

DOCUMENTS FOR THE CONSTRUCTION OF
PARADISE IRRIGATION DISTRICT
ZONE A PUMP STATION AND TRANSMISSION MAIN PROJECT
JOB NUMBER 17-041

VOLUME 1
TECHNICAL SPECIFICATIONS
(DIVISIONS 00-16)

December 2022

BID DOCUMENTS



ENGINEER:



WATER WORKS ENGINEERS, LLC.

CONTACT:

Sami Kader, P.E. (530) 355-7646

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ADVERTISEMENT FOR BIDS

Sealed Bids for construction of the Paradise Irrigation District Zone A Pump Station and Transmission Main Project, addressed to ATTN: Georgeanna Borrayo, Paradise Irrigation District, 6332 Clark Road, Paradise, CA 95969 shall be received until **1:00 p.m.**, local time, on **Tuesday, February 14, 2023.** Bids will be opened immediately thereafter and read aloud.

Bids will be publicly opened, examined and declared by Water Works Engineers (ENGINEER) on said day and hour, and will be referred to Paradise Irrigation District (OWNER) for subsequent action. Any Bids received after the specified time and date will not be considered.

The Work is located in Paradise CA, at the Paradise Water Treatment Plant (13888 Pine Needle Drive), along Pine Needle Drive, Skyway and New Skyway (from Coutolenc Road to approximately 1000' west of Pentz Road) and adjoining roadways, and at Pump Station 2 (6650 Moore Road).

The Project contemplated consists of the construction of the Zone A Pump Station (ZAPS) and the Zone A Transmission Main (ZATM), Improvements to Pump Station 2, and performing related required work. The project includes the following major components as identified on the Bid Form:

1. Mobilization and Demobilization to the site, including all temporary construction facilities
2. Trenching, sheeting, shoring, and bracing as required by Section 6707 of the California Labor Code
3. Stormwater Pollution Prevention Plan
4. Traffic Control measures on Pine Needle, Old Skyway, and New Skyway.
5. T-trench (52" – 60" Wide) Repaving (Unit Price, \$/LF)
6. 3" thick Lane Grind and Repave (Unit Price, \$/SF)
7. Installation of 16" ZATM including valves and fittings
8. Leak Testing and Disinfection of ZATM pipeline and appurtenances
9. Pump Station #2 improvements
10. Leak Testing and Disinfection of Pump Station #2 piping and appurtenances
11. ZAPS Civil Site Work
12. ZAPS Building Foundation
13. ZAPS Pumps and Installation
14. ZAPS Building Structure
15. ZAPS HVAC
16. ZAPS Site finishing work including gravel surfacing, stairway and sidewalk concrete, asphalt road repair within the limits of the WTP)
17. ZAPS floor drain system
18. ZAPS potable water system (W1)
19. ZAPS finished water system (FW)
20. Leak Testing and Disinfection of ZAPS W1 and FW piping and appurtenances
21. Electrical and Instrumentation installation
22. SCADA Integration

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23. All remaining work including identification devices

Project shall be substantially complete in **200** working days. A portion of the ZATM pipeline (from Station 23+19.30 to 70+00, approximately 4681-ft) shall be substantially complete in **70** working days. All Work shall be completed within **220** working days from the date established in the Notice to Proceed. At this time, Notice to Proceed is expected prior to March 1, 2023. Refer to Section 01130, Special Project Constraints in the Technical Specifications for project constraints.

In order to facilitate the early completion milestone for the noted portion of the Zone A Transmission Main work, OWNER will pre-purchase and Owner-supply the pipe, valves and appurtenances required for that work. Owner-supplied pipe, valves and appurtenances are expected to be available to CONTRACTOR by March 15, 2023.

The engineer's estimate for this project is \$6,340,000, including Owner-supplied equipment value. The value of the Owner supplied equipment is estimated at \$930,000 and will not be included in Contractor Bids.

A **mandatory** pre-bid meeting is scheduled between ENGINEER, OWNER and interested bidders on **Tuesday, January 31st at 10:00 a.m.** Interested bidders should meet at Paradise Irrigation District's Reservoir Water Treatment Plant located at *13888 Pine Needle Drive, Magalia, California 95954*. At this time the project will be reviewed, followed by a tour of the facilities and work areas. It is a mandatory requirement that each prime contractor must have a representative at the pre-bid meeting to be allowed to submit a bid. Potential sub-contractors and suppliers are not required to attend the pre-bid meeting but are encouraged to attend.

Bidding Documents include the following:

- Volume 1 – Bid Requirements and Specifications
- Volume 2 – Drawings (11-inch by 17-inch)
- Volume 3 – Geotechnical Report

Bidding Documents and addenda may be obtained at CIPLIST.com at no charge. Supporting documents as required (i.e., geotechnical reports, etc.) will also be posted on this site. Supporting and informational documents are for informational purposes only and for the convenience of the bidders and are not considered a part of the Bidding Documents.

Bidding Documents are provided electronically and free of charge. It is the responsibility of each prospective bidder to verify the completeness of their printed Bidding Documents before submitting their Bid and accompanying completed forms. Users are cautioned that OWNER and ENGINEER do not assume any liability or responsibility based on any defective or incomplete copying, excerpting, scanning, faxing, downloading, or printing of the Bidding Documents.

The Bidding Documents shall supersede any information posted or transmitted by CIPLIST.com.

Be advised that the information contained on CIPLIST.com may change and without notice to prospective bidders. It is the responsibility of each prospective bidder to check

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CIPLIST.com on a daily basis through the close of bids for any applicable addenda or updates. CIPLIST.com sends email notifications to ONLY those registered for the project.

Submit all bidder's questions in writing to the ENGINEER. Last day to submit questions is February 1st, 2023. All questions will be answered by end of day on February 3rd, 2023.

The Work under these Bidding Documents is funded by the EPA's Drinking Water State Revolving Fund Program (DWSRF) which is administered by the California State Water Resources Control Board (SWRCB) Division of Drinking Water's (DDW). The general Federal prevailing rate of per diem wages, holidays, and overtime work for each craft, classification, or type of workmen needed to execute the contract are established by the Secretary of Labor in accordance with the Davis-Bacon Act and can be found online at <http://www.sam.gov>. Contractors shall not pay wages less often than once per week. The successful Bidder agrees upon execution of this Agreement to post a copy of the wage rates at the project site.

Bidders shall provide a Good Faith Effort to include Disadvantaged Business Enterprises (DBE) in the Work, as described in the Section 00830, SWRCB State Revolving Fund Construction Contract Requirements.

This project is subject to "Use of American Iron and Steel" provisions of the "Consolidated Appropriations Act, 2014," H.R. 3547, Title IV.

Each Bid must be submitted on the prescribed Bid Form and accompanied by Bid security as prescribed in the Instructions to Bidders, payable to the OWNER in an amount not less than 10 percent of the amount Bid.

The Successful Bidder will be required to furnish the additional Bond(s) prescribed in the Bidding Documents.


In order to Bid and perform public work, the Bidder and Subcontractors shall hold or obtain such licenses as required by State Statutes, and federal and local Laws and Regulations. **Bids will be accepted only from Bidders holding a Class A California Contractors' License.**

For information concerning the proposed Work or to arrange to visit the project site, contact Sami Kader via phone at 530-355-7646 or email at samik@wwengineers.com.

OWNER's right is reserved to reject all Bids or any Bid not conforming to the intent and purpose of the Bidding Documents.

Dated this 10th day of January, 2023.

Paradise Irrigation District

By 

Tom Lando, District Manager

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SECTION 00100

INSTRUCTIONS TO BIDDERS

PART 1 - DEFINED TERMS

Terms used in these Instructions to Bidders have the meanings assigned to them in the General Conditions.

Certain additional terms used in the Bidding Documents have the meanings indicated below which are applicable to both the singular and plural thereof.

1.1 Bidder—one who submits a Bid to OWNER as distinct from a subbidder, who submits a Bid to a Bidder.

1.2 Apparent Low Bidder—that Bidder whose Bids as offered in the Bid Form represents the lowest total as determined by the Base Bid.

1.3 Base Bid:

1.3.1 Base Bid—Includes Bid for all Lump Sum and Unit Price Work.

1.4 Successful Bidder—lowest, responsible and responsive Bidder to whom OWNER (on the basis of OWNER's evaluation as hereinafter provided) makes an award.

PART 2 - BIDDING DOCUMENTS

2.1 The Bidding Documents consist of the following volumes:

- Volume 1 – Bid Requirements and Specifications
- Volume 2 - Drawings (11-inch by 17 inch)
- Volume 3 – Geotechnical Report

2.2 Complete sets of Bidding Documents obtained from CIPList.com must be used in preparing Bids. Neither OWNER nor ENGINEER assume any responsibility for errors or misinterpretations resulting from use of incomplete sets of Bidding Documents.

2.3 The Drawings included in the Bidding Document are half-size reductions of the original full-size drawings. The amount of reduction is indicated by a note or scale bar on the Drawings.

2.3 Bidding Documents made available on the above terms are only for the purpose of obtaining Bids for the Work and shall not be used for any other purpose.

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PART 3 - QUALIFICATIONS OF BIDDERS

3.1 To demonstrate qualifications to perform the Work, each Bidder must be prepared to submit within 5 days after Bid opening and upon OWNER's written request evidence, such as financial data, previous experience, present commitments, and other such data as may be called for below. Each Bid must contain evidence of Bidder's qualification to do business in the state of California or covenant to obtain such qualification prior to contract award.

3.2 Nothing indicated herein will prejudice OWNER's right to seek additional pertinent information as is provided in Article AWARD OF CONTRACT.

PART 4 - LICENSE REQUIREMENTS

4.1 The classification of Contractor's License a Bidder must hold to be eligible for an award of a contract for the Work is listed in the Advertisement for Bids.

PART 5 - EXAMINATION OF BIDDING DOCUMENTS AND SITE

5.1 It is each Bidder's responsibility, before submitting a Bid, to:

5.1.1 Examine thoroughly the Bidding Documents and other related data identified in the Bidding Documents (including "technical data" referred to below).

5.1.2 Inspect the site to become familiar with and satisfy Bidder as to the general, local, and site conditions that may affect cost, progress, performance, or furnishing of the Work.

5.1.3 Consider federal, state, and local Laws and Regulations that may affect cost, progress, performance, or furnishing of the Work.

5.1.4 Study and carefully correlate Bidder's knowledge and observations with the Bidding Documents and such other related data.

5.1.5 Promptly notify ENGINEER of all conflicts, errors, ambiguities, or discrepancies which Bidder has discovered in or between the Bidding Documents and such other related documents.

5.2 Reference is made to the Supplementary Conditions for identification of:

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5.2.1 Those reports, if any, of explorations and tests of subsurface conditions at the site which have been utilized by ENGINEER in preparation of the Bidding Documents.

5.2.2 Those drawings, if any, of physical conditions in or relating to existing surface and subsurface structures (except Underground Facilities) which are at or contiguous to the site which have been utilized by ENGINEER in preparation of the Bidding Documents.

Copies of such reports and drawings that are not included with the Bidding Documents may be examined at the office of OWNER or ENGINEER during regular business hours.

5.3 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders on subsurface conditions, other physical conditions and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated conditions appear in paragraphs 4.02 and 4.03 of the General Conditions.

5.4 Before submitting a Bid, each Bidder will be responsible to make or obtain such additional or supplementary examinations, investigations, explorations, tests, studies, and data concerning conditions (surface, subsurface, and Underground Facilities) at or contiguous to the site or otherwise and which may affect cost, progress, performance, or furnishings of the Work and which Bidder deems necessary to determine its Bid.

5.5 On request, OWNER will provide each Bidder access to the site to conduct such examinations, investigations, explorations, tests, and studies as each Bidder deems necessary for submission of a Bid. 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.

5.6 Reference is made to the Summary of Work for identification of the general nature of work that is to be performed at the site by OWNER or others and that relates to Work for which a Bid is to be submitted. On request, OWNER will provide to each Bidder, for examination, access to or copies of Bidding Documents (other than portions thereof related to price) for such work by others.

5.7 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 is premised upon performing and furnishing the Work required by the Bidding Documents and applying the specific means, methods, techniques, sequences, or procedures of construction (if any) that may be shown or indicated or expressly required by the Bidding Documents; that Bidder has given ENGINEER written notice of all conflicts, errors, ambiguities, and discrepancies that Bidder has discovered in the Bidding Documents, and the written resolution thereof by ENGINEER is acceptable to Bidder; and that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work and for preparing the Bid.

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PART 6 - INTERPRETATIONS AND ADDENDA

6.1 All questions about the meaning or intent of the Bidding Documents are to be directed to ENGINEER in writing. Interpretations or clarifications considered necessary by ENGINEER in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by the office issuing documents as having received the Bidding Documents. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

6.2 Addenda may also be issued to modify the Bidding Documents as deemed advisable by OWNER or ENGINEER.

PART 7 - BID SECURITY

7.1 Each Bid must be accompanied by Bid security made payable to OWNER in an amount of 10 percent of Bidder's maximum Bid price and in the form of a certified or cashier check or completed Section 00400, Bid Bond, issued by a surety meeting the requirements of paragraph 5.01 and 5.02 of the General Conditions.

7.2 Each bid must be accompanied by a power-of-attorney for the Surety's agent to execute the Bid Bond.

7.3 The Bid security of Successful Bidder will be retained until such Bidder has executed the Agreement, furnished the required Performance and Payment Bond(s), certificates of insurance, and met the other conditions of the Bidding Documents. If the Successful Bidder fails to sign and deliver the Agreement and furnish the required Bond(s) and certificates of insurance within the time period specified in Article EXECUTION OF AGREEMENT, OWNER may annul the award and the Bid security of that Bidder will be forfeited. The Bid security of other Bidders whom OWNER believes to have a reasonable chance of receiving the award may be retained by OWNER until the earlier of the 10th day after the execution of the Agreement by the Successful Bidder or the rejection of all Bids by OWNER. Bid security submitted with Bids which are not competitive will be returned within 15 days after the Bid opening.

PART 8 - CONTRACT TIMES

8.1 Contract Times are set forth in the Agreement.

PART 9 - LIQUIDATED DAMAGES

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9.1 Provisions for liquidated damages are set forth in the Agreement.

PART 10 - SUBSTITUTE AND "OR EQUAL" ITEMS

10.1 The contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration of possible substitute or "or-equal" items. Whenever it is specified or described in the Bidding Documents that a substitute or "or-equal" item of material or equipment may be furnished or used if acceptable to ENGINEER, application for such acceptance will not be considered by ENGINEER until after the Effective Date of the Agreement. The procedure for submission of any such application and consideration by ENGINEER is set forth in General Conditions paragraph 6.05 and may be supplemented in Section 01610, GENERAL EQUIPMENT REQUIREMENTS.

PART 11 - SUBCONTRACTORS, SUPPLIERS, AND OTHERS

11.1 Bidder shall submit with its Bid the names and business addresses of each proposed Subcontractor who will perform Work under these Bidding Documents in excess of 1/2 of 1 percent of the amount of the total Bid and shall list the portion of the Work (discipline and subcontract dollar amount) which will be done by such Subcontractor. If the Bidder fails to specify a Subcontractor for any portion of the Work to be performed under the Bidding Documents, the Bidder agrees to perform that portion of the Work itself, and further agrees that it is qualified to perform that portion of the Work.

11.2 Subcontractors, business addresses, and the portion of work each subcontractor will perform shall be listed in the table provided in Section 00310, List of Subcontractors, which shall be submitted with each Bid. Failure to submit this List of Subcontractors will be grounds for rejection of the Bid.

11.3 Subletting and Subcontracting Fair Practices Act:

Contractor shall comply with the requirements of the Subletting and Subcontracting Fair Practices Act, Chapter 4, Part 1, Division 2 of the Government Code, which include the following:

1. Contractor shall, in its bid or proposal, set forth:
 - a. The name, the location of the place of business, the California contractor license number, and public works contractor registration number issued pursuant to Section 1725.5 of the Labor Code of each subcontractor who will perform work or labor or render service to Contractor in or about the construction of the work or improvement, or a subcontractor licensed by the State of California who, under subcontract to Contractor, specially fabricates and installs a portion of the work or improvement according to detailed drawings contained in the plans and specifications, in an amount in excess of one-half of 1

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percent of Contractor's total bid or proposal.

b. The portion of the work that will be done by each subcontractor under this act. Contractor shall list only one subcontractor for each portion as is defined by the Contractor in its bid.

2. If Contractor fails to specify a subcontractor or specifies more than one subcontractor for the same portion of work to be performed under the Contract in excess of one-half of 1 percent of the Contractor's total bid, Contractor agrees that it is fully qualified to perform that portion itself, and that Contractor shall perform that portion itself.

3. Contractor may not substitute a person as subcontractor in place of the subcontractor listed in the original bid, except as provided in the Act.

PART 12 - MBE/WBE UTILIZATION AND DOCUMENTATION REQUIREMENTS

12.1 Bidders, including prospective Subcontractors, are required to follow certain procedures to ensure compliance with the affirmative action requirements set forth in these Bidding Documents and are hereby advised to familiarize themselves with the requirements and to initiate the compliance procedures at the earliest time possible. State and federal regulations require that certain notices be given and procedures be completed within specific minimum periods of time; compliance with the affirmative action requirements might not be achievable if there is any delay in starting the compliance procedures.

PART 13 - WAGE RATES

13.1 The Work under these Bidding Documents is to be paid for with a variety of State and Federal funds. Therefore, both State and Federal prevailing wage rates are applicable. Where a conflict occurs between the State and Federal prevailing wage rates for any job description, the higher rate shall be used.

13.2 Federal prevailing wage rates information is available at <http://www.wdol.gov/dba.aspx>. The successful Bidder agrees upon execution of this Agreement to post a copy at the site.

13.3 State of California prevailing wage rates information is available at <http://www.dir.ca.gov/OPRL/PWD/>. The successful Bidder agrees upon execution of this Agreement to post a copy at the site.

PART 14 - BID FORM

14.1 The Bid Form and other attachments are included with the Bidding Documents. No substitution of forms will be allowed.

14.2 All blanks on the Bid Form must be completed by typing or printing with black ink. All price information shall be shown in both words and figures where required. No changes shall be made in the phraseology of the forms.

14.3 Bids by corporations must be executed in the corporate name by the president or a vice-president (or other corporate officer accompanied by evidence of authority to sign) and the corporate seal must be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation must be shown above the signature.

14.4 Bids by partnerships must be executed in the partnership name and signed by a partner, whose title must appear on the line below the signature.

14.5 All names must be typed or printed on the line with the signature.

14.6 The Bid shall contain an acknowledgement of receipt of all Addenda (the numbers of which must be filled in on the Bid Form).

14.7 The address and telephone number for communications regarding the Bid must be shown.

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PART 15 - SUBMISSION OF BIDS

15.1 Bidders must bid on all schedules for their Bid to be considered responsive.

15.2 Bid Form and attachments may be photocopied for submission of Bids.

15.3 Submit Bids not later than the time prescribed, at the place, and in the manner set forth in the Advertisement for Bids. Enclose Bids in an opaque sealed envelope, marked with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted) and name and address of Bidder and accompanied by the Bid security and other required documents. If the Bid is sent through the mail or other delivery system, the sealed envelope shall be enclosed in a separate envelope with the notation "BID ENCLOSED" on the face of it. Bids must be made on the prescribed Bid Form provided and submitted with the attachments listed below.

15.4 Bidders shall complete and submit the following attachments with its Bid:

- Bid Form
- Authority to sign bid if signature is by agent other than officer of corporation, partner, or owner
- List of Subcontractors
- DWSRF Required Forms:
 - Certification of Nonsegregated Facilities
 - DBE Subcontractor Performance Form
 - DBE Subcontractor Utilization Form
 - Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion
 - Nondiscrimination Clause
 - Non-Collusion Affidavit
 - Equal Employment Opportunity Certification
 - Lobbying Certification
 - Drug-Free Workplace Certification
- American Iron and Steel Acknowledgement
- Bid Bond
- Power of Attorney for Surety's Agent to execute Bidder's Bond

15.5 Only one Bid from any individual, firm, partnership, or corporation, under the same or different names, will be considered. Should it appear to OWNER that any Bidder is interested in more than one Bid for Work contemplated, all Bids in which such Bidder is interested will be rejected.

PART 16 - MODIFICATION AND WITHDRAWAL OF BIDS

16.1 Bids may be modified or 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 at any time prior to the opening of Bids.

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16.2 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, that Bidder will be disqualified from further consideration on the Work to be provided under the Contract Documents.

