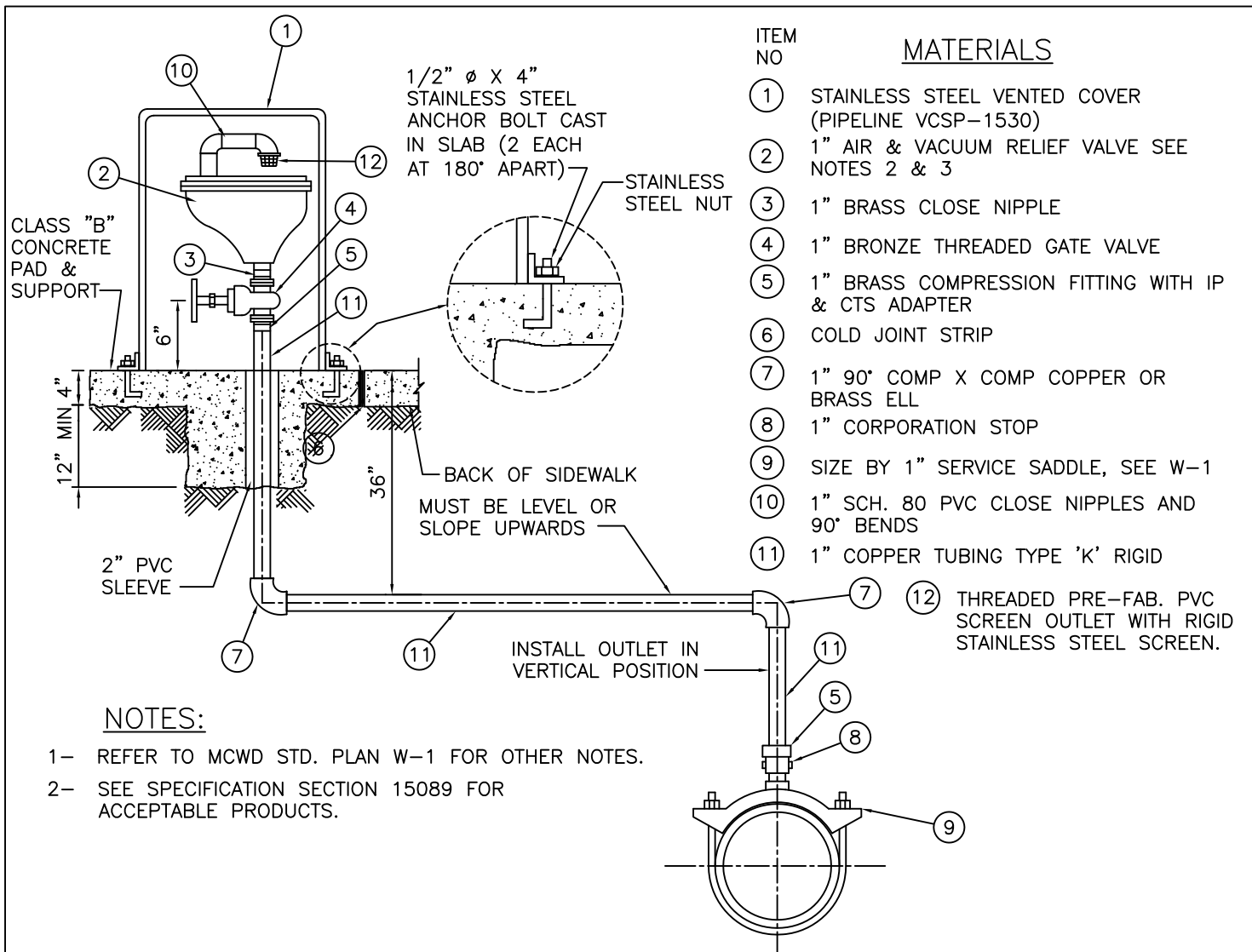
MARINA COAST WATER DISTRICT STANDARD PLAN