PART 17 - OPENING OF BIDS

17.1 Bids will be opened and (unless obviously nonresponsive) read aloud publicly. A summary of the amounts of the Base Bids will be made available to Bidders within 7 days after the date of Bid opening.

PART 18 - BIDS TO REMAIN SUBJECT TO ACCEPTANCE

18.1 All Bids will remain subject to acceptance for 90 days after the date of the Bid opening, but OWNER may, in its sole discretion, release any Bid and return the Bid security prior to that date.

18.2 NOTICE OF INTENT TO AWARD – The OWNER will submit a Notice of Intent to Award within three days of the closing of the bidding period.

PART 19 - BASIS OF AWARD; AWARD OF CONTRACT

19.1 If the contract is to be awarded, OWNER will give Successful Bidder a Notice of Award within 90 days after the day of the Bid opening.

19.2 OWNER reserves its right to reject any or all Bids, including without limitation the rights to reject any or all nonconforming, nonresponsive, unbalanced or conditional Bids, and to reject the Bid of any Bidder if OWNER believes that it would not be in the best interest of the Project to make an award to that Bidder, whether because the Bid is not responsive or the Bidder is unqualified or of doubtful financial ability or fails to meet any other pertinent standard or criteria established by OWNER. OWNER also reserves the right to waive all informalities not involving price, time, or changes in the Work. Discrepancies in the quantity multiplied by unit price and the extended total amount will be resolved in favor of the quantity multiplied by unit price. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of the words.

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19.3 In evaluating Bids, OWNER will consider the qualifications of Bidders, 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. OWNER shall have the right to accept alternates in any order or combination unless otherwise provided in the Bidding Documents.

19.4 OWNER may consider the qualifications and experience of Subcontractors, Suppliers, and other persons and organizations proposed for those portions of the Work for which the identity was required. OWNER also may consider the operating costs, maintenance requirements, performance data, and guarantees of major items of materials and equipment proposed for incorporation in the Work when such data are required to be submitted prior to the Notice of Award.

19.5 OWNER may conduct such investigations as OWNER deems necessary to assist in Bid evaluation and to establish responsibility, qualifications, and financial ability of Bidders, proposed Subcontractors, Suppliers, and other persons and organizations to execute Work in accordance with the Bidding Documents to OWNER's satisfaction within the prescribed time.

19.6 If, at the time this contract is to be awarded, the total of the lowest acceptable Bid exceeds the funds then estimated by OWNER as available, OWNER may reject all Bids or take such other action as best serves OWNER's interests.

19.7 If the contract is to be awarded, it will be awarded to lowest Bidder whose evaluation by OWNER indicates to OWNER that the award will be in the best interests of OWNER.

19.8 In the event of failure of the Successful Bidder to sign the Agreement and provide an acceptable Performance and Payment Bond(s), insurance certificate(s), and other required documents, OWNER may award the contract to the next lowest responsive, responsible Bidder.

PART 20 - EXECUTION OF AGREEMENT

20.1 When OWNER gives a Notice of Award to Successful Bidder, it will be accompanied by unsigned copies of the Agreement and other appropriate documents. Within 15 days thereafter, CONTRACTOR shall sign and deliver the copies of the Agreement and attached documents to OWNER with the required Bonds. Within 10 days thereafter, OWNER shall deliver two fully executed copies to CONTRACTOR.

PART 21 - RETAINAGE

21.1 Provisions concerning retainage and CONTRACTORS' rights to deposit securities in lieu of retainage are set forth in the Agreement.

00100-10

PART 22 - SALES AND OTHER TAXES

22.1 All taxes, as required by the laws and statutes of the state and its political subdivisions, shall be paid by CONTRACTOR. Prices quoted in the Bid Form shall include all taxes.

PART 23 - PROTESTS

23.1 Any party with a direct financial interest adversely affected by any alleged bid irregularity at the Bid opening may file a protest with OWNER, where such protest is based on alleged violations of federal, state, or local law or ordinance, or alleged bid irregularity. A protest must:

23.1.1 be written

23.1.2 state the specific basis of the appeal.

23.1.3 request a determination of the protest issue, and

23.1.4 be filed no later than 72 hours before the scheduled Award of Contract by OWNER, as determined by the published agenda of the PARADISE IRRIGATION DISTRICT'S BOARD OF DIRECTORS. Any protest filed after this time will not be considered.

23.2 The party filing the protest must concurrently transmit a copy of all protest documents and any attachments to all other parties with a direct financial interest which may be adversely affected by the determination of the protest appeal.

23.3 OWNER will review the protest and make a determination.

PART 24 - PARADISE IRRIGATION DISTRICT'S PROCUREMENT POLICY

24.1 Refer to Paradise Irrigation District's Procurement Policy Chapter 12.1 for General Provisions and 12.3 for information pertaining to Construction and Capital Improvement Contracts. **LOOK FOR THIS ON PID'S WEBSITE**

+ + END OF SECTION + +

00100-12

Paradise Irrigation District
Zone A Pump Station and Transmission Main Project
WWE Project No. 17-041

December 2022
Bid Documents

SECTION 00120

BIDDER'S CHECKLIST

This checklist has been prepared and furnished to aid Bidders in including all necessary supporting information with their bid. Bidders' submittals shall include, but are not limited to, the following:

<u>Item</u>	<u>Checked</u>
Bid Form	_____
Addenda Acknowledged on Bid Form	_____
Contractor's License Number and Class Provided	_____
Authority to Sign Bid if Signature is by Agent Other Than Officer of Corporation, Partner, or Owner	_____
List Subcontractors	_____
<u>DWSRF Required Forms:</u>	
Certification of Nonsegregated Facilities	_____
DBE Subcontractor Performance Form	_____
DBE Subcontractor Utilization Form	_____
Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion	_____
Nondiscrimination Clause	_____
Non-Collusion Affidavit	_____
Equal Employment Opportunity Certification	_____
Lobbying Certification	_____
Drug-Free Workplace Certification	_____
American Iron and Steel Acknowledgement	_____
Bid Bond	_____
Power-of-Attorney for Surety's Agent to execute Bidder's Bond	_____
Confirmed Bond and Insurance Companies Ratings are in accordance with Supplemental Conditions, Par. SC-5.02.A.	_____

++ END OF SECTION ++

00120-1

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00120-2

NOTE TO BIDDER: Use BLACK ink for completing this Bid Form.

SECTION 00300

BID FORM

To: Paradise Irrigation District

Address: 6332 Clark Road,
Paradise, CA 95969

Project Identification: Zone A Pump Station and Transmission Main Project

1. BIDDER'S DECLARATION AND UNDERSTANDING.

1.1 This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm, or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization, or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; Bidder has not solicited or induced any person, firm, or corporation to refrain from bidding; and Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over OWNER.

1.2 In submitting this Bid, Bidder acknowledges and accepts CONTRACTOR's representations as more fully set forth in the Agreement Form.

1.3 In submitting this Bid, Bidder certifies Bidder is qualified to do business in the state where the Project is located as required by laws, rules, and regulations or, if allowed by statute, covenants to obtain such qualification prior to contract award.

2. CONTRACT EXECUTION AND BONDS.

2.1 The undersigned Bidder agrees, if this Bid is accepted, to enter into an Agreement with OWNER on the form included in the Bidding Documents to perform and furnish Work as specified or indicated in the Bidding Documents for the Contract Price derived from the Bid and within the Contract Times indicated in the Agreement and in accordance with the other terms and conditions of the Bidding Documents.

2.2 Bidder accepts the terms and conditions of the Bidding Documents.

3. INSURANCE.

3.1 Bidder further agrees that the Bid amount(s) stated herein includes specific consideration for the specified insurance coverages.

4. CONTRACT TIMES.

00300-1

4.1 Bidder agrees to accept Contract Times set forth in the Agreement Form.

5. LIQUIDATED DAMAGES.

5.1 Bidder accepts the provisions in the Agreement Form as to liquidated damages.

6. ADDENDA.

Bidder hereby acknowledges that it has received Addenda Nos. _____,

_____, _____, _____, _____, _____ (Bidder shall insert number of each Addendum received) and agrees that Addenda issued are hereby made part of the Bidding Documents, and Bidder further agrees that this Bid includes impacts resulting from said Addenda.

7. SUBCONTRACTORS.

7.1 Bidder agrees to submit with their Bid a listing of all subcontracting firms or businesses that will be awarded subcontracts for portions of the Work which equal or exceed one-half of one percent of the Total Contract Price.

8. SALES AND USE TAXES.

8.1 The Bidder agrees that all federal, state, and local sales and use taxes are included in the stated Bid prices for the Work.

9. BID

9.1 Bidder agrees to accept as full payment for the proposed Work within the Bidding Documents, based upon the undersigned's own estimate of quantities and costs and including sales, consumer, use, and other taxes, and overhead and profit, the bid quantities and totals stated in the following Bid Schedule.

Bid Schedule		
Item No.	Description	Total Cost
1.	Mobilization - Demobilization	\$
2.	Trench sheeting, shoring, and bracing as required by Section 6707 of the California Labor Code	\$
3.	Stormwater Pollution Prevention Plan	\$
4.	Traffic Control	\$
5.	3" Thick T-trench (52-60" wide) Repaving (Unit Price) \$/LF	
	Unit Price (\$/LF)	\$
	Bid Quantity 3670 LF	
	Total T-trench Repaving Bid Amount	
6.	3" Thick Lane Grind and Repave (Unit Price) \$/SF	
	Unit Price (\$/SF)	\$
	Bid Quantity 70,000 SF	
	3" Thick Lane Grind and Repave Bid Amount	
7.	Installation of 16" ZATM including Valves and Fittings	\$
8.	Leak Testing and Disinfection of 16" ZATM Pipeline and Appurtenances	\$
9.	Pump Station #2 Improvements (including Demolition)	\$
10.	Leak Testing and Disinfection of Pump Station #2 Piping and Appurtenances	\$
11.	ZAPS Civil Site Work (including site preparation, temporary shoring system, earthwork)	\$

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12.	ZAPS Building Foundation (including slurry backfill)	\$
13.	ZAPS Pumps and Installation	\$
14.	ZAPS Building Structure (CMU walls and Metal Roofing Structure)	\$
15.	ZAPS Heating, Ventilation and Air Conditioning	\$
16.	ZAPS Site Finishing (including gravel surfacing, stairway and sidewalk concrete, and asphalt road repair within the limits of the WTP)	\$
17.	ZAPS Floor Drain System	\$
18.	ZAPS Potable Water Piping, Valves, and Accessories (W1 System)	\$
19.	ZAPS Finished Water Piping and Valves and Installation (FW System)	\$
20.	Leak Testing and Disinfection of ZAPS W1 and FW Piping and Appurtenances	\$
21.	ZAPS Electrical and Instrumentation	\$
22.	SCADA Integration	\$
23.	All Remaining Work	\$
Total Bid Lines 1-23 (Basis for Award)		\$

All other associated items of work and incidentals that are required to complete this project and provide a fully functioning facility in accordance with the contract documents are considered to be included in the Bid Schedule items and no additional compensation will be made by the District.

10. SURETY.

10.1 If Bidder is awarded a construction contract from this Bid, the surety who provides the Performance and Payment Bond(s) shall be:

Whose address is

00300-4

Street

City

State

Zip

11. LICENSE.

11.1 Class _____, California Contractor License No.: _____.

12. BIDDER.

An Individual

By _____
(Individual's name and signature)

A Partnership

By _____
(Partnership name)

(Name and signature of general partner)

(Title)

A Corporation

By _____
(Corporation name)

(State of incorporation)

By _____
(Name and signature of person authorized to sign)

(Title)

(Corporate Seal)

00300-5

A Joint Venture

By _____
(Business name)

(Name and signature of person authorized to sign)

By _____
(Business name)

(Name and signature of person authorized to sign)

(Each joint venturer must sign. The manner of signing each individual, partnership, and corporation that is a party to the joint venture should be in the manner indicated above.)

Name, Phone Number, and Address for receipt of official communications and for additional information on this Bid:

SUBMITTED ON _____, 20__.

+ + END OF SECTION + +

00300-6

SECTION 00310
(Required to Accompany Bid)

LIST OF SUBCONTRACTORS

PART 1 - GENERAL

1.1 SUBLETTING AND SUBCONTRACTING FAIR PRACTICES ACT

- A. Contractor shall comply with the requirements of the Subletting and Subcontracting Fair Practices Act, Chapter 4, Part 1, Division 2 of the Government Code, which include the following:
1. Contractor shall, in its bid or proposal, set forth:
 - a. The name, the location of the place of business, the California contractor license number, and public works contractor registration number issued pursuant to Section 1725.5 of the Labor Code of each subcontractor who will perform work or labor or render service to Contractor in or about the construction of the work or improvement, or a subcontractor licensed by the State of California who, under subcontract to Contractor, specially fabricates and installs a portion of the work or improvement according to detailed drawings contained in the plans and specifications, in an amount in excess of one-half of 1 percent of Contractor's total bid or proposal.
 - b. The portion of the work that will be done by each subcontractor under this act. Contractor shall list only one subcontractor for each portion as is defined by the Contractor in its bid.
 2. If Contractor fails to specify a subcontractor or specifies more than one subcontractor for the same portion of work to be performed under the Contract in excess of one-half of 1 percent of the Contractor's total bid, Contractor agrees that it is fully qualified to perform that portion itself, and that Contractor shall perform that portion itself.
 3. Contractor may not substitute a person as subcontractor in place of the subcontractor listed in the original bid, except as provided in the Act.

00310-1

(Required to Accompany Bid)

California State Water Resources Control Board Division of Drinking Water-Safe Drinking Water State Revolving Fund

PROJECT INFORMATION

Water System Name: Paradise Irrigation District

Project Name: Zone A Pump Station and Transmission Main Project

Project Number: N/A

Data Universal Numbering System (DUNS) Number: 049302371

Principal Contact: Water Works Engineers / Sami Kader / Principal

Firm Name / Contact Name / Title

760 Cypress Avenue, Suite 201, Redding, CA 96001 / (530)-243-2113 / samik@wwengineers.com

Firm Address/ Phone Number / Email Address

CERTIFICATION OF NONSEGREGATED FACILITIES

[Note: This certification is required by 41 CFR 60-1.8 (b) and/or as required by the May 9, 1967 Order (32 F.R. 7439, May 19, 1967) and is applicable to all California SDWSRF assisted construction contracts and subcontracts with a price exceeding \$10,000 which are not exempt from the Equal Opportunity Clause.]

The federally assisted construction contractor certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The federally assisted construction contractor certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The federally assisted construction contractor agrees that a breach of this certification is a violation of the Equal Opportunity Clause in this contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise.

The federally assisted construction contractor agrees that (except where he has obtained identical certifications from proposed subcontractors for specified time period) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity Clause, and that he will retain such certifications in his files.

Signature of Authorized Representative

Date

Name and Title of Authorized representative (Print or Type)

Name of Prospective Construction Contractor or Subcontractor (Print or Type)

Address and Telephone Number of Prospective Construction Contractor or Subcontractor

Employer Identification Number of Prospective Construction Contractor or Subcontractor

Note: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001

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(Required to Accompany Bid)

California State Water Resources Control Board Division of Drinking Water-Safe Drinking Water State Revolving Fund

PROJECT INFORMATION

Water System Name: Paradise Irrigation District

Project Name: Zone A Pump Station and Transmission Main Project

Project Number: N/A

Data Universal Numbering System (DUNS) Number: 049302371

Principal Contact: Water Works Engineers / Sheila Magladry / Associate Engineer

Firm Name / Contact Name / Title

760 Cypress Avenue, Suite 201, Redding, CA 96001 / (530)-243-2113 / sheilam@wwengineers.com

Firm Address/ Phone Number / Email Address

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion

-Prime Contractors and Subcontractors-

(1) The contractor certifies, by submission of this proposal, that it and its principals:

- (a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal agencies;
- (b) Have not within a three-year period preceding this proposal 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 (1)(b) of this certification; and
- (d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

(2) Where the contractor is unable to certify to any of the statements in this certification, such contractor shall attach an explanation to this proposal*.

*Exceptions will not necessarily result in denial of award, but will be considered in determining bidder responsibility. For any exception noted, indicate to whom it applies, initiating agency, dates of action, and the type of violation.

I, the official named below, hereby swear that I am duly authorized to legally bind the prospective contractor to the above described certification. I am fully aware that this certification is made under penalty of perjury under the laws of the State of California.

Signature/Authorized Certifying Official

Typed Name and Title

Prospective Contractor/Organization

Date Signed

State Contractor License No. (if any)

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(Required to Accompany Bid)

California State Water Resources Control Board Division of Drinking Water-Safe Drinking Water State Revolving Fund

PROJECT INFORMATION

Water System Name: Paradise Irrigation District

Project Name: Zone A Pump Station and Transmission Main Project

Project Number: N/A

Data Universal Numbering System (DUNS) Number: 049302371

Principal Contact: Water Works Engineers / Sami Kader / Principal

Firm Name / Contact Name / Title

760 Cypress Avenue, Suite 201, Redding, CA 96001 / (530)-243-2113 / samik@wwengineers.com

Firm Address/ Phone Number / Email Address

NONDISCRIMINATION CLAUSE

1. During the performance of this contract, contractor and its subcontractors shall not unlawfully discriminate against any employee or applicant for employment because of race, religion, color, national origin, ancestry, physical handicap, medical condition, marital status, age (over 40) or sex. Contractors and subcontractors shall insure that the evaluation and treatment of their employees and applicants for employment are free of such discrimination. Contractors and subcontractors shall comply with the provisions of the Fair Employment and Housing Act (Government Code Section 12900 et seq.) and the applicable regulations promulgated thereunder (California Administrative Code, Title 2, Section 7285.0 et seq.). The applicable regulations of the Fair Employment and Housing Commission implementing Government Code, Section 12900, set forth in Chapter 5 of Division 4 of Title 2 or the California Administrative Code are incorporated into this contract by reference and made a part hereof as if set forth in full. Contractor and its subcontractor shall give written notice of their obligations under this clause to labor organizations with which they have a collective bargaining or other agreement.
2. This contractor shall include the nondiscrimination and compliance provisions of this clause in all subcontracts to perform work under the contract.

THE UNDERSIGNED CERTIFIES THAT THE CONTRACTOR WILL COMPLY WITH THE ABOVE REQUIREMENTS.

CONTRACTOR OR
SUBCONTRACTOR NAME: _____

CERTIFIED BY:

NAME: _____ TITLE: _____

SIGNATURE: _____ DATE: _____

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(Required to Accompany Bid)

California State Water Resources Control Board Division of Drinking Water-Safe Drinking Water State Revolving Fund

PROJECT INFORMATION

Water System Name: Paradise Irrigation District

Project Name: Zone A Pump Station and Transmission Main Project

Project Number: N/A

Data Universal Numbering System (DUNS) Number: 049302371

Principal Contact: Water Works Engineers / Sami Kader / Principal

Firm Name / Contact Name / Title

760 Cypress Avenue, Suite 201, Redding, CA 96001 / (530)-243-2113 / samik@wwengineers.com

Firm Address/ Phone Number / Email Address

NON-COLLUSION AFFIDAVIT*

TO BE EXECUTED BY BIDDER AND SUBMITTED WITH BID

State of California

County of _____,

_____ ; being first duly sworn, deposes and says that he or she is

_____ of _____ 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 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 the effectuate a collusive or sham bid.

By _____

Subscribed and sworn to before me on _____

(Notary Public)

*Note: Public Contracts Code 7106 requires this noncollusion affidavit be submitted with a bid for any public works contract of a public entity.

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(Required to Accompany Bid)

California State Water Resources Control Board Division of Drinking Water-Safe Drinking Water State Revolving Fund

PROJECT INFORMATION

Water System Name: Paradise Irrigation District

Project Name: Zone A Pump Station and Transmission Main Project

Project Number: N/A

Data Universal Numbering System (DUNS) Number: 049302371

Principal Contact: Water Works Engineers / Sheila Magladry / Associate Engineer

Firm Name / Contact Name / Title

760 Cypress Avenue, Suite 201, Redding, CA 96001 / (530)-243-2113 / sheilam@wwengineers.com

Firm Address/ Phone Number / Email Address

(THE BIDDER'S EXECUTION ON THE SIGNATURE PORTION OF THIS PROPOSAL
SHALL ALSO CONSTITUTE AN ENDORSEMENT AND EXECUTION OF THOSE
CERTIFICATIONS WHICH ARE A PART OF THIS PROPOSAL)

Equal Employment Opportunity Certification

(The Bidder must fill-in and check the appropriate blank space)

The bidder _____ (Name), proposed
subcontractor _____ (Name), hereby certifies that he/she has _____,
has not _____, participated in a previous contract or subcontract subject to the equal opportunity clauses, as required by
executive order 10925, 11114, or 11246, and that, where required, he has filed with the Joint reporting Committee, the Director of
the Office of Federal Contract Compliance, a Federal Government contracting or administering agency, or the former President's
Committee on Equal Opportunity, all reports due under applicable filing requirements.

Note:

The above certification is required by the Equal Employment Opportunity regulations of the Secretary of Labor (42 CFR 60-1.7(b) (1)), and must be submitted by bidders and proposed subcontractors only in connection with contracts and subcontracts which are subject to the equal opportunity clause. Contracts and subcontracts which are exempt from the equal opportunity clause are set forth in 41 CFR 60-1.5. (Generally, only contracts or subcontracts of \$10,000 or under are exempt.)

Currently, Standard Form 100 (EE)-1 is the only report required by the Executive Orders or their implementing regulations.

Proposed prime contractors and subcontractors who have participated in a previous contract or subcontract subject to the Executive Orders and have not filed the required reports should note that 41 CFR 60-1.7(b) (1) prevents the awards of contracts and subcontracts unless such contractor submits a report covering the delinquent period or such other period specified by the Federal Highway Administration or by the director, Office of Federal Contract Compliance, U.S. Department of Labor.

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(Required to Accompany Bid)

California State Water Resources Control Board Division of Drinking Water-Safe Drinking Water State Revolving Fund

PROJECT INFORMATION

Water System Name: Paradise Irrigation District

Project Name: Zone A Pump Station and Transmission Main Project

Project Number: N/A

Data Universal Numbering System (DUNS) Number: 049302371

Principal Contact: Water Works Engineers / Sami Kader / Principal

Firm Name / Contact Name / Title

760 Cypress Avenue, Suite 201, Redding, CA 96001 / (530)-243-2113 / samik@wwengineers.com

Firm Address/ Phone Number / Email Address

LOBBYING CERTIFICATION

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 an 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, an officer or employee of Congress, or an employee of 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 Form to Report Lobbying," in accordance with its instructions.
- (3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients 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 imposed by Section 1352, Title 31, of the U.S. Code. 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 OF AUTHORIZED REPRESENTATIVE

DATE

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SECTION 00330
(Required to Accompany Bid)

AMERICAN IRON AND STEEL ACKNOWLEDGEMENT

The Contractor acknowledges to and for the benefit of the District and the State of California (the "State") that it understands the goods and services under this Agreement are being funded with monies made available by the Drinking Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel;" that requires all of the iron and steel products used in the project to be produced in the United States ("American Iron and Steel Requirement") including iron and steel products provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the District and the State that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, as may be requested by the District or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the District or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the District or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the District). While the Contractor has no direct contractual privity with the State, as a lender to the District for the funding of its project, the District and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

Signed this _____ day of _____, 20____.

Name of Bidder

Contractor's License No.

Expiration Date

Signature of Bidder

Title of Signatory

++ END OF SECTION ++

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SECTION 00400

BID BOND

BOND NO. _____

KNOW ALL MEN BY THESE PRESENTS, that _____

hereinafter called the PRINCIPAL, and _____

a corporation duly organized under the laws of the State of _____

having its principal place of business at _____

_____ in the State of _____

and authorized to do business in the State of California, as SURETY,

are held and firmly bound unto _____,

as OWNER, hereinafter called the OBLIGEE, in the sum of _____

_____ DOLLARS (\$ _____)

for the payment for which we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS BOND IS SUCH THAT:

WHEREAS, the PRINCIPAL is herewith submitting his or its Bid for _____

_____ said Bid, by reference thereto, being hereby made a part hereof.

NOW, THEREFORE, if said Proposal shall be rejected, or in the alternate, if said Proposal shall be accepted and the PRINCIPAL shall sign and deliver a Contract to OBLIGEE, in the form of Contract attached hereto and shall execute and deliver Performance and Payment Bonds in the forms attached hereto (all completed in accordance with said Proposal) to OBLIGEE, and shall in all other respects perform the agreement created by the acceptance of said Proposal;

Then, this obligation shall be void, otherwise the same shall remain in force and effect; it being expressly understood and agreed that the liability of the SURETY for any and all default of the PRINCIPAL hereunder shall be the amount of this obligation as herein stated.

The SURETY, for value received, hereby stipulates and agrees that the obligations of said SURETY and its bond shall be in no way impaired or affected by any extension of the

00400-1

time within which the Owner may accept such Proposal, and said SURETY does hereby waive notice of any such extension.

IN WITNESS THEREOF, the above-bounded parties have executed this instrument under their several seals, the name and corporate seal of each corporate party being hereto affixed and those presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Signed and sealed this _____ day of _____, 20__.

PRINCIPAL

By _____

SURETY

By _____
Attorney-In-Fact

The rate of premium on this bond is _____ per thousand.

Total amount of premium charged \$ _____.

+ + END OF SECTION + +

00400-2

SECTION 00500
AGREEMENT FORM

This Agreement is by and between **Paradise Irrigation District** (“Owner”) and _____ (“Contractor”).

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

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:

- Mobilization and Demobilization to the site, including all temporary construction facilities
- Trenching, sheeting, shoring, and bracing as required by Section 6707 of the California Labor Code
- Stormwater Pollution Prevention Plan
- Traffic Control measures on Pine Needle, Old Skyway, and New Skyway.
- T-trench (52” – 60” Wide) Repaving (Unit Price, \$/LF)
- 3” thick Lane Grind and Repave (Unit Price, \$/SF)
- Installation of 16” ZATM including valves and fittings
- Leak Testing and Disinfection of ZATM pipeline and appurtenances
- Pump Station #2 improvements
- Leak Testing and Disinfection of Pump Station #2 piping and appurtenances
- ZAPS Civil Site Work
- ZAPS Building Foundation
- ZAPS Pumps and Installation
- ZAPS Building Structure
- ZAPS HVAC
- ZAPS Site finishing work including gravel surfacing, stairway and sidewalk concrete, asphalt road repair within the limits of the WTP)
- ZAPS floor drain system
- ZAPS potable water system (W1)
- ZAPS finished water system (FW)
- Leak Testing and Disinfection of ZAPS W1 and FW piping and appurtenances
- Electrical and Instrumentation installation
- SCADA Integration
- All remaining work including identification devices

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ARTICLE 2—THE PROJECT

- 2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: **Zone A Pump Station and Transmission Main Project.**

ARTICLE 3—ENGINEER

- 3.01 The Owner has retained **Water Works Engineers** (“Engineer”) to act as Owner’s representative, assume all duties and responsibilities of Engineer, and have the rights and authority assigned to Engineer in the Contract.
- 3.02 The part of the Project that pertains to the Work has been designed by **Water Works Engineers.**

ARTICLE 4—CONTRACT TIMES

4.01 *Contract Times: Working Days*

- A. The Work will be substantially complete within **200** working 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 **220** working days after the date when the Contract Times commence to run.
- B. A portion of the ZATM pipeline (from Station 23+19.30 to 70+00, approximately 4681-ft) shall be substantially complete in **70** working days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions.

4.02 *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 Contract Times, as duly modified. 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 **\$1,500** for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for Substantial Completion, until the Work is substantially complete.
- B. If Owner recovers liquidated damages for a delay in completion by Contractor, then such liquidated damages are Owner’s sole and exclusive remedy for such delay, and Owner is precluded from recovering any other damages, whether actual, direct, excess, or consequential, for such delay.

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 Work other than Unit Price Work, a lump sum of \$_____.

All specific cash allowances are included in the above price in accordance with Paragraph 13.02 of the General Conditions.

B. 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 times the actual quantity of that item).

Unit Price Work					
Item No.	Description	Unit	Estimated Quantity	Unit Price	Extended Price
				\$	\$
				\$	\$
				\$	\$
				\$	\$
				\$	\$
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.

C. Total of Lump Sum Amount and Unit Price Work (subject to final Unit Price adjustment) \$_____.

D. For all Work, at the prices stated in Contractor's Bid, attached hereto as an exhibit.

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 the basis of Contractor's Applications for Payment on or about the 10th day of each month during performance of the Work as provided in

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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. 5 percent of the value of the Work completed (with the balance being retainage).

- 1) If 50 percent or more of the Work has been 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. 5 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 95 percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less the 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, Owner shall pay the remainder of the Contract Price in accordance with Paragraph 15.06 of the General Conditions.

6.04 *Consent of Surety*

- A. Owner will not make final payment, or return or release retainage at Substantial Completion or any other time, unless Contractor submits written consent of the surety to such payment, return, or release.

ARTICLE 7—CONTRACT DOCUMENTS

7.01 *Contents*

- A. The Contract Documents consist of all of the following:

- Volume 1 – Bid Requirements and Specifications

- Volume 2 – Drawings (11-inch by 17-inch)

- B. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:

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- a. Notice to Proceed.
 - b. Work Change Directives.
 - c. Change Orders.
 - d. Field Orders.
 - e. Warranty Bond, if any.
- C. The Contract Documents listed in Paragraph 7.01.A are attached to this Agreement (except as expressly noted otherwise above).
- D. There are no Contract Documents other than those listed above in this Article 7.
- E. The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

ARTICLE 8—REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

8.01 Contractor's Representations

- A. In order to induce Owner to enter into this Contract, Contractor makes the following representations:
- 1. Contractor has examined and carefully studied the Contract Documents, including Addenda.
 - 2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
 - 3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
 - 4. Contractor has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.
 - 5. Contractor has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.
 - 6. 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 Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and

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procedures of construction to be employed by Contractor; and (c) Contractor's safety precautions and programs.

7. 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.
8. 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.
9. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
10. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
11. 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.

8.02 *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 8.02:
 1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything 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.

8.03 *Standard General Conditions*

- A. Owner stipulates that if the General Conditions that are made a part of this Contract are EJCDC® C-700, Standard General Conditions for the Construction Contract (2018), published by the Engineers Joint Contract Documents Committee, and if Owner is the party that has

furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor, through a process such as highlighting or “track changes” (redline/strikeout), or in the Supplementary Conditions.

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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:

(typed or printed name of organization)

(typed or printed name of organization)

By:

(individual's signature)

By:

(individual's signature)

Date:

(date signed)

Date:

(date signed)

Name:

(typed or printed)

Name:

(typed or printed)

Title:

(typed or printed)

Title:

(typed or printed)

(If **[Type of Entity]** is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest:

(individual's signature)

Attest:

(individual's signature)

Title:

(typed or printed)

Title:

(typed or printed)

Address for giving notices:

Address for giving notices:

Designated Representative:

Name:

(typed or printed)

Designated Representative:

Name:

(typed or printed)

Title:

(typed or printed)

Title:

(typed or printed)

Address:

Address:

Phone:

Phone:

Email:

Email:

(If **[Type of Entity]** is a corporation, attach evidence of authority to sign. If **[Type of Entity]** is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)

License No.:

(where applicable)

State:

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++ END OF SECTION ++

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SECTION 00600

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: That

WHEREAS, the Paradise Irrigation District, hereinafter designated as the "Owner" has awarded to _____

as the

(Principal)

"Principal," a contract for the construction of _____ for the Owner; and

WHEREAS, said Principal is required under the terms of said contract to furnish a bond for the faithful performance of said contract;

NOW, THEREFORE, we the PRINCIPAL, and _____

as Surety are held and firmly bound unto the Owner in the penal sum of _____

Dollars

(\$_____), lawful money of the United States for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that if said Principal, his or its heirs, executors, administrators, successors or assigns, shall in all things stand to and abide by, and well and truly keep and perform the covenants, conditions and agreements in said contract and any alteration therefore made as therein provided, on his or their part, to be kept and performed at the time and in the manner therein specified and in all respects according to their true intent and meaning; shall guarantee and shall repair and replace defective materials and workmanship therein, for all work required under the said contract and shall indemnify and save harmless the Owner, their officers and agents as therein stipulated, then this obligation shall become null and void; otherwise it shall be and remain in full force and virtue.

Neither the Owner's acceptance of any work by, or on behalf of, Principal, nor the Owner or its agents' repair of any defects arising in the work, shall be deemed a waiver of any Owner's rights under this bond, where defects, whether resulting from defective materials or defective workmanship, are discovered after the Owner's issuance of its Notice of Completion. Principal and Surety shall remain jointly and severally liable for such defects for the period of time set forth in the Code of Civil Procedure Sections 337 and 337.15, or any successor statute or amendment thereto.

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And the Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the work to be performed thereunder or the Specifications accompanying the same shall in any way affect its obligations on this bond and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the work or to the Specifications.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their seals this _____ day of _____, 20____, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representatives, pursuant to authority of its governing body.

Principal

By: _____

Surety

By: _____
(Attach Acknowledgment)

NOTE: The principal amount of this bond shall not be less than 100% of the total contract price.

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SECTION 00605

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: That we (1) _____
_____ a (2) _____

hereinafter called "Principal" and (3) _____
of _____ State of _____ hereinafter called the
"Surety," are held and firmly bound unto Paradise Irrigation District, hereinafter called
"Owner," in the penal sum of _____ dollars (\$_____) in
lawful money of the United States, for the payment of which sum well and truly to be made,
we bind ourselves, our heirs, executors, administrators and successors, jointly and severally,
firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that WHEREAS, the Principal entered into a
certain Contract with the Owner, dated the _____ day of _____, 20____, a
copy of which is hereto attached and made a part hereof for the construction of the -----
-----,
-----, including all appurtenances thereto, all as set forth in the
Contract Documents entitled, "-----
PROJECT ".

NOW, THEREFORE, if the Principal, or a Subcontractor, fails to pay (1) persons or entities
authorized to make claims under Civil Code Section 9100, (2) amounts due under the
Unemployment Insurance Code with respect to work or labor performed under Contract, or (3)
for any amounts required to be deducted, withheld, and paid over to the Employment
Development Department from the wages of employees of the Contractor and Subcontractors
pursuant to §13020 of the Unemployment Insurance Code with respect to the work and labor,
then surety will pay for the same, and also, in case suit is brought upon this bond, a
reasonable attorney's fee, to be fixed by the Court,

PROVIDED, FURTHER, Surety's obligation hereunder shall inure to the benefit of any of the
persons or entities authorized to make claims under Civil Code § 9100 so as to give a right of
action to those persons or entities or their assigns in any suit brought upon this bond, and

PROVIDED, FURTHER, that no final settlement between the Owner and the Contractor shall
abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

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IN WITNESS WHEREOF, this instrument is executed in two (2) counter-parts, each one of which shall be deemed an original, this the ____ day of _____, 20____.

ATTEST:

_____ (Principal) Secretary	_____ Principal	,
(Seal)	By _____	,

_____ (Witness as to Principal)	_____	,
------------------------------------	-------	---

_____ (Address)	_____ (Address)	,
--------------------	--------------------	---

ATTEST:

_____ (Surety) Secretary	_____ Surety	,
(Seal)		

_____ (Witness as to Surety)	By _____ Attorney-in-Fact	,
---------------------------------	------------------------------	---

_____ (Address)	_____ (Address)	,
--------------------	--------------------	---

NOTE: Date of Bond must not be prior to date of Contract:

- (1) Correct name of Contractor.
- (2) A Corporation, A Partnership, or an Individual, as case may be.
- (3) Correct name of Surety.
- (4) If Contractor is Partnership, all partners should execute bond.

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared By



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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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 document prepared by Contractor, in a form acceptable to Engineer, to request 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; 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; 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.

- 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.
 - c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.
 - d. 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), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations 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 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. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.
 - 21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the

recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

22. *Engineer*—The individual or entity named as such in the Agreement.
23. *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.
24. *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.
 - a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.
 - b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.
 - c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.
25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
26. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.
27. *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.
28. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.
29. *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.
30. *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.
31. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor's plan to accomplish the Work within the Contract Times.
32. *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.

33. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.
34. *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.
35. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals.
36. *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.
37. *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.
38. *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 or areas furnished by Owner which are designated for the use of Contractor.
39. *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.
40. *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.
41. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.
42. *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 of such Work.

43. *Successful Bidder*—The Bidder to which the Owner makes an award of contract.
44. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.
45. *Supplier*—A manufacturer, fabricator, supplier, distributor, 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.
46. *Technical Data*
- a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.
 - b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.
 - c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.
47. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.
48. *Unit Price Work*—Work to be paid for on the basis of unit prices.
49. *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.
50. *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 Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.
- B. *Intent of Certain Terms or Adjectives:* 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:* The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.
- D. *Defective:* The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
 - 1. does not conform to the Contract Documents;
 - 2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
 - 3. 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 Paragraph 15.04).
- E. *Furnish, Install, Perform, Provide*
 - 1. The word “furnish,” when used in connection with services, materials, or equipment, means 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, means 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, means 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. *Contract Price or Contract Times*: References to a change in “Contract Price or Contract Times” or “Contract Times or Contract Price” or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term “or both” is not expressed.
- G. 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 Performance and Payment Bonds; Evidence of Insurance*

- A. *Performance and Payment Bonds*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).
- B. *Evidence of Contractor’s Insurance*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.
- C. *Evidence of Owner’s Insurance*: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), 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 signed 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 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 *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 the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will 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.
 - 4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 *Electronic Transmittals*

- A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.
- B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.
- C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents 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 Electronic Documents.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one Contract Document 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 versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will 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.
- F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will 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.
- G. Nothing in the Contract Documents creates:
 - 1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or
 - 2. 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.

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, means 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, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer 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 or Engineer 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 issued pursuant to Paragraph 11.01.
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 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 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 in writing 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.

- 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 notify Owner and Contractor in writing 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 versions, 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 precludes 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 30th 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 60th day after the day of Bid opening or the 30th 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 may 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.
 - 2. Proposed adjustments in the Progress Schedule that will change the Contract Times must 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 will 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 Contract Price or 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. Such an adjustment will 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 third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and
 - 4. Acts of war or terrorism.

- D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:
1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.
 2. Contractor shall not be entitled to an adjustment in Contract Price 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. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.
 3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.
- E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:
1. The circumstances that form the basis for the requested adjustment;
 2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;
 3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;
 4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and
 5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.
- Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.
- F. 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, together with the provisions of Paragraphs 4.05.D and 4.05.E.
- G. Paragraph 8.03 addresses 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.

ARTICLE 5—SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

- A. Owner shall furnish the Site. Owner shall notify Contractor in writing 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, or to improvements, structures, utilities, or similar facilities located at such adjacent lands 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 7.13, 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 in a court of competent jurisdiction; 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 will 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 of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;
2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and
3. Technical Data contained in such reports and drawings.

- B. *Underground Facilities:* Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

- C. *Reliance by Contractor on Technical Data:* 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 Paragraph 1.01.A.46.b.

- D. *Limitations of Other Data and Documents:* 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;
 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;
 3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or
 4. 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:
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;
 2. is of such a nature as to require a change in the Drawings or Specifications;
 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 whether it is necessary for Owner to obtain 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; 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. *Early Resumption of Work:* If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.
- E. *Possible Price and Times Adjustments*
1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, 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 subject to the provisions of Paragraphs 4.05.D and 4.05.E.
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;
 - 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 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, then any such adjustment will 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, 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.
- F. *Underground Facilities; Hazardous Environmental Conditions:* Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 *Underground Facilities*

- A. *Contractor's Responsibilities:* Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:
1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;
 2. complying with applicable state and local utility damage prevention Laws and Regulations;

3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;
 4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
 5. 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 on the Drawings, or was not shown or indicated on the Drawings 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), notify Owner and Engineer in writing regarding such Underground Facility.
- C. *Engineer's Review:* Engineer will:
1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;
 2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;
 3. obtain any pertinent cost or schedule information from Contractor; 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
 4. 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. *Early Resumption of Work:* If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.
- F. *Possible Price and Times Adjustments*
1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown

or indicated on the Drawings, 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. 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;
 - b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and
 - c. 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, then any such adjustment will 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, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.
 4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings:* The Supplementary Conditions identify:

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;
2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; 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 on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. 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;
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, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, 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. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.
- 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, 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 obligates 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 obligates 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 Contractor's obligations under the Contract. These bonds must 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 terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.
- B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.
- C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or

Regulations, and must be issued and signed by a surety named in “Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies” as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, 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 must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

- D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.
- E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.
- F. 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.
- G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.
- H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

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. Alternative forms of insurance coverage, including but not limited to self-insurance and “Occupational Accident and Excess Employer’s Indemnity Policies,” are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.
- D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages 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, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by

Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.