VALVE & VALVE BOX INSTALLATION

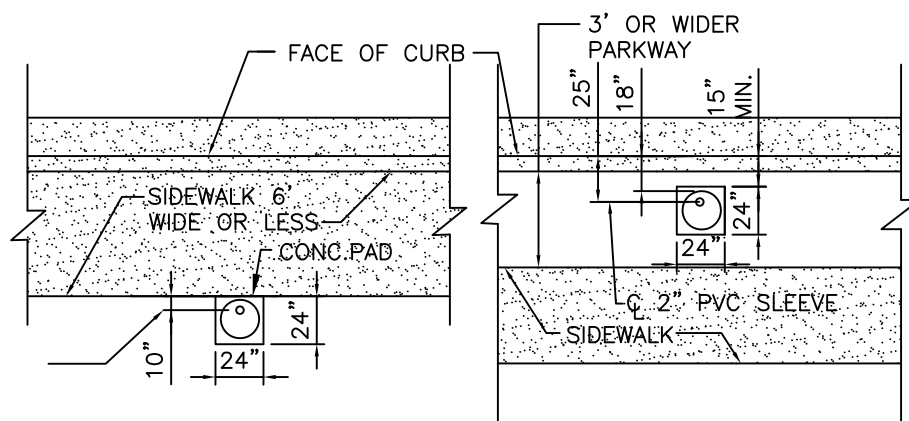
STANDARD

W-7

SHEET 1 OF 1



VALVE ASSEMBLY LOCATION



SIDEWALK ADJACENT TO CURB

SIDEWALK NOT ADJACENT TO CURB

APPROVED BY
DISTRICT
ENGINEER

DATE

11/2007



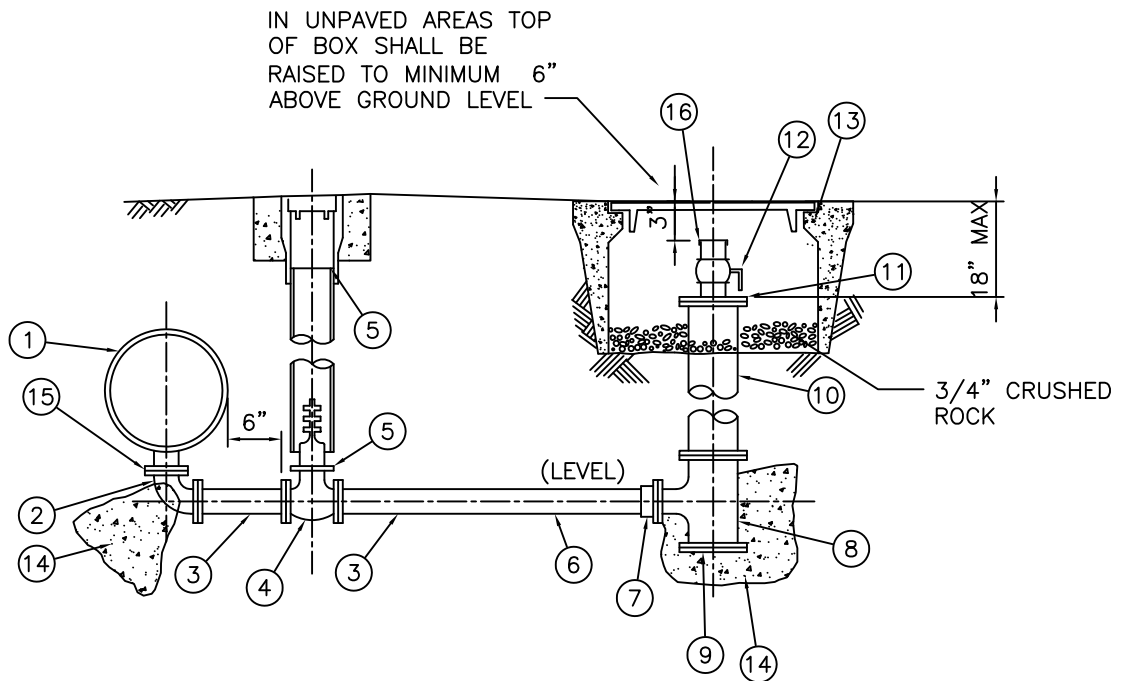
MARINA COAST WATER DISTRICT STANDARD PLAN

1" AIR RELEASE & VACUUM RELIEF
VALVE ASSEMBLY

STANDARD

W-10

SHEET 1 OF 1



MATERIALS

- | | |
|--|---|
| ① PIPE DIA. x 4" D.I. OR WSP TEE, FLANGED | ⑩ 8" x AS REQ'D D.I. PIPE |
| ② 4" D.I. 90° ELL, FLG. x FLG. | ⑪ 8" BLIND FLANGE W/ 2 1/2" TAP |
| ③ 4" x AS REQ'D D.I. SPOOL | ⑫ 2 1/2" BRASS NIPPLE AND 2 1/2" BALL VALVE, IP THREAD |
| ④ 4" RW GATE VALVE, FLG. x FLG. ONE VALVE REQUIRED FOR MAINS LESS THAN 24-INCHES IN DIAMETER. TWO VALVES ARE REQUIRED, AS SHOWN, FOR MAINS 24-INCHES IN DIAMETER AND LARGER. | ⑬ 8" MINIMUM DIAMETER VALVE BOX |
| ⑤ VALVE AND VALVE BOX INSTALLATION PER M.C.W.D. STD. PLAN W-7 | ⑭ THRUST BLOCKS PER MCWD STD. PLAN W-13 |
| ⑥ 4" x AS REQ'D FLG. x PE D.I. PIPE | ⑮ INSULATING KIT SHALL BE PROVIDED AS REQUIRED BY CORROSION STUDY & DISTRICT. |
| ⑦ 4" D.I. FLANGE COUPLING ADAPTER | ⑯ 2 1/2" BRASS NIPPLE, I.P. THREAD X FH THREAD, WITH PROTECTIVE CAP |
| ⑧ 8" x 4" D.I. TEE | |
| ⑨ 8" D.I. BLIND FLANGE | |