- E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages 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, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.
- F. 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, will not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.
- G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner's option, may purchase and maintain Owner's own liability insurance. 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.
- H. Contractor shall require:
 - 1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and
 - 2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.
- I. If either party does not purchase or maintain 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.
- J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.
- K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) 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 will be adjusted accordingly.

- L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.
- M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.
- N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, 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 and Engineer.

6.03 *Contractor's Insurance*

- A. *Required Insurance:* Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.
- B. *General Provisions:* The policies of insurance required by this Paragraph 6.03 as supplemented must:
 - 1. include at least the specific coverages required;
 - 2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;
 - 3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, 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;
 - 4. apply with respect to the performance of the Work, whether such performance is 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; and
 - 5. include all necessary endorsements to support the stated requirements.
- C. *Additional Insureds:* The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:
 - 1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;
 - 2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;
 - 3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);

4. not seek contribution from insurance maintained by the additional insured; and
5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.04 *Builder's Risk and Other 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 Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.
- B. *Property Insurance for Facilities of Owner Where Work Will Occur*: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.
- C. *Property Insurance for Substantially Complete Facilities*: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.
- 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 advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.
- E. *Insurance of Other Property; Additional Insurance*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. 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 6.04, it may do so at Contractor's expense.

6.05 *Property Losses; Subrogation*

- A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer 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.

1. 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, risks, 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 individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater 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.
 2. None of the above waivers extends 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. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, 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, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.
1. 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 all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.
- C. The waivers in this Paragraph 6.05 include the waiver of rights 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 insured peril, risk, or cause of loss.
- D. Contractor shall be responsible for assuring that each Subcontract 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 fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

6.06 *Receipt and Application of Property Insurance Proceeds*

- A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 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 6.04 shall maintain such proceeds in a segregated account, and 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, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *Contractor's Means and Methods of Construction*

- A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.
- B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 *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.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 *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 maintain good discipline and order at the Site.

- B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.
- C. 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 will 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.

7.04 *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 must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will 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 must 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.

7.05 *"Or Equals"*

- A. *Contractor's Request; Governing Criteria:* Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, 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 equipment or material, or items from other proposed Suppliers, under the circumstances described below.
 - 1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:
 - a. in the exercise of reasonable judgment Engineer determines that the proposed item:
 - 1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

- 2) 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) has a proven record of performance and availability of responsive service; and
 - 4) is not objectionable to Owner.
- b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:
- 1) there will be no increase in cost to the Owner or increase in Contract Times; and
 - 2) the item 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 will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.
- E. *Treatment as a Substitution Request*: If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 Substitutes

- A. *Contractor's Request; Governing Criteria*: Unless the specification or description of an item of equipment or material 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 equipment or material under the circumstances described below. To the extent possible such requests must 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 equipment or material from anyone other than Contractor.
 2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.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 equipment or material that Contractor seeks to furnish or use. The application:
 - a. will 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 the item specified; and
 - 3) be suited to the same use as the item 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 the item specified; and
 - 2) available engineering, sales, maintenance, repair, and replacement services.
 - d. will 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 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 will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 *Concerning Subcontractors and Suppliers*

- A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.
- B. Contractor shall retain specific Subcontractors and Suppliers 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 or Supplier 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 5 days.
- E. Owner may require the replacement of any Subcontractor or Supplier. 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 or Suppliers 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 or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.
- F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, 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 or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

- 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 solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.
- J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.
- K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.
- L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.
- M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *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 an 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 will be disclosed 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.

7.09 *Permits*

- A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy. 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.

7.10 *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.

7.11 *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. 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 is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.
- C. Owner or Contractor may give written 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 written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.12 *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.

7.13 *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.
- B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.
- C. 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.
- D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.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).
- E. 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.
- F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that 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.
- G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.
- H. 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.

- I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).
- J. Contractor's duties and responsibilities for safety and protection will 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.

7.14 *Hazard Communication Programs*

- A. Contractor shall be responsible for coordinating any exchange of safety data sheets (formerly known as 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 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 by an emergency, or are required as a result of Contractor's response to an emergency. If Engineer determines that a change in the Contract Documents is required because of an emergency or Contractor's response, a Work Change Directive or Change Order will be issued.

7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

- 1. Before submitting a Shop Drawing or Sample, Contractor shall:
 - a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
 - b. determine and verify:
 - 1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;
 - 2) 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
 - 3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;
 - c. confirm that the Submittal is complete with respect to all related data included in the Submittal.
- 2. Each Shop Drawing or Sample must 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.

3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.
- B. *Submittal Procedures for Shop Drawings and Samples:* Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.
1. *Shop Drawings*
 - a. Contractor shall submit the number of copies required in the Specifications.
 - b. Data shown on the Shop Drawings must 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.C.
 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.C.
 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. *Engineer's Review of Shop Drawings and Samples*
1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. 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, comply with the requirements of 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 will 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 or other appropriate Contract modification.

5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 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, will 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 or Sample will 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.C.4.

D. Resubmittal Procedures for Shop Drawings and Samples

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 Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.
3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

E. Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:
 - a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.
 - b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.
 - c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.

- d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.
- 2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03, 2.04, and 2.05.
- F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

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 is entitled to rely on Contractor's warranty and guarantee.
- B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:
 - 1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and
 - 2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.
- C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
 - 1. abuse, or improper modification, 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.
- D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:
 - 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. The end of the correction period established in Paragraph 15.08;
 - 8. Any inspection, test, or approval by others; or

9. Any correction of defective Work by Owner.
- E. 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 will 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 losses, damages, costs, and judgments (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 from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage 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 will 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.

7.19 *Delegation of Professional Design Services*

- A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.
- B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.
- C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.

- D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.
- E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:
 - 1. Checking for conformance with the requirements of this Paragraph 7.19;
 - 2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and
 - 3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.
- F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.
- G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

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 third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.
- C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.
- D. 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.

- E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, 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.
- F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

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 for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, 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. 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 will 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, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will 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 or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

- 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.
 - 1. 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 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 8.03.B.
 - 2. 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 Contractor.
- C. 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 will 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 (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 10.07. 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 *Resident 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 the Supplementary Conditions and in Paragraph 10.07.
- B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 *Engineer's Authority*

- A. Engineer has the authority to reject Work in accordance with Article 14.
- B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.
- C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.
- D. Engineer's authority as to changes in the Work is set forth in Article 11.

E. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.05 *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.

10.06 *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.

10.07 *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, will 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 Contractor under 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 10.07 also apply to the Resident Project Representative, if any.

10.08 *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 of which Engineer has been informed.

ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

- A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.
- B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.
- C. All changes to the Contract that 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, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 *Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders covering:
 - 1. Changes in 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 11.05, (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 that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.
- B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

- A. 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 11.07 regarding change of Contract Price.

- B. If Owner has issued a Work Change Directive and:
 - 1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.
 - 2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

- A. 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.
- B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 *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. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.
- B. Such changes in the Work 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 must be performed under the applicable conditions of the Contract Documents.
- C. Nothing in this Paragraph 11.05 obligates 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.

11.06 *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.C.2.

11.07 *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 must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must 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);
 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 11.07.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 11.07.C).
- C. *Contractor's Fee:* When applicable, the Contractor's fee for overhead and profit will 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 will be 15 percent;
 - b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 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 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.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 5 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 will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;
 - d. No fee will 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 of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and
 - f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

11.08 *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 must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.
- B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 *Change Proposals*

- A. *Purpose and Content:* Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

- B. *Change Proposal Procedures*

- 1. *Submittal:* Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.
- 2. *Supporting Data:* 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.
 - a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.
 - b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

The supporting data must 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.

- 3. *Engineer's Initial Review:* Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.
- 4. *Engineer's Full Review and Action on the Change Proposal:* Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must 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.

5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.
- C. *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 in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.
- D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 *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 are subject 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;
 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; and
 4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.
- 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 rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, 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 will 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 will 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 will 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 will 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 will 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 will 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 will be incorporated in a Change Order or other written document 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. When needed 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 will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will 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 in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, 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, will 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 accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will 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, which 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 will 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 or retained for services specifically related to the Work.
 5. Other costs consisting of 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, 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.

- 1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.

c. *Construction Equipment Rental*

- 1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.
 - 2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.
 - 3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed 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 builder's risk or other property insurance established in accordance with Paragraph 6.04), 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 include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will 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 does not include any of the following items:
- 1. Payroll costs and other compensation of Contractor's officers, executives, principals, general 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. The cost of purchasing, renting, or furnishing small tools and hand tools.
 - 3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
 - 4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
 - 5. 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.
 - 6. Expenses incurred in preparing and advancing Claims.
 - 7. 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*
- 1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:
 - a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.
 - b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:
 - 1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.
 - 2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.
 - 2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change

Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

- E. *Documentation and Audit*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

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.
- 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 for any of the foregoing will be valid.
- C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's 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 for Work covered by allowances, and the Contract Price will 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, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:
 - a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and
 - b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.
2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.
3. Adjusted unit prices will apply to all units of that item.

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 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 with such procedures and programs 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 will 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 will 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 will 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 written 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 will 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.
- 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, 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 will 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 defective Work as required by Engineer, then Owner may, after 7 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 for 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.
 - 2. 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 must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation

establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) 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.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
4. 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 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;
 - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;
 - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;
 - d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; 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 based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from 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 has occurred that would constitute a default by Contractor and therefore justify a termination for cause;
 - j. Liquidated or other 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; or
 - l. Other items entitle 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 will 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 will be treated as an amount due as determined by Paragraph 15.01.D.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 7 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 will 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 7 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 15.03.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 6.04 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 7.12), and other documents, Contractor may make application for final payment.
2. The final Application for Payment must 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 duly pending Change Proposals and Claims; 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 Final Application and Recommendation of Payment:* 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 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will 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. 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. *Notice of Acceptability:* In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.
- D. *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 and issuance of notice of the acceptability of the Work.
- E. *Final Payment Becomes Due:* Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 *Waiver of Claims*

- A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim,

appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

- 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 as a Claim, 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 Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect 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 adjacent areas;
 - 2. correct such defective Work;
 - 3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, 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 from the corrective measures.
- B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.
- C. If, after receipt of a notice of defect within 60 days and within the correction period, 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 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). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.
- D. 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.
- E. 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.

- F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to 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 directly attributable to any such suspension. Any Change Proposal seeking such adjustments must 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) 10 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) written 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 7 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 will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate for Convenience*

- A. Upon 7 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 for any loss of anticipated profits or revenue, post-termination overhead costs, 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 7 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, 7 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, pursuant to Article 12; and
 - 2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise 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;
 - 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 requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:
 - 1. in person, by a commercial courier service or otherwise, to the recipient's place of business;
 - 2. by registered or certified mail, postage prepaid, to the recipient's place of business; or
 - 3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

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 will not constitute a waiver of that provision, nor will 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 of the Contract or 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 *Assignment of Contract*

- A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party 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.

18.09 *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.

18.10 *Headings*

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

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SECTION 00825

SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement EJCDC® C-700, Standard General Conditions of the Construction Contract (2018). The General Conditions remain in full force and effect except as amended.

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—for example, "Paragraph SC-4.05."

ARTICLE 1— DEFINITIONS AND TERMINOLOGY

1.01 Defined Terms

SC-1.01.10.A. Delete 10.A in its entirety.

SC-1.01.10.B Amend the section 10.B to read as follows:

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, or contesting Owner's determination to reject Engineer's decision.

SC-1.01.10.C. Delete 10.C in its entirety.

SC-1.01.50 Amend the section 50 to read as follows:

Work Change Directive—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner, ordering an addition, deletion, or revision in the Work.

ARTICLE 2— PRELIMINARY MATTERS

2.02 Copies of Documents

SC-2.02 Amend the first sentence of Paragraph 2.02.A. to read as follows:

Owner shall furnish to Contractor one electronic portable document format (PDF) of the Contract Documents (including one fully signed counterpart of the Agreement).

ARTICLE 3— CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.04 Requirements of Contract Documents

SC-3.04.A Amend the section to read as follows:

During the performance of the Work and until final payment, Contractor shall submit to the Engineer in writing 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.

SC-3.04.B Amend the section to read as follows:

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.

SC-3.04.C Amend the section to read as follows:

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 notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. Contractor may pursue resolution as provided in Article 12.

ARTICLE 4— COMMENCEMENT AND PROGRESS OF THE WORK

No suggested Supplementary Conditions in this Article.

ARTICLE 5— SITE, SUBSURFACE AND PHYSICAL CONDITIONS, HAZARDOUS ENVIRONMENTAL CONDITIONS

5.03 Subsurface and Physical Conditions

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

- E. The following table lists the reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data, and specifically identifies the Technical Data in the report upon which Contractor may rely:

Report Title	Date of Report	Technical Data
Geotechnical Report – Reservoir B Replacement Study for Paradise Irrigation District	July 31, 2018	Technical data related to subsurface conditions at the Reservoir B site
Final Mitigated Negative Declaration and Initial Study	October 15, 2021	Environmental conditions related to site construction activities

- F. The following table lists the drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data, and specifically identifies the Technical Data upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
None provided		

- G. Contractor may examine copies of reports and drawings identified in SC-5.03.E and SC-5.03.F that were not included with the Bidding Documents at 6332 Clark Road, Paradise, CA during regular business hours or may request copies from Engineer.

5.05 *Underground Utilities*

SC-5.05.G Amend the section to read as follows:

1. Notwithstanding the foregoing, and pursuant to Government Code section 4215, Owner shall assume the responsibility, between the parties to the Contract, for the timely removal, relocation, or protection of existing utilities located on the site of the Project that is a subject of the Contract, if such utilities are not identified by Owner in the Contract. Contractor shall be compensated for the costs of locating, repairing damage not due to the failure of Contractor to exercise reasonable care, and removing or relocating such utility facilities not indicated in the Contract with reasonable accuracy, and for equipment necessarily idled during such work. Contractor shall not be assessed liquidated damages for delay in completion of the work, when such delay was caused by the failure of Owner or the owner of the utility to provide for removal or relocation of such utility facilities.
2. Nothing herein shall be deemed to require Owner to indicate the presence of existing service laterals or appurtenances whenever the presence of such utilities on the site of the work can be inferred from the presence of other visible facilities, such as buildings, meter and junction boxes, on or adjacent to the site of the construction; provided, however, nothing herein shall relieve Owner from identifying main or trunk lines in the Contract.
3. If Contractor, while performing the Contract, discovers utility facilities not identified by Owner in the Contract Documents, it shall immediately notify Owner and the utility in writing.
4. This section does not relieve Contractor of its obligations under the Regional Notification Center System, Section 4216 et seq., of the California Government Code.

5.06 *Hazardous Environmental Conditions*

SC-5.06 Add the following new paragraphs immediately after Paragraph 5.06.A.3:

4. The following table lists the reports known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and the Technical Data (if any) upon which Contractor may rely: **[If there are no such reports, so indicate in the table]**

Report Title	Date of Report	Technical Data
None provided		

5. The following table lists the drawings known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and Technical Data (if any) contained in such Drawings upon which Contractor may rely: **[If there are no such drawings, so indicate in the table]**

Drawings Title	Date of Drawings	Technical Data
None provided		

ARTICLE 6— BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

6.03 *Contractor's Insurance*

SC-6.03 Supplement Paragraph 6.03 with the following provisions after Paragraph 6.03.C:

- E. *Workers' Compensation and Employer's Liability:* Contractor shall purchase and maintain workers' compensation and employer's liability insurance, including, as applicable, United States Longshoreman and Harbor Workers' Compensation Act, Jones Act, stop-gap employer's liability coverage for monopolistic states, and foreign voluntary workers' compensation (from available sources, notwithstanding the jurisdictional requirement of Paragraph 6.02.B of the General Conditions).

Workers' Compensation and Related Policies	Policy limits of not less than:
Workers' Compensation	
State	Statutory
Applicable Federal (e.g., Longshoreman's)	Statutory
Foreign voluntary workers' compensation (employer's responsibility coverage), if applicable	Statutory
Jones Act (if applicable)	
Bodily injury by accident—each accident	\$1,000,000
Bodily injury by disease—aggregate	\$1,000,000
Employer's Liability	
Each accident	\$1,000,000
Each employee	\$1,000,000
Policy limit	\$1,000,000

- F. *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 claims for:
1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees,
 2. damages insured by reasonably available personal injury liability coverage, and
 3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.
- G. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability form (occurrence form) and include the following coverages and endorsements:
1. Products and completed operations coverage.
 - a. Such insurance must 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, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
 3. Severability of interests and no insured-versus-insured or cross-liability exclusions.
 4. Underground, explosion, and collapse coverage.
 5. Personal injury coverage.
 6. 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). If Contractor demonstrates to Owner that the specified ISO endorsements are not commercially available, then Contractor may satisfy this requirement by providing equivalent endorsements.
 7. 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.
- H. *Commercial General Liability—Excluded Content:* The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:
1. Any modification of the standard definition of "insured contract" (except to delete the railroad protective liability exclusion if Contractor is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).
 2. Any exclusion for water intrusion or water damage.

3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.
4. Any exclusion of coverage relating to earth subsidence or movement.
5. Any exclusion for the insured's vicarious liability, strict liability, or statutory liability (other than worker's compensation).
6. Any limitation or exclusion based on the nature of Contractor's work.
7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.

I. *Commercial General Liability—Minimum Policy Limits*

Commercial General Liability	Policy limits of not less than:
General Aggregate	\$10,000,000
Products—Completed Operations Aggregate	\$5,000,000
Personal and Advertising Injury	\$5,000,000
Bodily Injury and Property Damage—Each Occurrence	\$5,000,000

- J. *Automobile Liability:* Contractor shall purchase and maintain automobile liability insurance 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 must be written on an occurrence basis.

Automobile Liability	Policy limits of not less than:
Bodily Injury	
Each Person	\$1,000,000
Each Accident	\$1,000,000
Property Damage	
Each Accident	\$1,000,000

- M. *Contractor's Pollution Liability Insurance:* Contractor shall purchase and maintain a policy covering third-party injury and property damage, including cleanup costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance must be maintained for no less than three years after final completion.

Contractor's Pollution Liability	Policy limits of not less than:
Each Occurrence/Claim	\$5,000,000
General Aggregate	\$10,000,000

- P. *Unmanned Aerial Vehicle Liability Insurance:* If Contractor uses unmanned aerial vehicles (UAV—commonly referred to as drones) at the Site or in support of any aspect of the Work, Contractor shall obtain UAV liability insurance in the amounts stated; name Owner, Engineer, and all individuals and entities identified in the Supplementary Conditions as additional insureds; and provide a certificate to Owner confirming Contractor's compliance with this requirement. Such insurance

will provide coverage for property damage, bodily injury or death, and invasion of privacy.

Unmanned Aerial Vehicle Liability Insurance	Policy limits of not less than:
Each Claim	\$1,000,000
General Aggregate	\$1,000,000

6.04 *Builder's Risk and Other Property Insurance*

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

F. *Builder's Risk Requirements:* The builder's risk insurance must:

1. be written on a builder's risk "all risk" policy form that at a minimum includes insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment stored and in transit, and must not exclude the coverage of the following risks: fire; windstorm; hail; flood; earthquake, volcanic activity, and other earth movement; lightning; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; and water damage (other than that caused by flood).
 - a. Such policy will include an exception that results in coverage for ensuing losses from physical damage or loss with respect to any defective workmanship, methods, design, or materials exclusions.
 - b. 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 will be provided through other insurance policies acceptable to Owner and Contractor.
2. 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.
3. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of contractors, engineers, and architects).

4. 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). If this coverage is subject to a sublimit, such sublimit will be a minimum of the contractor's bid price.
5. extend to cover damage or loss to insured property while in transit. If this coverage is subject to a sublimit, such sublimit will be a minimum of the contractor's bid price.
6. allow for the waiver of the insurer's subrogation rights, as set forth in this Contract.
7. allow for partial occupancy or use by Owner by endorsement, and without cancellation or lapse of coverage.
8. include performance/hot testing and start-up, if applicable.
9. be maintained in effect until the Work is complete, as set forth in Paragraph 15.06.D of the General Conditions, or until written confirmation of Owner's procurement of property insurance following Substantial Completion, whichever occurs first.
10. include as named insureds the Owner, Contractor, Subcontractors (of every tier), and any other individuals or entities required by this Contract to be insured under such builder's risk policy. For purposes of Paragraphs 6.04, 6.05, and 6.06 of the General Conditions, and this and all other corresponding Supplementary Conditions, the parties required to be insured will be referred to collectively as "insureds." In addition to Owner, Contractor, and Subcontractors of every tier, include as insureds the following:
 - a. None
11. include, in addition to the Contract Price amount, the value of the following equipment and materials to be installed by the Contractor but furnished by the Owner or third parties:
 - a. None.
12. If debris removal in connection with repair or replacement of insured property is subject to a coverage sublimit, such sublimit will be a minimum of 25 percent of the builder's risk insurance amount.
13. In addition to the coverage sublimits stated above, the following coverages are also subject to sublimits, as follows:
 - a. None

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

- H. *Builder's Risk and Other Property Insurance Deductibles:* The purchaser of any required builder's risk, installation floater, or other property insurance will be responsible for costs not covered because of the application of a policy deductible.
 1. The builder's risk policy (or if applicable the installation floater) will be subject to a deductible amount of no more than **\$50,000** for direct physical loss in any one occurrence.

ARTICLE 7— CONTRACTOR’S RESPONSIBILITIES

7.03 Labor; Working Hours

SC-7.03 Amend the first and second sentences of Paragraph 7.03.C to state “...all Work at the Site must be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday.”

7.17 Contractor’s General Warranty and Guarantee

SC-7.17.B Replace the section with:

Owner’s rights under this warranty and guarantee are in addition to, and are not limited by, Owner’s rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights.

7.20 Compliance with Requirements for Public Works

SC-7.20 Insert the following section:

- A. This is a public work. Contractor and any subcontractors are subject to the requirements of Chapter 1, Part 7 of the Labor Code, commencing with section 1720, pertaining to public works, and they are responsible for ascertaining and applying those requirements. Any person who willfully violates Article 2 of Chapter 1 is guilty of a misdemeanor. (Labor Code§ 1777). All contractors and subcontractors working on the Contract work must keep certified payroll records in accordance with Labor Code section 1776.
- B. At the time of the award, and at all times while performing the work, Contractor and any subcontractors shall be, and shall remain, registered and qualified to perform public work, pursuant to Labor Code sections 1725.5and 1771.1. This Agreement is subject to cancellation by District, and Contractor is subject to an assessment of penalties under section 1771.1, upon determination that Contractor or any subcontractor is not in compliance with the provisions of those sections.
- C. This Contract is subject to compliance monitoring and enforcement by the Department of Industrial Relations, as required by Labor Code section 1771.4. Contractor shall post job site notices, as prescribed by regulation. Contractor shall furnish the records specified in Labor Code section 1776 directly to the Labor Commissioner.
- D. Not less than the general prevailing rate of per diem wages for work of a similar character in the locality in which the work is performed, and not less than the general prevailing rate of per diem wages for holiday and overtime work fixed as provided in Chapter 1, Part 7 of the Labor Code, shall be paid for each craft, classification, or type of worker needed to execute the Contract work.
- E. Copies of the prevailing rates of per diem wages are on file at the District’s office and shall be made available on request. Alternatively, said rates are accessible on the INTERNET under the heading “General Prevailing Wage Determination made by the Director of Industrial Relations pursuant to California Labor Code Part 7, Chapter 1, Article 2, Sections 1770, 1773 and 1773.1”. The Internet address is <http://www.dir.ca.gov/>.

- F. A copy of the prevailing rate of per diem wages shall be posted at the worksite. Contractor, and any subcontractor under it, shall pay not less than the prevailing rates of wages to all workers employed in the execution of the Contract work. Contractor, and any subcontractor under it, shall be subject to penalties under Labor Code section 1775 for paying less than the prevailing wage rates.
- G. Contractor and any subcontractors 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 diem wages paid to each journeyman, apprentice, worker, or other employee employed by it in connection with the Project work, and shall certify and make those records available for inspection and otherwise comply with the provisions of Labor Code sections 1776 and 1812. Contractor's failure to comply is a misdemeanor, as provided in Labor Code section 1777.
- H. Contractor shall be subject to the provisions of Labor Code section 1777.5 pertaining to the employment of apprentices. Contractor shall pay every apprentice employed in the execution of the Contract work the prevailing rate of per diem wages for apprentices in the trade to which he or she is registered and shall otherwise comply with the provisions of that section.
- I. Contractor warrants that neither it nor any of its subcontractors is ineligible to work on public works projects pursuant to Section 1777.1 or 1777.7 of the Labor Code. Contractor is prohibited from performing the Contract work with an ineligible subcontractor.
- J. The time of service of any worker employed in the execution of the Contract work is limited and restricted to eight (8) hours during any one (1) calendar day, and forty (40) hours during any one calendar week, except that work performed by Contractor's or subcontractor's employees in excess of eight (8) hours per day, and forty (40) hours during any one week, shall be permitted upon compensation for all hours worked in excess of eight (8) hours per day at not less than one and one-half (1 ½) times the basic rate of pay, or at any higher rate of overtime pay that may be required pursuant to a Department of Industrial Relations prevailing wage determination. Contractor, or any subcontractor working under it, shall be subject to penalties under Labor Code section 1813 for violations of these limitations.
- K. Contractor and its subcontractors shall not discriminate in the employment of persons upon public works on any basis listed in subdivision (a) of Section 12940 of the Government Code, as those bases are defined in Sections 12926 and 12926.1 of the Government Code, except as otherwise provided in Section 12940 of the Government Code. Every contractor for public works who violates this section is subject to all the penalties imposed for a violation of this chapter.
- L. Contractor shall secure the payment of worker's compensation to its employees performing the work, in accordance with the provisions of Sections 1860 and 3700 of the Labor Code and, in case any such work is sublet, the Contractor shall require its subcontractors similarly to comply with those provisions.

7.21 Trenching Plan

SC-7.21 Add the following section:

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- A. Pursuant to Labor Code Section 6705, Contractor shall submit, in advance of excavation of any trench or trenches five feet or more in depth, a detailed plan showing the design of shoring, bracing, or sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of such trench or trenches, acceptable to Owner. If such plan varies from the shoring system standards, the plan shall be prepared by a registered civil or structural engineer.
- B. Pursuant to Labor Code section 6707, for trenches or other excavations which are five feet or deeper, Contractor's bid shall contain adequate sheeting, shoring, and bracing or equivalent method for the protection of life or limb, which shall conform to applicable safety orders.

ARTICLE 8— OTHER WORK AT THE SITE

No suggested Supplementary Conditions in this Article.

ARTICLE 9— OWNER'S RESPONSIBILITIES

9.02 Replacement of Engineer

SC-9.02.A Replace the section with:

Owner may at its discretion appoint an engineer to replace Engineer. The replacement engineer's status under the Contract Documents will be that of the former Engineer.

9.11 Evidence of Financial Arrangements

SC-9.11 Delete this section in its entirety.

ARTICLE 10— ENGINEER'S STATUS DURING CONSTRUCTION

10.01 Owner's Representative

SC-10.01.A Amend section to read as follows:

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, and by separate written agreement between Engineer and Owner.

10.03 Resident Project Representative

SC-10.03 Add the following new paragraphs immediately after Paragraph 10.03.B:

- C. The Resident Project Representative (RPR) will be Engineer's representative at the Site. RPR's dealings in matters pertaining to the Work in general will be with Engineer and Contractor. RPR's dealings with Subcontractors will only be through or with the full knowledge or approval of Contractor. The RPR will:
 - 1. *Conferences and Meetings:* Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other

Project-related meetings (but not including Contractor's safety meetings), and as appropriate prepare and circulate copies of minutes thereof.

2. *Safety Compliance:* Comply with Site safety programs, as they apply to RPR, and if required to do so by such safety programs, receive safety training specifically related to RPR's own personal safety while at the Site.
3. *Liaison*
 - a. Serve as Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.
 - b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.
 - c. Assist in obtaining from Owner additional details or information, when required for Contractor's proper execution of the Work.
4. *Review of Work; Defective Work*
 - a. Conduct on-Site observations of the Work to assist Engineer in determining, to the extent set forth in Paragraph 10.02, if the Work is in general proceeding in accordance with the Contract Documents.
 - b. Observe whether any Work in place appears to be defective.
 - c. Observe whether any Work in place should be uncovered for observation, or requires special testing, inspection or approval.
5. *Inspections and Tests*
 - a. Observe Contractor-arranged inspections required by Laws and Regulations, including but not limited to those performed by public or other agencies having jurisdiction over the Work.
 - b. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Work.
6. *Payment Requests:* Review Applications for Payment with Contractor.
7. *Completion*
 - a. Participate in Engineer's visits regarding Substantial Completion.
 - b. Assist in the preparation of a punch list of items to be completed or corrected.
 - c. Participate in Engineer's visit to the Site in the company of Owner and Contractor regarding completion of the Work, and prepare a final punch list of items to be completed or corrected by Contractor.
 - d. Observe whether items on the final punch list have been completed or corrected.

D. The RPR will not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).

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2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.
3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.
4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction.
5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.
6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.
7. Authorize Owner to occupy the Project in whole or in part.

10.06 Decisions on Requirements of Contract Documents and Acceptability of Work

SC-10.06.A Replace the section with:

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 Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.07 Limitations on Engineer's Authority and Responsibilities

SC-10.07.A Replace the section with:

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, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, or to any surety for or employee or agent of any of them.

SC-10.07.B Replace the section with:

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, except as provided by separate written agreement between Engineer and Owner.

ARTICLE 11— CHANGES TO THE CONTRACT

11.02 Change Orders

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SC-11.02A Amend the section to read:

A Change Order, to be effective, must be written and signed by Contractor and Owner.

11.03 *Work Change Directives*

SC-11.03.B.2 Amend the section to read:

Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall, after negotiations by the parties, notify Contractor of such an adjustment. Contractor may appeal Owner's determination under Article 12.

11.09 *Change Proposals*

SC-11.09.B.4 Amend the section to read:

Engineer's Full Review and Action on the Change Proposal: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must 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 Contractor may at any time thereafter submit a letter to Owner 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.

SC-11.09.B.5 Amend the section to read:

Binding Decision: Engineer's decision is final and binding upon Contractor, unless Contractor appeals the decision by filing a Claim under Article 12.

ARTICLE 12— CLAIMS

SC-12.0 Replace the section in its entirety with:

12.0 *Resolution of Construction Claims*

- A. Contractor claims shall be governed by Public Contract Code section 9204. Key provisions of that section are summarized below:
 - 1. "Claim" means a separate demand by Contractor sent by registered mail or certified mail with return receipt requested, for one or more of the following:
 - a. A time extension, including, without limitation, for relief from damages or penalties for delay assessed by District under this Contract.
 - b. Payment by District of money or damages arising from work done by, or on behalf of, Contractor pursuant to this Contract and payment for which is not otherwise expressly provided or to which the Contractor is not otherwise entitled.

- c. Payment of an amount that is disputed by District.
- 2. Upon receipt of a claim pursuant to this section, District shall conduct a reasonable review of the claim and, within a period not to exceed 45 days, shall provide Contractor a written statement identifying what portion of the claim is disputed and what portion is undisputed. Upon receipt of a claim, District and a Contractor may, by mutual agreement, extend the time period provided in this subdivision.
- 3. Contractor shall furnish reasonable documentation to support the claim.
- 4. Any payment due on an undisputed portion of the claim shall be processed and made within 60 days after Owner issues its written statement.
- 5. If Contractor disputes Owner's written response, or if Owner fails to respond to a claim, Contractor may demand in writing an informal conference to meet and confer for settlement of the issues in dispute. Upon receipt of a demand in writing sent by registered mail or certified mail, return receipt requested, Owner shall schedule a meet and confer conference within 30 days for settlement of the dispute.
- 6. Within 10 business days following the conclusion of the meet and confer conference, if the claim or any portion of the claim remains in dispute, Owner shall provide Contractor a written statement identifying the portion of the claim that remains in dispute and the portion that is undisputed. Any payment due on an undisputed portion of the claim shall be processed and made within 60 days after Owner issues its written statement.
- 7. Any disputed portion of the claim, as identified by Contractor in writing, shall be submitted to nonbinding mediation, with Owner and Contractor sharing the associated costs equally. If the mediation is unsuccessful, the parts of the claim remaining in dispute shall be subject to sections 12 B and 12 C, below.
- 8. Failure by Owner to respond to a claim from Contractor within the time periods described herein or to otherwise meet the time requirements of this section shall result in the claim being deemed rejected in its entirety.
- 9. Amounts not paid in a timely manner as required by this section shall bear interest at 7 percent per annum.
- 10. Contractor may present to Owner a claim on behalf of a subcontractor or lower tier subcontractor. A subcontractor may request in writing, either on his or her own behalf or on behalf of a lower tier subcontractor, that Contractor present a claim for work which was performed by the subcontractor or by a lower tier subcontractor on behalf of the subcontractor. The subcontractor requesting that the claim be presented to Owner shall furnish reasonable documentation to support the claim. Within 45 days of receipt of this written request, Contractor shall notify the subcontractor in writing as to whether Contractor presented the claim to the Owner and, if Contractor did not present the claim, provide the subcontractor with a statement of the reasons for not having done so.

- a. Nothing in this section creates or acknowledges a contractual or other legal relationship between Owner and any subcontractor.
 - b. Nothing in this section creates or acknowledges in a subcontractor a direct claim or cause or right of action against Owner.
 - c. Nothing in this section imposes on Owner an obligation to review claims presented directly by a subcontractor or, with regard to claims made by Contractor on behalf of a subcontractor, to issue written statements to the subcontractor, or to meet and confer with the subcontractor, or to mediate claims with the subcontractor, or to make payments to the subcontractor.
- 11. Except as provided herein, this section does not alter extra work, change order, claim, or dispute resolution procedures and requirements set forth in this Contract.
- B. Following the mediation, if the claim or any portion remains in dispute, Contractor may file a claim as provided in Chapter 1 (commencing with Section 900) and Chapter 2 (commencing with Section 910) of Part 3 of Division 3.6 of Title 1 of the Government Code. For purposes of those provisions, the running of the period of time within which a claim must be filed shall be tolled from the time Contractor submits his or her written claim until the conclusion of mediation.
- C. The following procedures are established for all civil actions filed to resolve claims subject to Article 12:
 - 1. Within 60 days, but no earlier than 30 days, following the filing or responsive pleadings, the court shall submit the matter to nonbinding mediation unless waived by mutual stipulation of both parties. The mediation process shall provide for the selection within 15 days by both parties of a disinterested third person as mediator, shall be commenced within 30 days of the submittal, and shall be concluded within 15 days from the commencement of the mediation unless a time requirement is extended upon a good cause showing to the court or by stipulation of both parties. If the parties fail to select a mediator within the 15-day period, any party may petition the court to appoint the mediator.
 - 2. If the matter remains in dispute after mediation, the case shall be submitted to judicial arbitration pursuant to Chapter 2.5 (commencing with Section 1141.10) of Title 3 of Part 3 of the Code of Civil Procedure, notwithstanding Section 1141.11 of that code. The Civil Discovery Act (Title 4 (commencing with Section 2016.010) of Part 4 of the Code of Civil Procedure) shall apply to any proceeding brought under this subdivision consistent with the rules pertaining to judicial arbitration.
 - a. Notwithstanding any other provision of law, upon stipulation of the parties, arbitrators shall be experienced in construction law, and, upon stipulation of the parties, mediators and arbitrators shall be paid necessary and reasonable hourly rates of pay not to exceed their customary rate, and such fees and expenses shall be paid equally by the parties, except in the case of arbitration where the arbitrator, for good cause, determines a different division. In no event shall these fees or expenses be paid by state or county funds.

- b. In addition to Chapter 2.5 (commencing with Section 1141.10) of Title 3 of Part 3 of the Code of Civil Procedure, any party who after receiving an arbitration award requests a trial de novo but does not obtain a more favorable judgment shall, in addition to payment of costs and fees under that chapter, pay the attorney's fees of the other party arising out of the trial de novo.
- c. The court may, upon request by any party, order any witnesses to participate in the mediation or arbitration process.

ARTICLE 13— COST OF WORK; ALLOWANCES, UNIT PRICE WORK

13.03 Unit Price Work

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

E. Adjustments in Unit Price

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:
 - a. 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 **25** percent from the estimated quantity of such item indicated in the Agreement; and
 - b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.
2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.
3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14— TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

No suggested Supplementary Conditions in this Article.

ARTICLE 15— PAYMENTS TO CONTRACTOR, SET OFFS; COMPLETIONS; CORRECTION PERIOD

15.01 Progress Payments

SC-15.01 Replace section 15.01.B.4. with the following:

- a. Owner shall retain five percent (5%) of all progress payments as part security for fulfillment of the Contract. In any contract between Contractor and a subcontractor the percentage of the retention proceeds withheld may not exceed

the percentage specified in this contract between Owner and Contractor. This section shall not be construed to limit the ability of Owner to withhold one hundred fifty percent (150%) of the value of any disputed amount of Work from the final payment, as provided for in subdivision (c) of section 7107 of the Public Contract Code. Nothing in this section shall be construed to require Owner to pay for work that is not approved or accepted in accordance with the Contract.

- b. Contractor may substitute securities for any moneys withheld by Owner to ensure performance under the Contract or Contractor may request and Owner shall make payment of retentions earned directly to the escrow agent at the expense of the Contractor, as provided in Public Contract Code section 22300.
- c. Within sixty (60) days after the date of completion of the Work, the retention withheld by the Owner shall be released. In the event of a dispute between Owner and Contractor, Owner may withhold from the final payment an amount not to exceed 150 percent of the disputed amount. For purposes of this requirement, "completion" means any of the following:
 - 1) The occupation, beneficial use, and enjoyment of a work of improvement, excluding any operation only for testing, startup, or commissioning, by Owner, or its agent, accompanied by cessation of labor on the work of improvement.
 - 2) The acceptance by Owner, or its agent, of the work of improvement.
 - 3) After the commencement of a work of improvement, a cessation of labor on the work of improvement for a continuous period of 100 days or more, due to factors beyond the control of Contractor.
 - 4) After the commencement of a work of improvement, a cessation of labor on the work of improvement for a continuous period of thirty (30) days or more, if Owner files for record a notice of cessation or a notice of completion.
- 2. Except as provided below, within seven (7) days from the time that all or any portion of the retention proceeds are received by Contractor, Contractor shall pay each of its subcontractors from whom retention has been specifically designated for a particular subcontractor, payment of the retention to the designated subcontractor, if the payment is consistent with the terms of the subcontract.
- 3. Contractor may withhold from a subcontractor its portion of the retention proceeds if a bona fide dispute exists between the subcontractor and Contractor. The amount withheld from the retention payment shall not exceed 150 percent of the estimated value of the disputed amount.
- 4. In the event that retention payments are not made within the time periods required by this section, Owner or Contractor withholding the unpaid amounts shall be subject to a charge of two percent (2%) per month on the improperly withheld amount, in lieu of any interest otherwise due. Additionally, in any action for the collection of funds wrongfully withheld, the prevailing party shall be entitled to attorney's fees and costs.
- 5. Release of retentions under this section shall not be construed as acceptance of defective or improper work or materials.

SC-15.01.C Replace section 15.01.C.1 with the following:

Engineer will, within seven 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.

SC-15.01.D Replace section 15.01.D.1 with the following:

B. Payment Becomes Due

1. Payment will be made within 30 days after receipt of an undisputed and properly submitted payment application from Contractor with Engineer's recommendation for payment. The 30-day period will be reduced by the number of days by which Engineer exceeds the seven-(7) day return requirement. Progress payments made after the required time period will include interest equivalent to the legal rate set forth in subdivision (a) of section 685.010 of the Code of Civil Procedure.

15.03 *Substantial Completion*

SC-15.03 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, will 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 this Article 15.

15.06 *Final Payment*

SC-15.06 Replace section 15.06.D with:

D. Payment Becomes Due

1. Payment will be made within 30 days after receipt of an undisputed and properly submitted payment application from Contractor with Engineer's recommendation for payment. The 30-day period will be reduced by the number of days by which Engineer exceeds the seven-(7) day return requirement. Progress payments made after the required time period will include interest equivalent to the legal rate set forth in subdivision (a) of section 685.010 of the Code of Civil Procedure.

SC-15.06 Replace section 15.06E with:

Final Payment Becomes Due: Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall also withhold for stop payment notices presented under Chapter 4, Title 3, Part 6, Division 4 of the Civil Code, commencing

with section 9350. Owner shall pay the resulting balance due to Contractor within 60 days of Owner's receipt of the final Application for Payment from Engineer.

ARTICLE 16— SUSPENSION OF WORK AND TERMINATION

16.02 Owner May Terminate for Cause

SC-16.02.E Replace 16.02.E with:

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

16.04 Contractor May Stop Work or Terminate

SC-16.04.A Replace section 16.04.A with:

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, then Contractor may, upon 7 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.

SC-16.04B Replace section 16.04.B with:

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, 7 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 RESOLUTIONS OF DISPUTES

17.01 Methods and Procedures

SC-17.01 Delete this section in its entirety.