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11/2007

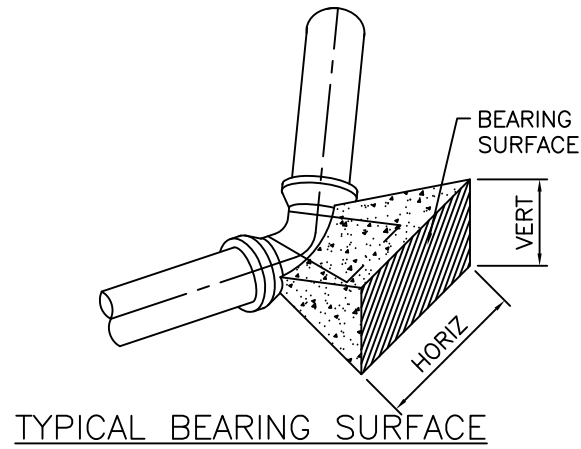


MARINA COAST WATER DISTRICT STANDARD PLAN
4 INCH LINE DRAIN
BLOWOFF ASSEMBLY
(FOR >12" MAINS)

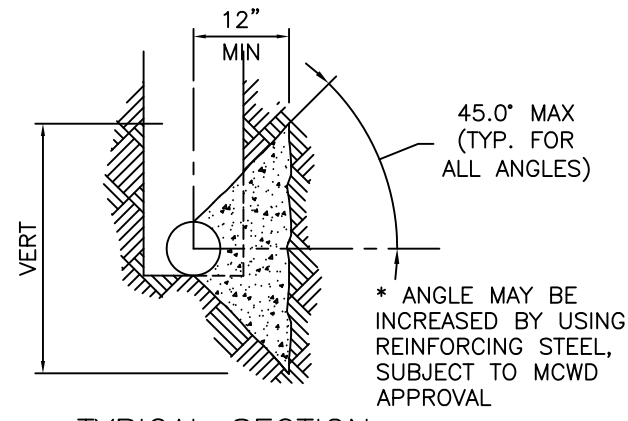
STANDARD

W-11

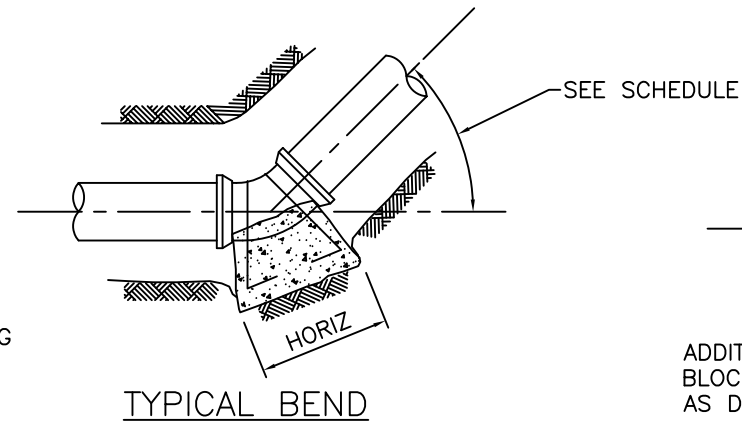
SHEET 1 OF 1



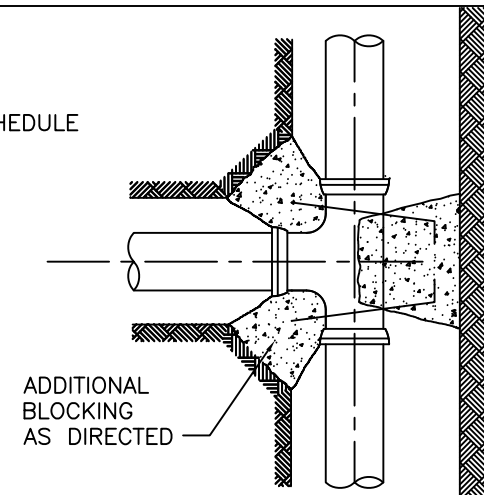
TYPICAL BEARING SURFACE



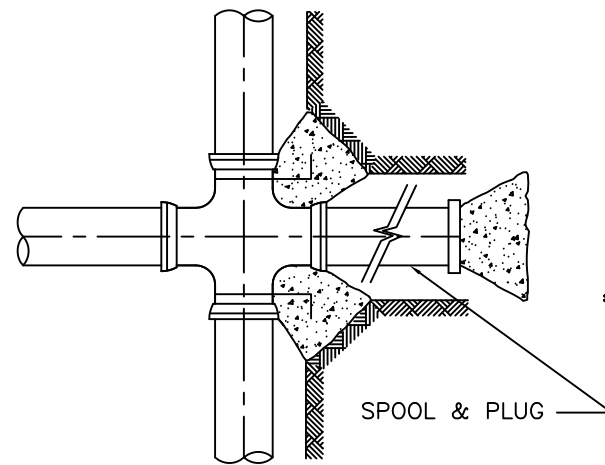
TYPICAL SECTION



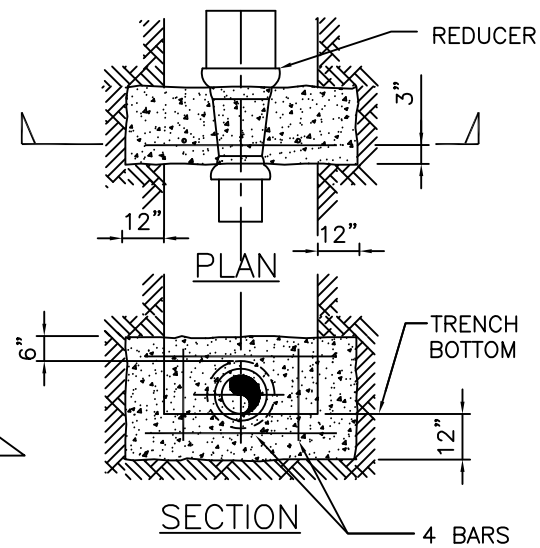
TYPICAL BEND



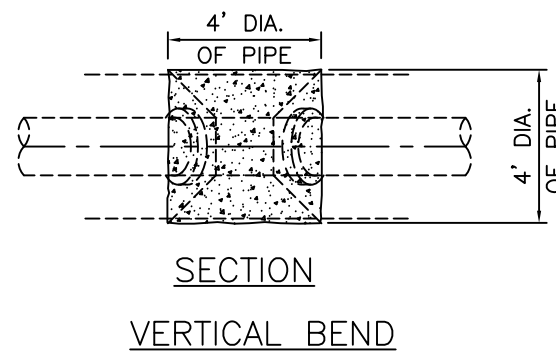
TEE OR VALVE



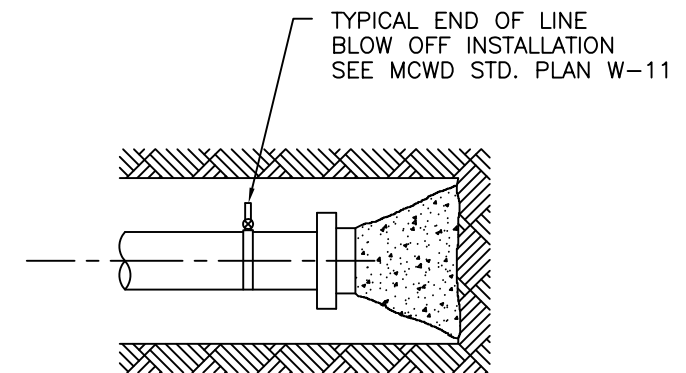
CROSS
SEE NOTE 8



REDUCER



SECTION
VERTICAL BEND



END CAP

NOTES:

- 1- THRUST BLOCK BEARING AREA BASED ON ALLOWABLE SOIL BEARING VALUE OF 1500 psf PRESSURE AND 225 psi LINE PRESSURE WITH 3'-0" COVER MINIMUM.
FOR BEARING = 1000 psf, 1.5 X AREA SHOWN
FOR BEARING = 500 psf, 3.0 X AREA SHOWN