ARTICLE 18— MISCELLANEOUS

No suggested Supplementary Conditions in this Article.

EXHIBIT C—GEOTECHNICAL BASELINE REPORT SUPPLEMENT TO THE SUPPLEMENTARY CONDITIONS

1.01 Definitions

SC-1.01 Add to the list of definitions in Paragraph 1.01.A by inserting the following as numbered items in their proper alphabetical positions:

1. *Geotechnical Baseline Report (GBR)*—The interpretive report prepared by or for Owner regarding subsurface conditions at the Site, and containing specific baseline geotechnical conditions that may be anticipated or relied upon for bidding and contract administration purposes, subject to the controlling provisions of the Contract, including the GBR's own terms. The GBR is a Contract Document.
2. *Geotechnical Data Report (GDR)*—The factual report that collects and presents data regarding actual subsurface conditions at or adjacent to the Site, including Technical Data and other geotechnical data, prepared by or for Owner in support of the Geotechnical Baseline Report. The GDR's content may include logs of borings, trenches, and other site investigations, recorded measurements of subsurface water levels, the results of field and laboratory testing, and descriptions of the investigative and testing programs. The GDR does not include an interpretation of the data. If opinions, or interpretive or speculative non-factual comments or statements appear in a document that is labeled a GDR, such opinions, comments, or statements are not operative parts of the GDR and do not have contractual standing. Subject to that exception, the GDR is a Contract Document.

5.03 Subsurface and Physical Conditions

SC-5.03 Delete Paragraph 5.03 in its entirety and replace with the following:

5.03 Subsurface and Physical Conditions

- A. *Reports and Drawings:* The Supplementary Conditions hereby identify:
1. those reports of explorations and tests of subsurface conditions at or adjacent to the Site (other than any Geotechnical Data Report or Geotechnical Baseline Report) that contain Technical Data. Such reports are as follows:
 - a. *Report Title:* Geotechnical Report, Reservoir B Replacement Study. Paradise Irrigation District, Town of Paradise & Butte County, California
 - b. *Date of Report:* July 31, 2018
 - c. 2. Contractor may examine copies of reports identified immediately above that were not included with the Bidding Documents at 6332 Clark Road, Paradise, CA during regular business hours, or may request copies from Engineer, at the cost of reproduction.
- B. *Underground Facilities:* Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph SC-5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

- C. *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 Paragraph 1.01.A.46.b.
- D. *Limitations of Other Data and Documents:* 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. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or
 4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.
- E. *Geotechnical Data Report*
1. This Contract contains a Geotechnical Data Report ("GDR"), identified as follows: Geotechnical Report for Reservoir B Replacement Study for Paradise Irrigation District, dated July 31, 2018 prepared by Vertical Sciences, Inc.
 2. The GDR is incorporated as Contract Documents. The GDR is to be used in conjunction with other Contract Documents, including the Drawings and Specifications.
 3. The GDR describes certain select subsurface conditions that are anticipated to be encountered by Contractor during construction in specified locations (referred to here in the Supplementary Conditions as "Baseline Conditions"). These may include ground, geological, groundwater, and other subsurface geotechnical conditions, and baselines of anticipated Underground Facilities or subsurface structures.
 4. The Baseline Conditions will be used to assist in the administration of the Contract's differing site conditions clause at locations where subsurface conditions have been baselined. If a condition is baselined in the GDR, then only the pertinent Baseline Conditions will be used to determine whether there is a differing site condition; and no other indication of that condition in the Contract Documents or Technical Data, or of a condition that describes, quantifies, or measures a similar characteristic of the subsurface, will be used for the differing site condition determination.
 5. The Baseline Conditions will not be used to make differing site conditions determinations at locations that have not been baselined in the GDR, or at any location with respect to subsurface conditions that the Baseline Conditions

do not address. If Underground Facilities or Hazardous Environmental Conditions are expressly addressed in the Baseline Conditions, then comparison to such Baseline Conditions will be the primary means of determining (a) whether an Underground Facility was shown or indicated with reasonable accuracy, as provided in Paragraph 5.05 of the General Conditions, or (b) whether a Hazardous Environmental Condition was shown or indicated in the Contract Documents as indicated in Paragraph 5.06.H of the General Conditions. As indicated in Paragraph SC-5.04 below, the GDR will be the primary resource for differing site conditions determinations.

6. The descriptions of subsurface conditions provided in the GDR are based on geotechnical investigations, laboratory tests, interpretation, interpolation, extrapolation, and analyses. Neither Owner, Engineer, nor any geotechnical or other consultant warrants or guarantees that actual subsurface conditions will be as described in the GDR, nor is the GDR intended to warrant or guarantee the use of specific means or methods of construction.
7. The behavior of the ground during construction depends substantially upon the Contractor's selected means, methods, techniques, sequences, and procedures of construction. If ground behavior conditions are baselined in the GDR, they are based on stated assumptions regarding construction means and methods.
8. The GDR will not reduce or relieve Contractor of its responsibility for the planning, selection, and implementation of safety precautions and programs incident to Contractor's means, methods, techniques, sequences, and procedures of construction, or to the Work.

5.04 *Differing Subsurface or Physical Conditions*

SC-5.04 Delete Paragraph 5.04 in its entirety and replace with the following:

5.04 *Differing Subsurface or Physical Conditions*

- A. *Notice:* If Contractor believes that any subsurface condition that is uncovered or revealed at the Site:
 1. differs materially from conditions shown or indicated in the GDR; or
 2. differs materially from conditions shown or indicated in Contract Documents other than the GDR, to the extent the GDR is inapplicable; or
 4. to the extent the GDR is inapplicable, 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
 5. to the extent the GDR is inapplicable, is of such a nature as to require a change in the Drawings or Specifications; or
 6. to the extent the GDR is inapplicable, 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 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 SC-5.04.A above; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption or continuation 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 or continuation 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. *Early Resumption of Work:* If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.
- E. *Possible Price and Times Adjustments*
 - 1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, 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 SC-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 of the General Conditions; and
 - c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.
 - 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 SC-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, then any such adjustment must 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, 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.
- F. *Underground Facilities; Hazardous Environmental Conditions:* Paragraph 5.05 of the General Conditions governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 of the General Conditions governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs SC-5.03 and SC-5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

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SECTION 00830

DWSRF CONSTRUCTION CONTRACT REQUIREMENTS

1.1 GENERAL

- A. Funding for this project has been provided in full or in part through an agreement with the State Water Resources Control Board. California's Drinking Water State Revolving Fund (DWSRF) is capitalized through a variety of funding sources, including grants from the United States Environmental Protection Agency and state bond proceeds. The contents of this document do not necessarily reflect the views and policies of the foregoing, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.
- B. This Section includes the DWSRF construction requirements and related boilerplate specifications.
- C. When general or supplementary conditions conflict with requirements contained herein, these DWSRF requirements take precedence.

1.2 CERTIFICATION OF NONSEGREGATED FACILITIES (41 CFR 60-1.8)

- A. General:
 - 1. All federally assisted construction contractors must comply with all appropriate Equal Employment Opportunity requirements.
- B. Contract Provisions:
 - 1. The federally assisted construction contractor certifies that he does not maintain or provide for his employees any segregated facilities at any of his establishments, and that he does not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The federally assisted construction contractor certifies further that he will not maintain or provide for his employees any segregated facilities at any of his establishments, and that he will not permit his employees to perform their services at any location, under his control, where segregated facilities are maintained. The federally assisted construction contractor agrees that a breach of this certification is a violation of the Equal Opportunity Clause in this contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, creed, color, or national origin, because of habit, local custom, or otherwise.
 - 2. The federally assisted construction contractor agrees that (except where he has obtained identical certifications from proposed subcontractors for specified time period) he will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity Clause, and that he will retain such certifications in his files.

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- C. The Certification of Nonsegregated Facilities form shall be completed by all bidding contractors and submitted with bids.

1.3 DISADVANTAGED BUSINESS ENTERPRISES PROVISIONS (EXECUTIVE ORDERS 11625, 121138, AND 12432)

A. General:

1. This project is funded in whole or part with federal loan or grant funds through the California Safe Drinking 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).
2. The Disadvantaged Business Enterprise Program is an outreach, education, and objectives program designed to increase the participation of DBEs in the Clean Water State Revolving Fund (CWSRF) and Drinking Water State Revolving Fund (DWSRF) Programs.
3. Recipients of CWSRF/DWSRF financing that are subject to the DBE requirements (recipients) are required to seek, and are encouraged to use, DBEs for their procurement needs. Recipients should award a "fair share" of sub-agreements to DBEs. This applies to all sub-agreements for equipment, supplies, construction, and services.
4. The key functional components of the DBE Program are as follows:
 - a. Fair Share Objectives
 - b. DBE Certification
 - c. Six Good Faith Efforts
 - d. Contract Administration Requirements
 - e. DBE Reporting
5. Disadvantaged Business Enterprises are defined as follows:
 - a. Entities owned and/or controlled by socially and economically disadvantaged individuals as described by Title X of the Clean Air Act Amendments of 1990 (42 U.S.C. 7601 note) (10% statute), and Public Law 102-389 (42 U.S.C. 4370d) (8% statute), respectively;
 - b. Minority Business Enterprise (MBE) - entities that are at least 51% owned and/or controlled by a socially and economically disadvantaged individual as described by Title X of the Clean Air Act Amendments of 1990 (42 U.S.C. 7601 note), and Public Law 102-389 (42 U.S.C. 4370d), respectively;
 - c. Women Business Enterprise (WBE) - entities that are at least 51% owned and/or controlled by women;
 - d. Small Business Enterprise (SBE);
 - e. Small Business in a Rural Area (SBRA);
 - f. Labor Surplus Area Firm (LSAF); or
 - g. Historically Underutilized Business (HUB) Zone Small Business Concern or a concern under a successor program.
6. Certifying DBE Firms:
 - a. Under the DBE Program, entities can no longer self-certify and contractors and sub-contractors must be certified at bid opening. Contractors and sub-contractors must provide to the CASRF recipient proof of DBE certification. Certifications will be accepted from the following:
 - 1) The U.S. Environmental Protection Agency (USEPA)
 - 2) The Small Business Administration (SBA)
 - 3) The Department of Transportation's State implemented DBE Certification Program (with U.S. citizenship)

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- 4) Tribal, State and Local governments
- 5) Independent private organization certifications
- b. If an entity holds one of these certifications, it is considered acceptable for establishing status under the DBE Program.

B. Contract Provisions:

1. Compliance with the requirements of this document and completion and submission of the DBE forms with the bids satisfies the DBE requirements for this construction contract. Failure to take the six (6) affirmative steps listed under Good Faith Effort Requirements **prior** to bid opening and to submit the necessary forms with the bid package shall cause the bid to be rejected as a non-responsive bid.
2. The DBE rule requires that responsive bid shall conform with "Good Faith Efforts" (GFE) 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 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 contractors, 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 Effort" steps:
3. Good Faith Effort Requirements:
 - a. All CWSRF/DWSRF financing recipients are required to complete and ensure that the prime contractor complies with the GFE below to ensure that DBEs have the opportunity to compete for financial assistance dollars.
 - 1) Ensure DBEs are made aware of contracting opportunities to the fullest extent practical through outreach and recruitment activities. For Tribal, State and Local Government Recipients, this will include placing DBEs on solicitation lists and soliciting them whenever they are potential sources.
 - 2) Make information on forthcoming opportunities available to DBEs. Posting solicitations for bids or proposals for a minimum of 30 calendar days in a local newspaper, before the bid opening date.
 - 3) Consider in the contracting process whether firms competing for large contracts could subcontract with DBEs.
 - 4) Encourage contracting with a group of DBEs when a contract is too large for one firm to handle individually.
 - 5) Use the services of the SBA and/or Minority Business Development Agency (MBDA) of the US Department of Commerce.
 - 6) If the prime contractor awards subcontracts, require the prime contractor to take the above steps.
 - b. The form listed below and included as an attachment to this Section shall be provided to awarded CONTRACTOR's DBE subcontractors for their use as needed at an time during the project period of performance:
 - 1) **Form 4500-2 DBE Subcontractor Participation Form:**
 - a) This form gives a DBE subcontractor the opportunity to describe the work the DBE subcontractor received from the prime contractor, how much the DBE subcontractor was paid and any other concerns the DBE subcontractor might have. DBE subcontractors can submit this Form 6100-2 directly to the Region 9 DBE Coordinator listed below at any time:

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Joseph Ochab, DBE Coordinator
USEPA Region 9 (MTS-4)
75 Hawthorne Street,
San Francisco, CA 94105

- a. The forms listed below shall be completed and submitted with each Bid:
 - 1) **Form 4500-3 DBE Subcontractor Performance Form:**
 - a) This form captures an intended subcontractor's description of work to be performed for the prime contractor and the price of the work submitted to the prime contractor. Prime contractor bidder must submit Form 4500-3 [completed by the DBE subcontractor] to the Water System as part of the bid submission.
 - 2) **Form 4500-4 DBE Subcontractor Utilization Form:**
 - a) This form captures the prime contractor's intended use of an identified DBE subcontractor, and the estimated dollar amount of the subcontract. Prime contractor bidder must submit Form 4500-4 to the Water System as part of their bid submission.
- b. **The completed forms must be submitted with each Bid.** The OWNER will review the bidder's documents closely to determine that the GFE was performed prior to bid or proposal opening date. Failure to complete the GFE and to substantiate completion of the GFE before the bid opening date could jeopardize DWSRF financing for the project. The following situations and circumstances require action as indicated below:
 - 1) If the apparent successful low bidder was rejected, a complete explanation must be provided.
 - 2) Failure of the apparent low bidder to **perform** the GFE **prior** to bid opening constitutes a non-responsive bid. The construction contract may then be awarded to the next low, responsive, and responsible bidder that meets the requirements or the OWNER may re-advertise the project.
 - 3) If there is a bid dispute, all disputes shall be settled **prior** to submission of the Final Budget Approval Form.
- c. Fair Share Objectives:
 - 1) Interested bidders are advised that the following fair share objectives have been established for this project. Fulfillment of the Disadvantaged Business Enterprise requirement is based on documented completion of the Good Faith Effort Requirements, not level of Disadvantaged Business Enterprise participation proposed/achieved.

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	Minority Business Enterprise	Women's Business Enterprise
Construction	11%	4%
Supplies	2%	1%
Services	4%	2%
Equipment	2%	2%

4. Administration Requirements:

- a. CONTRACTOR shall pay their subcontractors for satisfactory performance no more than 30 days from the prime contractor's receipt of payment from the OWNER.
- c. CONTRACTOR shall notify OWNER in writing prior to any termination of a DBE subcontractor by the CONTRACTOR.
- d. If a DBE subcontractor fails to complete work under the subcontract for any reason, the CONTRACTOR shall employ the six GFEs if soliciting a replacement subcontractor.
- e. CONTRACTOR shall employ the six GFEs even if CONTRACTOR has achieved their fair share objectives.

5. Contact for more information:

- a. SWRCB: Barbara August (916) 341-6952 barbara.august@waterboards.ca.gov
- b. US EPA, Region 9: Joe Ochab (415) 972-3761 ochab.joe@epa.gov

C. The following attachment shall be provided to CONTRACTOR's DBE subcontractors for their use as needed at any time during the project period of performance:

1. Attachment A –DBE Subcontractor Participation Form

D. The following forms shall be completed by all bidding contractors and submitted with bids:

1. DBE Subcontractor Performance Form
2. DBE Subcontractor Utilization Form

1.4 DEBARMENT, SUSPENSION, INELIGIBILITY, AND VOLUNTARY EXCLUSION (EXECUTIVE ORDER 12549)

A. General:

1. All prime contractors and subcontractors must meet debarment, suspension, ineligibility, and voluntary exclusion requirements pursuant to Executive Order 12549.
2. A list of excluded parties may be found at <https://www.epls.gov/>

B. Contract Provisions:

1. The bidding contractor certifies, by submission of their Bid, that it and its principals:
 - a. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal agencies;
 - b. Have not within a three-year period preceding this proposal 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

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- 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 (1)(b) of this certification; and
 - d. Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.
2. Where the bidding contractor is unable to certify to any of the statements in this certification, such contractor shall attach an explanation to their bid.
- C. The Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion form shall be completed by all bidding contractors and submitted with bids.

1.5 NONDISCRIMINATION CLAUSE (FAIR EMPLOYMENT AND HOUSING ACT, GOVERNMENT CODE 12900)

- A. General:
1. All prime contractors and subcontractors contracted to perform work on DWSRF funded projects must comply with California State nondiscrimination requirements.
- B. Contract Provisions:
1. During the performance of this contract, CONTRACTOR, its contractors and subcontractors, shall not deny the Agreement's benefits to any person on the basis of religion, color, ethnic group identification, sex, age, physical or mental disability, nor shall they discriminate unlawfully against any employee or applicant for employment because of race, religion, color, national origin, ancestry, physical handicap, mental disability, medical condition, marital status, age, or sex. CONTRACTOR, its contractors and subcontractors shall ensure that the evaluation and treatment of employees and applicants for employment are free of such discrimination.
 2. CONTRACTOR, its contractors and subcontractors shall comply with the provisions of the Fair Employment and Housing Act (Government Code, Section 12900 et seq.), the regulations promulgated thereunder (California Code of Regulations, Title 2, Section 7285.0 et seq.), the provisions of Article 9.5, Chapter 1, Part 1, Division 3, Title 2 of the Government Code (Government Code, Sections 11135 11139.5) and the regulations or standards adopted by the awarding State Agency to implement such article.
 3. By signing the Agreement, CONTRACTOR assures State that it shall comply with the requirements of the Americans with Disabilities Act (ADA) of 1990, (42 U.S.C. 12101 et seq.), which prohibits discrimination on the basis of disability, as well as all applicable regulations and guidelines issued pursuant to the ADA; the Civil Rights Act of 1964, as amended, 42 U.S.C. 2000d (1988) et seq.; Section 504 of the Rehabilitation Act of 1973, as amended, 29 U.S.C. 794 (1989); Federal Water Pollution Control Act Amendments of 1972, Pub.L. No. 92-500, 86 Stat 816; and the Age Discrimination Act of 1975, as amended, 42 U.S.C. 6102 (1994); together with all applicable regulations and guidelines adopted to implement same. Said group of laws and requirements are collectively referred to in the Agreement as the "anti-discrimination laws".
 4. CONTRACTOR agrees to collect and maintain information to show compliance with the "anti-discrimination laws" including a list of discrimination complaints, reports of any compliance reviews conducted by other agencies descriptions of any pending

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discrimination-based lawsuits and data on the racial, ethnic, national origin, sex and handicap characteristics of the population it serves.

5. CONTRACTOR, its contractors and subcontractors shall give written notice of their obligations under this Article to labor organizations with which they have a collective bargaining or other agreement.
6. CONTRACTOR's signature on the Agreement shall constitute a certification under penalty of perjury under the laws of the State of California that CONTRACTOR has, unless exempted, complied with the nondiscrimination program requirements of Government Code, Section 12990, and Title 2, California Code of Regulations, Section 8103.
7. CONTRACTOR shall include the nondiscrimination and compliance provisions of this Article A-15 in all contracts and subcontracts to perform work on the Project.

- C. The Nondiscrimination Clause certification form shall be completed by all bidding contractors and submitted with bids.

1.6 NON-COLLUSION AFFIDAVIT (CALIFORNIA PUBLIC CONTRACT CODE, SECTION 7106)

- A. General:
 1. Any public works contract of a supplier shall include a non-collusion affidavit.
- B. The Non-Collusion Affidavit form shall be completed by all bidding contractors and submitted with bids.

1.7 EEO AFFIRMITIVE ACTION PROVISIONS AND CLAUSES (EXECUTIVE ORDER 11246 AND 11375: 41 CFR PART 60-4)

- A. General:
 1. All prime contractors and subcontractors contracted to perform work on a DWSRF funded project must comply with all appropriate Equal Employment Opportunity and Affirmative Action requirements.
- B. Contract Provisions:
 1. 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, color, religion, sex, 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, color, religion, sex 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, color, religion, sex or national origin.
 - c. The CONTRACTOR will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant

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has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the CONTRACTOR's legal duty to furnish information.

- d. 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.
 - e. 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.
 - f. 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.
 - g. 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.
 - h. The CONTRACTOR shall include the provisions of paragraphs (a) through (h) 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 September 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 may be directed by the Secretary of Labor 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, the CONTRACTOR may request the United States to enter into such litigation to protect the interests of the United States.
- C. The following attachment shall be posted in a conspicuous place at the project site by the CONTRACTOR:
- 1. Attachment B – Equal Employment Opportunity Notice
- D. The Equal Employment Opportunity Certification form shall be completed by all bidding contractors and submitted with bids.

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1.8 RESTRICTIONS ON LOBBYING (31 USC 1352)

A. General:

1. As part of the for the DWSRF federal crosscutter requirements, water systems must include the following Lobbying Certification form in its contract documents, and certify that it has complied with Title 31, Section 1352, of the U.S. Code.
2. Certification forms submitted by contractors and subcontractors who are awarded the construction contract should be retained by the water system for audit purposes.

- B. The Lobbying Certification form shall be completed by all bidding contractors and submitted with bids.

1.9 DRUG-FREE WORKPLACE CERTIFICATION

A. General:

1. By signing the Agreement, the CONTRACTOR hereby certifies under penalty of perjury under the laws of the State of California that CONTRACTOR will comply with the requirements of the Drug-Free Workplace Act of 1990 (Government Code Section 8350 et seq.) and will provide a drug-free workplace by taking the following actions:
 - a. Publish a statement notifying employees that unlawful manufacture, distribution, dispensation, possession, or use of a controlled substance is prohibited and specifying actions to be taken against employees for violations.
 - b. Establish a Drug-Free Awareness program to inform employees about all of the following:
 - 1) The dangers of drug abuse in the workplace;
 - 2) The person's or organization's policy of maintaining a drug-free workplace;
 - 3) Any available counseling, rehabilitation and employee assistance programs;
 - 4) Penalties that may be imposed upon employees for drug abuse violations.
 - c. Every employee who works on the Project:
 - 1) Shall be issued a copy of CONTRACTOR's drug-free policy statement;
 - 2) Shall agree to abide by terms of CONTRACTOR's statement as a condition of employment on the Project.
2. The Agreement may be subject to suspension of payments or termination, or both, and CONTRACTOR may be subject to debarment if State determines that: (1) CONTRACTOR has made a false certification, or (2) CONTRACTOR has violated the certification by failing to carry out the requirements of this Article.

- B. The Drug-Free Workplace Certification form shall be completed by all bidding contractors and submitted with bids.

1.10 PREVAILING WAGES

- A. The CONTRACTOR agrees to be bound by all applicable provisions of State Labor Code regarding prevailing wages. The OWNER will monitor all agreements subject to reimbursement from this Agreement to ensure that the prevailing wage provisions of the State Labor Code are being met.
- B. In addition, the CONTRACTOR agrees to comply with the Davis-Bacon provisions incorporated herein.

1.11 DAVIS-BACON ACT PROVISIONS (29 CFR 5.5)

A. General:

1. All DWSRF funded projects must comply with the Davis-Bacon Act.
2. CONTRACTOR shall post information regarding the Davis Bacon Act requirements at the jobsite. An acceptable poster format is available at the following website:

B. Contract Provisions:

(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, <https://beta.sam.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

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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 report, 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 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

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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

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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 subcontractors 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.

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(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.

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 (b)(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,

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including watchmen and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the sum of \$25 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 (b)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The sub recipient shall upon the request of the EPA Award Official or an authorized representative of the Department of Labor, 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 (a)(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.

(c) 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 (write the name of agency) and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

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- C. The following attachment (or most recent version provided by addendum) shall be posted in a conspicuous place at the project site by the CONTRACTOR:
1. Attachment C – Davis Bacon Wage Determinations

1.12 CULTURAL RESOURCES PRESERVATION

- A. Should a potential tribal cultural resource and/or archaeological or historical resource be discovered during construction or Project implementation, the CONTRACTOR shall cease all work in the area of the find until a qualified archaeologist has evaluated the situation and made recommendations regarding preservation of the resource, and the Division of Drinking Water has determined what actions should be taken to protect and preserve the resource. The CONTRACTOR must implement appropriate actions as directed by the Division of Drinking Water.

1.13 ATTACHMENTS

- A. The following attachments are included as part of this Section.
1. Attachment A – DBE Subcontractor Participation Form
 2. Attachment B – Equal Employment Opportunity Notice
 3. Attachment C – Davis Bacon Wage Determinations

++ END OF SECTION ++



Disadvantaged Business Enterprise (DBE) Program
DBE Subcontractor Participation Form

A Financial Assistance Agreement Recipient must require its prime contractors to provide this form to its DBE subcontractors. This form gives a DBE¹ subcontractor² the opportunity to describe work received and/or report any concerns regarding the funded project (e.g., in areas such as termination by prime contractor, late payments, etc.). The DBE subcontractor can, as an option, complete and submit this form to the DBE Coordinator at any time during the project period of performance.

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 Received from the Prime Contractor Involving Construction, Services, Equipment or Supplies	Amount Received by Prime Contractor

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.

Please use the space below to report any concerns regarding the above funded project:

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.

Send completed Form 4500-2 to:

Mr. Joe Ochab, DBE Coordinator
US EPA, Region 9
75 Hawthorne Street
San Francisco, CA 94105

FORM 4500-2 (DBE Subcontractor Participation Form)

NOTICE TO BE POSTED

**EQUAL EMPLOYMENT OPPORTUNITY IS THE LAW – DISCRIMINATION IS
PROHIBITED BY THE CIVIL RIGHTS ACT OF 1964 AND BY EXECUTIVE
ORDER NO. 11246**

Title VII of the Civil Rights Act of 1964 – Administered by:

THE EQUAL EMPLOYMENT OPPORTUNITY COMMISSION

Prohibits discrimination because of Race, Color, Religion, Sex, or National Origin by Employers with 75 or more employees, by Labor Organizations with a hiring hall of 75 or more members, by Employment Agencies, and by Joint Labor-Management Committees for Apprenticeship or Training. After July 1, 1967, employers and labor organizations with 50 or more employees or members will be covered; after July 1, 1968, those with 25 or more will be covered.

ANY PERSON

Who believes he or she has been discriminated against

SHOULD CONTACT

THE EQUAL EMPLOYMENT OPPORTUNITY COMMISSION

2401 E Street NW, Washington, D.C. 20506

Executive Order No. 11246 – Administered by:

THE OFFICE OF FEDERAL CONTRACT COMPLIANCE PROGRAMS

Prohibits discrimination because of Race, Color, Religion, Sex, or National Origin, and requires affirmative action to ensure equality of opportunity in all aspects of employment.

By all Federal Government Contractors and Subcontractors, and by Contractors Performing Work Under a Federally Assisted Construction Contract, regardless of the number of employees in either case.

ANY PERSON

Who believes he or she has been discriminated against

SHOULD CONTACT

THE OFFICE OF FEDERAL CONTRACT COMPLIANCE PROGRAMS

U. S. Department of Labor, Washington, D.C. 20210

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DAVIS BACON WAGE DETERMINATIONS

General Decision Number: CA20210007 10/29/2021

Superseded General Decision Number: CA20200007

State: California

Construction Types: Building, Heavy (Heavy and Dredging) and Highway

Counties: Alpine, Amador, Butte, Colusa, El Dorado, Glenn, Lassen, Marin, Modoc, Napa, Nevada, Placer, Plumas, Sacramento, Shasta, Sierra, Siskiyou, Solano, Sonoma, Sutter, Tehama, Trinity, Yolo and Yuba Counties in California.

BUILDING CONSTRUCTION PROJECTS (excluding Amador County only);
DREDGING CONSTRUCTION PROJECTS (does not include hopper dredge work); HEAVY CONSTRUCTION PROJECTS (does not include water well drilling); AND HIGHWAY CONSTRUCTION PROJECTS

Note: Under Executive Order (EO) 13658, an hourly minimum wage of \$10.95 for calendar year 2021 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.95 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2021. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate, if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
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0	01/01/2021
1	01/08/2021
2	01/15/2021
3	01/22/2021

4	02/05/2021
5	02/19/2021
6	02/26/2021
7	04/02/2021
8	04/23/2021
9	05/07/2021
10	05/14/2021
11	05/21/2021
12	06/18/2021
13	06/25/2021
14	07/02/2021
15	07/09/2021
16	08/06/2021
17	08/13/2021
18	08/20/2021
19	08/27/2021
20	09/10/2021
21	09/24/2021
22	10/15/2021
23	10/22/2021
24	10/29/2021

ASBE0016-001 01/01/2021

AREA 1: MARIN, NAPA, SAN BENITO, SAN FRANCISCO, SOLANO, &
SONOMA COUNTIES

AREA 2: ALPINE, AMADOR, BUTTE, COLUSA, EL DORADO, GLENN,
MODOC, NEVADA, PLACER, PLUMAS, SACRAMENTO, SHASTA, SIERRA,
SISKIYOU, SUTTER, TEHEMA, TRINITY, YOLO, & YUBA COUNTIES

	Rates	Fringes
Asbestos Workers/Insulator (Includes the application of all insulating materials, Protective Coverings, Coatings, and Finishes to all types of mechanical systems)		
Area 1.....	\$ 74.16	23.58
Area 2.....	\$ 46.81	33.50

ASBE0016-007 01/01/2021

AREA 1 : ALPINE, AMADOR, BUTTE, COLUSA, EL DORADO, GLENN,
LASSEN, MODOC, NEVADA, PLACER, PLUMAS, SACRAMENTO, SHASTA,
SIERRA, SISKIYOU, SOLANO, SONOMA, SUTTER, TEHAMA, TRINITY, YOLO
& YUBA COUNTIES

AREA 2: MARIN & NAPA COUNTIES

Rates	Fringes
-------	---------

Asbestos Removal
worker/hazardous material
handler (Includes
preparation, wetting,
stripping, removal,
scrapping, vacuuming, bagging
and disposing of all
insulation materials from
mechanical systems, whether
they contain asbestos or not)

AREA 1.....	\$ 30.45	10.60
AREA 2.....	\$ 36.53	9.27

BOIL0549-002 01/01/2021

	Rates	Fringes
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BOILERMAKER

(1) Marin & Solano Counties..	\$ 49.62	41.27
(2) Remaining Counties.....	\$ 45.60	38.99

BRCA0003-001 08/01/2020

	Rates	Fringes
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MARBLE FINISHER.....	\$ 36.53	17.08
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BRCA0003-004 05/01/2019

AREA 1: ALPINE, AMADOR, BUTTE, COLUSA, EL DORADO, GLENN,
LASSEN, MODOC, NEVADA, PLACER, PLUMAS, SACRAMENTO, SHASTA,
SIERRA, SUTTER, TEHAMA, YOLO AND YUBA COUNTIES

AREA 2: MARIN, NAPA, SISKIYOU, SOLANO, SONOMA AND TRINITY
COUNTIES

	Rates	Fringes
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BRICKLAYER

AREA 1.....	\$ 43.24	21.63
AREA 2.....	\$ 45.92	26.70

SPECIALTY PAY:

(A) Underground work such as tunnel work, sewer work,
manholes, catch basins, sewer pipes and telephone conduit
shall be paid \$1.25 per hour above the regular rate. Work
in direct contact with raw sewage shall receive \$1.25 per
hour in addition to the above.

(B) Operating a saw or grinder shall receive \$1.25 per hour
above the regular rate.

(C) Guniting nozzle person shall receive \$1.25 per hour above
the regular rate.

BRCA0003-008 07/01/2019

	Rates	Fringes
TERRAZZO FINISHER.....	\$ 37.58	17.33
TERRAZZO WORKER/SETTER.....	\$ 48.53	26.84

BRCA0003-010 04/01/2019

	Rates	Fringes
TILE FINISHER		
Area 1.....	\$ 27.31	14.75
Area 2.....	\$ 27.10	16.50
Area 3.....	\$ 29.94	16.38
Area 4.....	\$ 28.06	15.82
Tile Layer		
Area 1.....	\$ 45.51	17.64
Area 2.....	\$ 45.15	19.06
Area 3.....	\$ 49.90	19.16
Area 4.....	\$ 46.77	19.08

AREA 1: Butte, Colusa, El Dorado, Glenn, Lassen, Modoc,
Nevada, Placer, Plumas, Sacramento, Shasta, Sierra, Sutter,
Tehama, Yolo, Yuba
AREA 2: Alpine, Amador
AREA 3: Marin, Napa, Solano, Siskiyou
AREA 4: Sonoma

BRCA0003-014 08/01/2020

	Rates	Fringes
MARBLE MASON.....	\$ 51.30	28.47

CARP0034-001 07/01/2021

	Rates	Fringes
Diver		
Assistant Tender, ROV		
Tender/Technician.....	\$ 54.10	34.69
Diver standby.....	\$ 60.51	34.69
Diver Tender.....	\$ 59.51	34.69
Diver wet.....	\$ 103.62	34.69
Manifold Operator (mixed gas).....	\$ 64.51	34.69
Manifold Operator (Standby).\$	59.51	34.69

DEPTH PAY (Surface Diving):
050 to 100 ft \$2.00 per foot

101 to 150 ft \$3.00 per foot
 151 to 220 ft \$4.00 per foot
 221 ft.-deeper \$5.00 per foot

SATURATION DIVING:

The standby rate shall apply until saturation starts. The saturation diving rate applies when divers are under pressure continuously until work task and decompression are complete. The diver rate shall be paid for all saturation hours.

DIVING IN ENCLOSURES:

Where it is necessary for Divers to enter pipes or tunnels, or other enclosures where there is no vertical ascent, the following premium shall be paid: Distance traveled from entrance 26 feet to 300 feet: \$1.00 per foot. When it is necessary for a diver to enter any pipe, tunnel or other enclosure less than 48" in height, the premium will be \$1.00 per foot.

WORK IN COMBINATION OF CLASSIFICATIONS:

Employees working in any combination of classifications within the diving crew (except dive supervisor) in a shift are paid in the classification with the highest rate for that shift.

 CARP0034-003 07/01/2021

	Rates	Fringes
Piledriver.....	\$ 54.10	34.69

CARP0035-001 08/01/2020

AREA 1: MARIN, NAPA, SOLANO & SONOMA

AREA 3: SACRAMENTO, WESTERN EL DORADO (Territory west of and including highway 49 and the territory inside the city limits of Placerville), WESTERN PLACER (Territory west of and including highway 49), & YOLO

AREA 4: ALPINE, BUTTE, COLUSA, EASTERN EL DORADO, GLENN, LASSEN, MODOC, NEVADA, EASTERN PLACER, PLUMAS, SHASTA, SIERRA, SISKIYOU, SUTTER, TEHAMA, TRINITY, & YUBA

	Rates	Fringes
Drywall Installers/Lathers:		
Area 1.....	\$ 52.65	31.26
Area 3.....	\$ 47.27	31.26
Area 4.....	\$ 45.92	31.26
Drywall Stocker/Scraper		

Area 1.....	\$ 26.33	18.22
Area 3.....	\$ 23.64	18.22
Area 4.....	\$ 22.97	18.22

CARP0035-009 07/01/2020

Marin County

	Rates	Fringes
CARPENTER		
Bridge Builder/Highway Carpenter.....	\$ 52.65	30.82
Hardwood Floorlayer, Shingler, Power Saw Operator, Steel Scaffold & Steel Shoring Erector, Saw Filer.....	\$ 52.80	30.82
Journeyman Carpenter.....	\$ 52.65	30.82
Millwright.....	\$ 52.75	32.41

CARP0035-010 07/01/2020

AREA 1: Marin, Napa, Solano & Sonoma Counties

AREA 2: Monterey, San Benito and Santa Cruz

AREA 3: Alpine, Butte, Colusa, El Dorado, Glenn, Lassen, Modoc,
Nevada, Placer, Plumas, Sacramento, Shasta, Sierra, Siskiyou,
Sutter, Tehama, Trinity, Yolo & Yuba counties

	Rates	Fringes
Modular Furniture Installer		
Area 1		
Installer.....	\$ 28.76	22.53
Lead Installer.....	\$ 32.21	23.03
Master Installer.....	\$ 36.43	23.03
Area 2		
Installer.....	\$ 26.11	22.53
Lead Installer.....	\$ 29.08	23.03
Master Installer.....	\$ 32.71	23.03
Area 3		
Installer.....	\$ 25.16	22.53
Lead Installer.....	\$ 27.96	23.03
Master Installer.....	\$ 31.38	23.03

CARP0046-001 07/01/2021

El Dorado (West), Placer (West), Sacramento and Yolo Counties

Rates	Fringes
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Carpenters

Bridge Builder/Highway		
Carpenter.....	\$ 54.85	31.49
Hardwood Floorlayer,		
Shingler, Power Saw		
Operator, Steel Scaffold &		
Steel Shoring Erector, Saw		
Filer.....	\$ 49.12	31.49
Journeyman Carpenter.....	\$ 48.97	31.49
Millwright.....	\$ 51.47	33.08

Footnote: Placer County (West) includes territory West of and including Highway 49 and El Dorado County (West) includes territory West of and including Highway 49 and territory inside the city limits of Placerville.

CARP0046-002 07/01/2021

Alpine, Colusa, El Dorado (East), Nevada, Placer (East),
Sierra, Sutter and Yuba Counties

Rates	Fringes
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Carpenters

Bridge Builder/Highway		
Carpenter.....	\$ 54.85	31.49
Hardwood Floorlayer,		
Shingler, Power Saw		
Operator, Steel Scaffold &		
Steel Shoring Erector, Saw		
Filer.....	\$ 47.77	31.49
Journeyman Carpenter.....	\$ 47.62	31.49
Millwright.....	\$ 50.12	33.08

CARP0152-003 07/01/2020

Amador County

Rates	Fringes
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Carpenters

Bridge Builder/Highway		
Carpenter.....	\$ 52.65	30.82
Hardwood Floorlayer,		
Shingler, Power Saw		
Operator, Steel Scaffold &		
Steel Shoring Erector, Saw		
Filer.....	\$ 45.57	30.82
Journeyman Carpenter.....	\$ 45.42	30.82
Millwright.....	\$ 47.92	32.41

CARP0180-001 07/01/2021

Solano County

	Rates	Fringes
Carpenters		
Bridge Builder/Highway		
Carpenter.....	\$ 54.85	31.49
Hardwood Floorlayer, Shingler, Power Saw Operator, Steel Scaffold & Steel Shoring Erector, Saw Filer.....	\$ 55.00	31.49
Journeyman Carpenter.....	\$ 54.85	31.49
Millwright.....	\$ 54.95	33.08

CARP0751-001 07/01/2021

Napa and Sonoma Counties

	Rates	Fringes
Carpenters		
Bridge Builder/Highway		
Carpenter.....	\$ 54.85	31.49
Hardwood Floorlayer, Shingler, Power Saw Operator, Steel Scaffold & Steel Shoring Erector, Saw Filer.....	\$ 55.00	31.49
Journeyman Carpenter.....	\$ 54.85	31.49
Millwright.....	\$ 54.95	33.08

CARP1599-001 07/01/2020Butte, Glenn, Lassen, Modoc, Plumas, Shasta, Siskiyou, Tehama
and Trinity Counties

	Rates	Fringes
Carpenters		
Bridge Builder/Highway		
Carpenter.....	\$ 52.65	30.82
Hardwood Floorlayer, Shingler, Power Saw Operator, Steel Scaffold & Steel Shoring Erector, Saw Filer.....	\$ 45.57	30.82
Journeyman Carpenter.....	\$ 45.42	30.82
Millwright.....	\$ 47.92	32.41

ELEC0180-001 06/01/2021

NAPA AND SOLANO COUNTIES

	Rates	Fringes
CABLE SPLICER.....	\$ 59.69	3%+24.38
ELECTRICIAN.....	\$ 53.06	3%+24.38

ELEC0180-003 12/01/2020

NAPA AND SOLANO COUNTIES

	Rates	Fringes
Sound & Communications		
Installer.....	\$ 42.11	22.41
Technician.....	\$ 48.43	22.60

SCOPE OF WORK INCLUDES-

SOUND & VOICE TRANSMISSION (Music, Intercom, Nurse Call, Telephone); FIRE ALARM SYSTEMS [excluding fire alarm work when installed in raceways (including wire and cable pulling) and when performed on new or major remodel building projects or jobs], TELEVISION & VIDEO SYSTEMS, SECURITY SYSTEMS, COMMUNICATIONS SYSTEMS that transmit or receive information and/or control systems that are intrinsic to the above.

EXCLUDES-

Excludes all other data systems or multiple systems which include control function or power supply; excludes installation of raceway systems, line voltage work, industrial work, life-safety systems (all buildings having floors located more than 75' above the lowest floor level having building access); excludes energy management systems.