- 2- ALL THRUST BLOCKS SHALL BE 2,000 PSI CONCRETE AND PLACED AGAINST UNDISTURBED SOIL. DESIGN ENGINEER SHALL DETERMINE SIZES NOT SHOWN.
- 3- STRAPS TO BE #4 REBARS EMBEDDED IN THRUST BLOCK TO A DEPTH EQUAL TO 3/4 OF PIPE DIAMETER. STRAP BEND EQUALS 1/2 PIPE DIAMETER
- 4- CONCRETE SHALL NOT EXTEND ONTO FLANGE OR ADJOINING PIPE.
- 5- JOINTS AND FACE OF PLUGS TO BE KEPT CLEAR OF CONCRETE
- 6- WRAP EXPOSED PORTION OF BARS AND 2" INTO CONCRETE WITH HALF LAPPED, 10 MIL PVC TAPE
- 7- WHEN CLEARANCES TO OTHER FACILITIES OR UTILITIES DO NOT ALLOW THE USE OF THRUST BLOCK, RESTRAINED PIPE SHALL BE USED.
- 8- THRUST BLOCKS ON CROSSES SHALL BE USED ONLY WHEN THERE IS A STUB-OUT ON ONE OR MORE SIDES, OR WHEN THERE IS ADJOINING UNRESTRAINED LENGTHS OF VALVES.
- 9- PIPE DIAMETERS GREATER THAN 12" SHALL BE CALCULATED BY THE ENGINEER & SUBMITTED TO DISTRICT ENGINEER FOR APPROVAL.
- 10- DISTRICT ALLOWS RESTRAINED JOINTS AS AN ALTERNATIVE TO THRUST BLOCKS.

MINIMUM SIZE OF THRUST BLOCK BEARING SURFACE

PIPE SIZE	11 1/4" BEND		22 1/2" BEND		45° BEND		90° BEND		TEE		END CAP	
	HORIZ.	VERT.	HORIZ.	VERT.	HORIZ.	VERT.	HORIZ.	VERT.	HORIZ.	VERT.	HORIZ.	VERT.
4"	1'-6"	0'-9"	1'-6"	0'-9"	1'-6"	1'-0"	2'-3"	1'-3"	1'-6"	1'-0"	1'-6"	1'-6"
6"	2'-6"	1'-0"	2'-6"	1'-0"	3'-6"	1'-6"	4'-6"	2'-3"	4'-0"	2'-0"	2'-6"	1'-9"
8"	3'-0"	1'-6"	3'-0"	1'-6"	4'-3"	2'-3"	5'-6"	3'-0"	5'-0"	2'-6"	3'-9"	2'-0"
10"	3'-9"	1'-9"	3'-9"	1'-9"	5'-0"	2'-9"	7'-0"	3'-6"	5'-6"	3'-3"	4'-6"	2'-6"
12"	4'-3"	2'-3"	4'-3"	2'-3"	5'-6"	3'-6"	8'-3"	4'-0"	7'-0"	3'-6"	5'-3"	3'-0"

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MARINA COAST WATER DISTRICT STANDARD PLAN

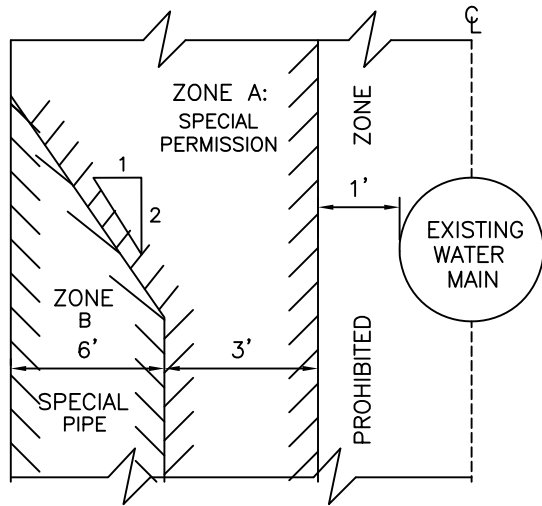
THRUST BLOCK DETAILS

STANDARD

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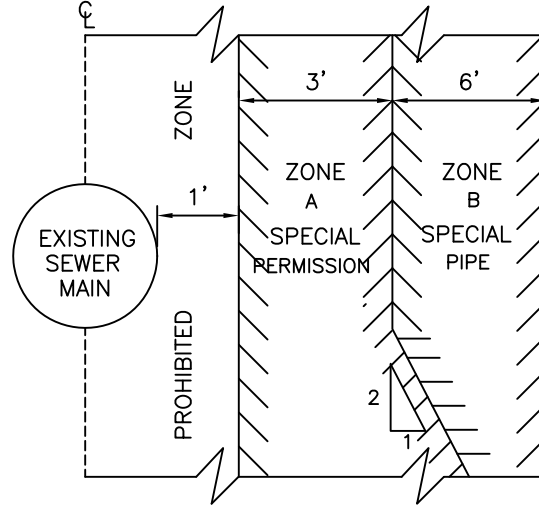
SHEET 1 OF 1

CASE 1: NEW SEWER MAIN



PARALLEL CONSTRUCTION

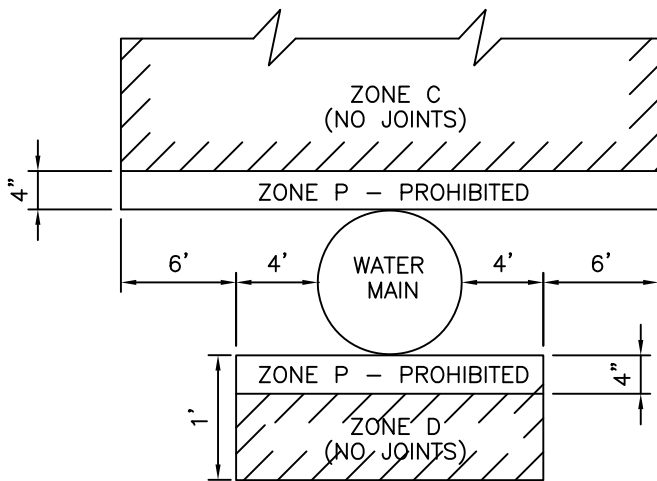
CASE 2: NEW WATER MAIN



PARALLEL CONSTRUCTION

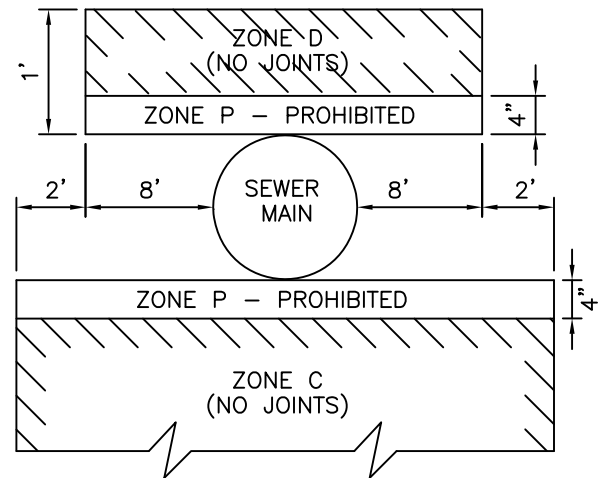
FIGURE 1

CASE 1: NEW SEWER MAIN



PERPENDICULAR CROSSING

CASE 2: NEW WATER MAIN



PERPENDICULAR CROSSING

FIGURE 2

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MARINA COAST WATER DISTRICT STANDARD PLAN
STATE HEALTH DEPT. EXCEPTIONS TO
BASIC SEPARATION AND STANDARDS FOR
WATER MAINS AND NON-POTABLE PIPELINES

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W-16

SHEET 1 OF 3

Proposed requirements as of the date of this document (April 14, 2003; Revised October 16, 2003)

Title 22 California Code of Regulations

Section 64572. Water Main Separation

(a) New water mains and new supply lines shall be installed at least 10 feet horizontally from, and one foot vertically above, any parallel pipeline conveying:

- (1) Untreated sewage,
- (2) Primary or secondary treated sewage,
- (3) Disinfected secondary-2.2 recycled water (defined in section 60301.220),
- (4) Disinfected secondary-23 recycled water (defined in section 60301.225), and
- (5) Hazardous fluids such as fuels, industrial wastes, and wastewater sludge.

(b) New water mains and new supply lines shall be installed at least 4 feet horizontally from, and one foot vertically above, any parallel pipeline conveying:

- (1) Disinfected tertiary recycled water (defined in section 60301.230), and
- (2) Storm drainage.

(c) New supply lines conveying raw water to be treated for drinking purposes shall be installed at least 4 feet horizontally from, and one foot vertically below, any water main.

(d) If crossing a pipeline conveying a fluid listed in subsection (a) or (b), a new water main shall be constructed perpendicular to and at least one foot above that pipeline. No connection joints shall be made in the water main within eight horizontal feet of fluid pipeline.

(e) The vertical separation specified in subsections (a), (b), and (c) is required only when the horizontal distance between a water main and pipeline is eleven feet or less.

(f) New water mains and new supply lines shall not be installed within 100 horizontal feet of any sanitary landfill, wastewater disposal pond, or hazardous waste disposal site, or within 25 feet of any cesspool, septic tank, sewage leach field, seepage pit, or groundwater recharge project site.

(g) The minimum separation distances set forth in this section shall be measured from the nearest outside edge of each pipe.

ALTERNATIVE CRITERIA FOR CONSTRUCTION

Water Mains, and Sewers and Other Non-potable Fluid-carrying Pipelines

When new water mains, new sanitary sewer mains, or other non-potable fluid-carrying pipelines are being installed in existing developed areas, local conditions (e.g., available space, limited slope, existing structures) may create a situation in which there is no alternative but to install water mains, sanitary sewer mains, or other non-potable pipelines at a distance less than that required by the regulations [existing Section 64630 (proposed Section 64572)]. In such cases, through permit action, the Department may approve alternative construction criteria. The alternative approach is allowed under the proposed regulation Section 64551(c):

"A water system that proposes to use an alternative to the requirements in this chapter shall demonstrate to the Department how it will institute additional mitigation measures to ensure that the proposed alternative would not result in an increased risk to public health."

Appropriate alternative construction criteria for two different cases in which the regulatory criteria for sanitary sewer main and water main separation cannot be met are shown in **Figures 1 and 2**.

Case 1 - New sanitary sewer main and a new or existing water main; alternative construction criteria apply to the sanitary sewer main.

Case 2 - New water main and an existing sanitary sewer main; alternative construction criteria may apply to either or both the water main and sanitary sewer main.

Case 1: New Sanitary Sewer Main Installation (Figures 1 and 2)

Zone Special Construction Required for Sanitary Sewer Main

A) Sanitary sewer mains parallel to water mains shall not be permitted in this zone without prior written approval from the Department and public water system.

B) If the water main paralleling the sanitary sewer main does not meet the Case 2 Zone B requirements, the sanitary sewer main should be constructed of one of the following:


- 1. PVC sewer pipe with rubber ring joints (per ASTM D3034) or equivalent;
- 2. Cast or ductile iron pipe with compression joints; or
- 3. Reinforced concrete pressure pipe with compression joints (per AWWA C302-95).

C) If the water main crossing below the sanitary sewer main does not meet the Case 2 Zone C requirements, the sanitary sewer main should have no joints within 10 feet from either side of the water main (in Zone C) and should be constructed of one of the following:

- 1. A continuous section of ductile iron pipe with hot dip bituminous coating; or
- 2. One of the Zone C options 1, 2, 3, or 4 below.

D) If the water main crossing above the sanitary sewer main does not meet the requirements for Case 2 Zone D, the sanitary sewer main should have no joints within four feet from either side of the water main (in Zone D) and should be constructed of one of the following:

- 1. Ductile iron pipe with hot dip bituminous coating and mechanical joints (gasketed, bolted joints);
- 2. A continuous section of Class 200 (DR 14 per AWWA C900-97) PVC pipe or equivalent, centered over the pipe being crossed;
- 3. A continuous section of reinforced concrete pressure pipe (per AWWA C302-95) centered over the pipe being crossed; or
- 4. Any sanitary sewer main within a continuous sleeve.

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Proposed Regulations, continued:

Case 2: New water mains Installation (Figures 1 and 2)

Zone Special Construction Required for Water Main

- A) No water mains parallel to sanitary sewer mains shall be constructed without prior written approval from the Department.
- B) If the sanitary sewer main paralleling the water main does not meet the Case 1 Zone B requirements, the water main should be constructed of one of the following:
 1. Ductile iron pipe with hot dip bituminous coating;
 2. Class 200 pressure rated PVC water pipe (DR 14 per AWWA C900-97) or equivalent; or
 3. Reinforced concrete pressure pipe, steel cylinder type, per AWWA (C300-97 or C302-99 or C303-95).
- C) If the sanitary sewer main crossing above the water main does not meet the Case 1 Zone C requirements, the water main should have no joints within ten feet from either side of the sanitary sewer main (in Zone C) and be constructed of one of the following:
 1. Ductile iron pipe with hot dip bituminous coating;
 2. Class 200 pressure rated PVC water pipe (DR 14 per AWWA C900-97); or
 3. Reinforced concrete pressure pipe, steel cylinder type, per AWWA (C300-97 or C301-99 or C303-95).
- D) If the sanitary sewer main crossing below the water main does not meet the requirements for Zone D Case 1, the water main should have no joints within eight feet from either side of the sanitary sewer main and should be constructed as for Zone C.

Water Mains and Pipelines Conveying Non-potable Fluids

When the basic separation criteria cannot be met between water mains and pipelines conveying non-potable fluids, the requirements described above for sanitary sewer mains should apply. This includes the requirements for selecting special construction materials and the separation requirements shown in Figures 1 and 2. Note that not all construction materials allowed for sanitary sewer mains will be appropriate for other non-potable fluid lines. For example, certain plastic lines may not be appropriate for the transport of some fuel products. The selection of compatible materials of construction for non-potable fluids is a decision to be made by the project engineer.

Water Mains and Sewage Force Mains

- * Sewage force mains shall not be installed within ten feet (horizontally) of a water main.
- * When a sewage force main must cross a water main, the crossing should be as close as practical to the perpendicular. The sewage force main should be at least one foot below the water main.
- * When a new sewage force main crosses under an existing water main, and a one foot vertical separation cannot be provided, all portions of the sewage force main within eight feet (horizontally) of the outside walls of the water main should be enclosed in a continuous sleeve. In these cases, a minimum vertical separation distance of 4 inches should be maintained between the outside edge of the bottom of the water main and the top of the continuous sleeve.
- * When a new water main crosses over an existing sewage force main, the water main should be constructed of pipe materials with a minimum rated working pressure of 200 psig or the equivalent.


Water Mains and Tertiary Treated Recycled Water or New Supply Lines

- * The basic separation criteria for water mains and pipelines conveying tertiary treated recycled water or supply lines are a 4-foot horizontal separation where lines are running parallel and a 1-foot vertical separation (water line above recycled or supply line) where the lines cross each other.
- * When these criteria cannot be met, the Zone A criteria apply where lines are running parallel, and the Zone C and Zone D criteria apply where the lines cross each other as shown on Figures 1 and 2. For these situations, the Zone "P" criteria are in effect and prohibit construction less than 1 foot in parallel installations and less than 4 inches in vertical (crossing) situations.
- * For tertiary treated recycled water and new supply lines, the Zone B criteria (requirements for special pipe) do not apply as the basic separation criteria is a four-foot horizontal separation criteria for parallel lines. The tertiary treated recycled water lines should be constructed in accordance with the color-coding, and labeling requirements per Section 116815, California Health and Safety Code of Regulations.

MISCELLANEOUS GUIDANCE

- * More stringent requirements may be necessary if conditions such as high groundwater exist. HDPE or similar pipe may be required to provide flexibility to move without potential joint leaks.
- * Sanitary sewer mains should not be installed within 25 feet horizontally of a low head (5 psig or less pressure) water main.
- * New water mains and sanitary sewer mains should be pressure tested in accordance with manufacturer's specifications.
- * When installing water mains, sewers, or other pipelines, measures should be taken to prevent or minimize disturbances of existing pipelines. Disturbance of the conduit's supporting base could eventually result in pipeline failure.
- * Special consideration should be given to the selection of pipe materials if corrosive conditions are likely to exist. These conditions may be due to soil type and/or the nature of the fluid conveyed in the conduit, such as a septic sewage producing corrosive hydrogen sulfide.

NOTE: Dimensions are from the outside of the water main to the outside of the other pipeline, manhole, or sleeve.

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MATERIALS

<u>ITEM</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>
①	1 EACH	SIZE X 4" TAPPING SLEEVE (USE PUSH-ON X FLG. TEE IF HOT TAP IS NOT REQUIRED).
②	1 EACH	4" PUSH-ON X FLG. TAPPING VALVE (USE RW OR GATE VALVE IF HOT TAP IS NOT REQUIRED).
③	AS REQ'D	4" PVC PIPE OR D.I. PIPE LATERAL, PUSH-ON JOINTS
④	1 EACH	4" D.I. 90° ELL, PUSH-ON X FLG.
⑤	2 EACH	FLG X FLG. D.I. SPOOL - METER SIZE X 2'-6"
⑥	1 EACH	4" D.I. 90° ELL FLG. X FLG.
⑦	1 EACH	4" X 3" D.I. REDUCER FLG. X FLG. (FOR 3" SERVICE ONLY)
⑧	2 EACH	RW OR GATE VALVE FLG. X FLG.
⑨	2 EACH	FLG. X GROOVED END D.I. SPOOL, 6" LENGTH
⑩	1 EACH	GROOVED-END COUPLING
⑪	1 EACH	STRAINER
⑫	1 EACH	TURBINE METER
⑬	1 EACH	METER SIZE X 6" D.I. TEE - FLANGED
⑭	1 EACH	METER-SIZE D.I. COMPANION FLANGE TAPPED FOR 2 1/2" I.P.
⑮	1 EACH	2" CORPORATION STOP - MIP X MIP
⑯	1 EACH	D.I. BLIND FLANGE
⑰	2 EACH	METER SIZE FLANGED D.I. TEE
⑱	4 EACH	ADAPTER - 2" M.I.P. BY S.J.
⑲	AS REQ'D	2" COPPER TUBING
⑳	2 EACH	2" 90° ELBOW - S.J. X S.J.
㉑	1 EACH	2" BALL VALVE WITH LOCKING WING - F.I.P. X F.I.P.
㉒	1 EACH	4" D.I. SPOOL - FLG. X FLG. (IF REQUIRED)
㉓	2 EACH	GALVANIZED PIPE SUPPORT
㉔	1 EACH	PRECAST CONCRETE VAULT (5'-0" WIDE X 6'-6" LONG X 5'-0" HIGH) WITH HALLIDAY SPRING ASSIST HINGED DIAMOND PLATE ALUMINUM COVER (M4' X 4' MIN.) AND RECESSED LOCKING HASP. PROVIDE 6" X 12" HINGED READING LID INSTALLED OVER METER REGISTER.
㉕	4 EACH	BOLT AND FLANGE INSULATING KIT
㉖	1 EACH	GALV. STEEL LADDER W/LADDER - UP AND S.S. ANCHOR BOLTS.
㉗	2 EACH	METER SIZE BRONZE COMPANION FLANGE WITH 2" THREADED I.P. OUTLET

NOTES:

1. VAULT SHOWN IS FOR PARKWAY USE ONLY. FOR TRAFFIC LOADING AND OTHER REQUIREMENTS, CONTACT DISTRICT REPRESENTATIVE.
2. VAULT COVER TO BE SET TO CONFORM TO PARKWAY GRADE.
3. WHEN A BY - PASS LINE IS NOT REQUIRED PER SECTION 15150, DELETE ITEMS 18, 19, 20 AND 21.
4. ALL PART SHALL BE INSTALLED SUCH THAT THEY MAY BE LIFTED DIRECTLY THROUGH THE ACCESS COVER.

APPROVED BY
DISTRICT
ENGINEER

DATE

11/2007



MARINA COAST WATER DISTRICT STANDARD PLAN

**3" TO 10" TURBINE METER INSTALLATION
MATERIALS LIST**

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