ELEC0340-002 02/01/2018

ALPINE, AMADOR, BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, NEVADA, PLACER, PLUMAS, SACRAMENTO, TRINITY, YOLO, YUBA COUNTIES

	Rates	Fringes
Communications System		
Sound & Communications		
Installer.....	\$ 29.35	3%+15.35
Sound & Communications		
Technician.....	\$ 33.75	3%+15.35

SCOPE OF WORK

Includes the installation testing, service and maintenance,

of the following systems which utilize the transmission and/or transference of voice, sound, vision and digital for commercial, education, security and entertainment purposes for the following TV monitoring and surveillance, background-foreground music, intercom and telephone interconnect, inventory control systems, microwave transmission, multi-media, multiplex, nurse call system, radio page, school intercom and sound, burglar alarms, and low voltage master clock systems.

A. SOUND AND VOICE TRANSMISSION/TRANSFERENCE SYSTEMS

Background foreground music Intercom and telephone interconnect systems, Telephone systems, Nurse call systems, Radio page systems, School intercom and sound systems, Burglar alarm systems, Low voltage master clock systems, Multi-media/multiplex systems, Sound and musical entertainment systems, RF systems, Antennas and Wave Guide.

B. FIRE ALARM SYSTEMS

Installation, wire pulling and testing

C. TELEVISION AND VIDEO SYSTEMS Television monitoring and surveillance systems, Video security systems, Video entertainment systems, Video educational systems, Microwave transmission systems, CATV and CCTV

D. SECURITY SYSTEMS Perimeter security systems
Vibration sensor systems Card access systems Access control systems Sonar/infrared monitoring equipment

E. COMMUNICATIONS SYSTEMS THAT TRANSMIT OR RECEIVE INFORMATION AND/OR CONTROL SYSTEMS THAT ARE INTRINSIC TO THE ABOVE LISTED SYSTEMS SCADA (Supervisory Control and Data Acquisition) PCM (Pulse Code Modulation) Inventory Control Systems Digital Data Systems Broadband and Baseband and Carriers Point of Sale Systems VSAT Data Systems Data Communication Systems RF and Remote Control Systems Fiber Optic Data Systems WORK EXCLUDED Raceway systems are not covered (excluding Ladder-Rack for the purpose of the above listed systems). Chases and/or nipples (not to exceed 10 feet) may be installed on open wiring systems. Energy management systems. SCADA (Supervisory Control and Data Acquisition) when not intrinsic to the above listed systems (in the scope). Fire alarm systems when installed in raceways (including wire and cable pulling) shall be performed at the electrician wage rate, when either of the following two (2) conditions apply:

1. The project involves new or major remodel building trades construction.
2. The conductors for the fire alarm system are installed in conduit.

ELEC0340-003 06/01/2021

ALPINE (West of Sierra Mt. Watershed), AMADOR, BUTTE, COLUSA,
EL DORADO (West of Sierra Mt. Watershed), GLENN, LASSEN, NEVADA
(West of Sierra Mt. Watershed), PLACER, PLUMAS, SACRAMENTO,
SHASTA, SIERRA (West of Sierra Mt. Watershed), SUTTER, TEHAMA,
TRINITY, YOLO & YUBA COUNTIES

	Rates	Fringes
ELECTRICIAN		
Remaining area.....	\$ 41.56	32.49
Sierra Army Depot, Herlong..	\$ 48.83	18.54
Tunnel work.....	\$ 41.01	18.54

CABLE SPLICER: Receives 110% of the Electrician basic hourly rate.

ELEC0401-005 07/01/2020

ALPINE (east of the main watershed divide), EL DORADO (east of the main watershed divide), NEVADA (east of the main watershed), PLACER (east of the main watershed divide) and SIERRA (east of the main watershed divide) COUNTIES:

	Rates	Fringes
ELECTRICIAN.....	\$ 41.50	20.17

ZONE RATE:

70-90 miles - \$8.00 per hour
91+ miles - \$10.00 per hour

ELEC0551-004 06/01/2021

MARIN AND SONOMA COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 53.90	26.47

ELEC0551-005 12/21/2020

MARIN & SONOMA COUNTIES

	Rates	Fringes
Sound & Communications		
Installer.....	\$ 42.11	22.41

Technician.....\$ 48.43 22.60

SCOPE OF WORK INCLUDES-

SOUND & VOICE TRANSMISSION (Music, Intercom, Nurse Call, Telephone); FIRE ALARM SYSTEMS [excluding fire alarm work when installed in raceways (including wire and cable pulling) and when performed on new or major remodel building projects or jobs],

TELEVISION & VIDEO SYSTEMS, SECURITY SYSTEMS, COMMUNICATIONS SYSTEMS that transmit or receive information and/or control systems that are intrinsic to the above.

EXCLUDES-

Excludes all other data systems or multiple systems which include control function or power supply; excludes installation of raceway systems, line voltage work, industrial work, life-safety systems (all buildings having floors located more than 75' above the lowest floor level having building access); excludes energy management systems.

ELEC0659-006 01/01/2021

DEL NORTE, MODOC and SISKIYOU COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 38.49	17.74

ELEC0659-008 02/01/2020

DEL NORTE, MODOC & SISKIYOU COUNTIES

	Rates	Fringes
Line Construction		
(1) Cable Splicer.....	\$ 60.28	4.5%+19.40
(2) Lineman, Pole Sprayer, Heavy Line Equipment Man....	\$ 53.82	4.5%+19.40
(3) Tree Trimmer.....	\$ 37.84	4.5%+14.30
(4) Line Equipment Man.....	\$ 53.82	4.5%+19.40
(5) Powdermen, Jackhammermen.....	\$ 40.37	4.5%+14.30
(6) Groundman.....	\$ 33.37	4.5%+14.30

ELEC1245-004 06/01/2021

ALL COUNTIES EXCEPT DEL NORTE, MODOC & SISKIYOU

	Rates	Fringes
LINE CONSTRUCTION		
(1) Lineman; Cable splicer..	\$ 60.19	21.94

(2) Equipment specialist (operates crawler tractors, commercial motor vehicles, backhoes, trenchers, cranes (50 tons and below), overhead & underground distribution line equipment).....	\$ 48.08	20.73
(3) Groundman.....	\$ 36.76	20.33
(4) Powderman.....	\$ 51.87	18.79

HOLIDAYS: New Year's Day, M.L. King Day, Memorial Day,
Independence Day, Labor Day, Veterans Day, Thanksgiving Day
and day after Thanksgiving, Christmas Day

ELEV0008-001 01/01/2021

	Rates	Fringes
ELEVATOR MECHANIC.....	\$ 72.10	35.825+a+b

FOOTNOTE:

- a. PAID VACATION: Employer contributes 8% of regular hourly rate as vacation pay credit for employees with more than 5 years of service, and 6% for 6 months to 5 years of service.
b. PAID HOLIDAYS: New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, Friday after Thanksgiving, and Christmas Day.

ENGI0003-008 07/20/2020

	Rates	Fringes
Dredging: (DREDGING: CLAMSHELL & DIPPER DREDGING; HYDRAULIC SUCTION DREDGING:)		
AREA 1:		
(1) Leverman.....	\$ 49.88	34.35
(2) Dredge Dozer; Heavy duty repairman.....	\$ 44.92	34.35
(3) Booster Pump Operator; Deck Engineer; Deck mate; Dredge Tender; Winch Operator.....	\$ 43.80	34.35
(4) Bargeman; Deckhand; Fireman; Leveehand; Oiler..	\$ 40.50	34.35
AREA 2:		
(1) Leverman.....	\$ 51.88	34.35
(2) Dredge Dozer; Heavy duty repairman.....	\$ 46.92	34.35
(3) Booster Pump		

Operator; Deck		
Engineer; Deck mate;		
Dredge Tender; Winch		
Operator.....	\$ 45.80	34.35
(4) Bargeman; Deckhand;		
Fireman; Leveehand; Oiler..	\$ 42.50	34.35

AREA DESCRIPTIONS

AREA 1: ALAMEDA,BUTTE, CONTRA COSTA, KINGS, MARIN, MERCED,
NAPA, SACRAMENTO, SAN BENITO, SAN FRANCISCO, SAN JOAQUIN,
SAN MATEO, SANTA CLARA, SANTA CRUZ, SOLANO, STANISLAUS,
SUTTER, YOLO, AND YUBA COUNTIES

AREA 2: MODOC COUNTY

THE REMAINING COUNTIES ARE SPLIT BETWEEN AREA 1 AND AREA 2
AS NOTED BELOW:

ALPINE COUNTY:

Area 1: Northernmost part
Area 2: Remainder

CALAVERAS COUNTY:

Area 1: Remainder
Area 2: Eastern part

COLUSA COUNTY:

Area 1: Eastern part
Area 2: Remainder

ELDORADO COUNTY:

Area 1: North Central part
Area 2: Remainder

FRESNO COUNTY:

Area 1: Remainder
Area 2: Eastern part

GLENN COUNTY:

Area 1: Eastern part
Area 2: Remainder

LASSEN COUNTY:

Area 1: Western part along the Southern portion of border
with Shasta County
Area 2: Remainder

MADERA COUNTY:

Area 1: Except Eastern part
Area 2: Eastern part

MARIPOSA COUNTY

Area 1: Except Eastern part

Area 2: Eastern part

MONTERREY COUNTY

Area 1: Except Southwestern part

Area 2: Southwestern part

NEVADA COUNTY:

Area 1: All but the Northern portion along the border of
Sierra County

Area 2: Remainder

PLACER COUNTY:

Area 1: All but the Central portion

Area 2: Remainder

PLUMAS COUNTY:

Area 1: Western portion

Area 2: Remainder

SHASTA COUNTY:

Area 1: All but the Northeastern corner

Area 2: Remainder

SIERRA COUNTY:

Area 1: Western part

Area 2: Remainder

SISKIYOU COUNTY:

Area 1: Central part

Area 2: Remainder

SONOMA COUNTY:

Area 1: All but the Northwestern corner

Area 2: Remainder

TEHAMA COUNTY:

Area 1: All but the Western border with Mendocino & Trinity
Counties

Area 2: Remainder

TRINITY COUNTY:

Area 1: East Central part and the Northeastern border with
Shasta County

Area 2: Remainder

TUOLUMNE COUNTY:

Area 1: Except Eastern part

Area 2: Eastern part

ENGI0003-019 06/29/2020

SEE AREA DESCRIPTIONS BELOW

	Rates	Fringes
OPERATOR: Power Equipment (LANDSCAPE WORK ONLY)		
GROUP 1		
AREA 1.....	\$ 39.95	30.28
AREA 2.....	\$ 41.95	30.28
GROUP 2		
AREA 1.....	\$ 36.35	30.28
AREA 2.....	\$ 38.35	30.28
GROUP 3		
AREA 1.....	\$ 31.74	30.28
AREA 2.....	\$ 33.74	30.28

GROUP DESCRIPTIONS:

GROUP 1: Landscape Finish Grade Operator: All finish grade work regardless of equipment used, and all equipment with a rating more than 65 HP.

GROUP 2: Landscape Operator up to 65 HP: All equipment with a manufacturer's rating of 65 HP or less except equipment covered by Group 1 or Group 3. The following equipment shall be included except when used for finish work as long as manufacturer's rating is 65 HP or less: A-Frame and Winch Truck, Backhoe, Forklift, Hydragraphic Seeder Machine, Roller, Rubber-Tired and Track Earthmoving Equipment, Skiploader, Straw Blowers, and Trencher 31 HP up to 65 HP.

GROUP 3: Landscape Utility Operator: Small Rubber-Tired Tractor, Trencher Under 31 HP.

AREA DESCRIPTIONS:

AREA 1: ALAMEDA, BUTTE, CONTRA COSTA, KINGS, MARIN, MERCED, NAPA, SACRAMENTO, SAN BENITO, SAN FRANCISCO, SAN JOAQUIN, SAN MATEO, SANTA CLARA, SANTA CRUZ, SOLANO, STANISLAUS, SUTTER, YOLO, AND YUBA COUNTIES

AREA 2 - MODOC COUNTY

THE REMAINING COUNTIES ARE SPLIT BETWEEN AREA 1 AND AREA 2 AS NOTED BELOW:

ALPINE COUNTY:

Area 1: Northernmost part
Area 2: Remainder

CALAVERAS COUNTY:

Area 1: Except Eastern part
Area 2: Eastern part

COLUSA COUNTY:

Area 1: Eastern part
Area 2: Remainder

DEL NORTE COUNTY:
Area 1: Extreme Southwestern corner
Area 2: Remainder

ELDORADO COUNTY:
Area 1: North Central part
Area 2: Remainder

FRESNO COUNTY
Area 1: Except Eastern part
Area 2: Eastern part

GLENN COUNTY:
Area 1: Eastern part
Area 2: Remainder

HUMBOLDT COUNTY:
Area 1: Except Eastern and Southwestern parts
Area 2: Remainder

LAKE COUNTY:
Area 1: Southern part
Area 2: Remainder

LASSEN COUNTY:
Area 1: Western part along the Southern portion of border
with Shasta County
Area 2: Remainder

MADERA COUNTY
Area 1: Remainder
Area 2: Eastern part

MARIPOSA COUNTY
Area 1: Remainder
Area 2: Eastern part

MENDOCINO COUNTY:
Area 1: Central and Southeastern parts
Area 2: Remainder

MONTEREY COUNTY
Area 1: Remainder
Area 2: Southwestern part

NEVADA COUNTY:
Area 1: All but the Northern portion along the border of
Sierra County
Area 2: Remainder

PLACER COUNTY:

Area 1: All but the Central portion
Area 2: Remainder

PLUMAS COUNTY:
Area 1: Western portion
Area 2: Remainder

SHASTA COUNTY:
Area 1: All but the Northeastern corner
Area 2: Remainder

SIERRA COUNTY:
Area 1: Western part
Area 2: Remainder

SISKIYOU COUNTY:
Area 1: Central part
Area 2: Remainder

SONOMA COUNTY:
Area 1: All but the Northwestern corner
Area 2: Reaminder

TEHAMA COUNTY:
Area 1: All but the Western border with mendocino & Trinity
Counties
Area 2: Remainder

TRINITY COUNTY:
Area 1: East Central part and the Northeaster border with
Shasta County
Area 2: Remainder

TULARE COUNTY;
Area 1: Remainder
Area 2: Eastern part

TUOLUMNE COUNTY:
Area 1: Remainder
Area 2: Eastern Part

ENGI0003-038 06/29/2020

""AREA 1"" WAGE RATES ARE LISTED BELOW

""AREA 2"" RECEIVES AN ADDITIONAL \$2.00 PER HOUR ABOVE AREA 1
RATES.

SEE AREA DEFINITIONS BELOW

Rates	Fringes
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OPERATOR: Power Equipment

(AREA 1:)

GROUP 1.....	\$ 51.42	31.15
GROUP 2.....	\$ 49.89	31.15
GROUP 3.....	\$ 48.41	31.15
GROUP 4.....	\$ 47.03	31.15
GROUP 5.....	\$ 45.76	31.15
GROUP 6.....	\$ 44.44	31.15
GROUP 7.....	\$ 43.30	31.15
GROUP 8.....	\$ 42.16	31.15
GROUP 8-A.....	\$ 39.95	31.15

OPERATOR: Power Equipment

(Cranes and Attachments -

AREA 1:)

GROUP 1		
Cranes.....	\$ 52.30	31.15
Oiler.....	\$ 43.79	31.15
Truck crane oiler.....	\$ 46.08	31.15
GROUP 2		
Cranes.....	\$ 50.54	31.15
Oiler.....	\$ 42.83	31.15
Truck crane oiler.....	\$ 45.07	31.15
GROUP 3		
Cranes.....	\$ 48.80	31.15
Hydraulic.....	\$ 44.44	31.15
Oiler.....	\$ 42.55	31.15
Truck crane oiler.....	\$ 44.83	31.15
GROUP 4		
Cranes.....	\$ 45.76	31.15

OPERATOR: Power Equipment

(Piledriving - AREA 1:)

GROUP 1		
Lifting devices.....	\$ 52.64	31.15
Oiler.....	\$ 43.38	31.15
Truck Crane Oiler.....	\$ 45.66	31.15
GROUP 2		
Lifting devices.....	\$ 50.82	31.15
Oiler.....	\$ 43.11	31.15
Truck Crane Oiler.....	\$ 45.41	31.15
GROUP 3		
Lifting devices.....	\$ 49.14	31.15
Oiler.....	\$ 42.89	31.15
Truck Crane Oiler.....	\$ 45.12	31.15
GROUP 4		
Lifting devices.....	\$ 47.37	31.15
GROUP 5		
Lifting devices.....	\$ 44.73	31.15
GROUP 6		
Lifting devices.....	\$ 42.50	31.15

OPERATOR: Power Equipment

(Steel Erection - AREA 1:)

GROUP 1		
Cranes.....	\$ 53.27	31.15
Oiler.....	\$ 43.72	31.15

Truck Crane Oiler.....\$ 45.95	31.15
GROUP 2	
Cranes.....\$ 51.50	31.15
Oiler.....\$ 43.45	31.15
Truck Crane Oiler.....\$ 45.73	31.15
GROUP 3	
Cranes.....\$ 50.02	31.15
Hydraulic.....\$ 45.07	31.15
Oiler.....\$ 43.23	31.15
Truck Crane Oiler.....\$ 45.46	31.15
GROUP 4	
Cranes.....\$ 48.00	31.15
GROUP 5	
Cranes.....\$ 46.70	31.15
OPERATOR: Power Equipment (Tunnel and Underground Work - AREA 1:)	
SHAFTS, STOPES, RAISES:	
GROUP 1.....\$ 47.52	31.15
GROUP 1-A.....\$ 49.99	31.15
GROUP 2.....\$ 46.26	31.15
GROUP 3.....\$ 44.93	31.15
GROUP 4.....\$ 43.79	31.15
GROUP 5.....\$ 42.65	31.15
UNDERGROUND:	
GROUP 1.....\$ 47.42	31.15
GROUP 1-A.....\$ 49.89	31.15
GROUP 2.....\$ 46.16	31.15
GROUP 3.....\$ 44.83	31.15
GROUP 4.....\$ 43.69	31.15
GROUP 5.....\$ 42.55	31.15

FOOTNOTE: Work suspended by ropes or cables, or work on a Yo-Yo Cat: \$.60 per hour additional.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Operator of helicopter (when used in erection work); Hydraulic excavator, 7 cu. yds. and over; Power shovels, over 7 cu. yds.

GROUP 2: Highline cableway; Hydraulic excavator, 3-1/2 cu. yds. up to 7 cu. yds.; Licensed construction work boat operator, on site; Power blade operator (finish); Power shovels, over 1 cu. yd. up to and including 7 cu. yds. m.r.c.

GROUP 3: Asphalt milling machine; Cable backhoe; Combination backhoe and loader over 3/4 cu. yds.; Continuous flight tie back machine assistant to engineer or mechanic; Crane mounted continuous flight tie back machine, tonnage to apply; Crane mounted drill attachment, tonnage to apply; Dozer, slope brd; Gradall; Hydraulic excavator, up to 3 1/2

cu. yds.; Loader 4 cu. yds. and over; Long reach excavator; Multiple engine scraper (when used as push pull); Power shovels, up to and including 1 cu. yd.; Pre-stress wire wrapping machine; Side boom cat, 572 or larger; Track loader 4 cu. yds. and over; Wheel excavator (up to and including 750 cu. yds. per hour)

GROUP 4: Asphalt plant engineer/box person; Chicago boom; Combination backhoe and loader up to and including 3/4 cu. yd.; Concrete batch plant (wet or dry); Dozer and/or push cat; Pull- type elevating loader; Gradesetter, grade checker (GPS, mechanical or otherwise); Grooving and grinding machine; Heading shield operator; Heavy-duty drilling equipment, Hughes, LDH, Watson 3000 or similar; Heavy-duty repairperson and/or welder; Lime spreader; Loader under 4 cu. yds.; Lubrication and service engineer (mobile and grease rack); Mechanical finishers or spreader machine (asphalt, Barber-Greene and similar); Miller Formless M-9000 slope paver or similar; Portable crushing and screening plants; Power blade support; Roller operator, asphalt; Rubber-tired scraper, self-loading (paddle-wheels, etc.); Rubber- tired earthmoving equipment (scrapers); Slip form paver (concrete); Small tractor with drag; Soil stabilizer (P & H or equal); Spider plow and spider puller; Tubex pile rig; Unlicensed construction work boat operator, on site; Timber skidder; Track loader up to 4 yds.; Tractor-drawn scraper; Tractor, compressor drill combination; Welder; Woods-Mixer (and other similar Pugmill equipment)

GROUP 5: Cast-in-place pipe laying machine; Combination slusher and motor operator; Concrete conveyor or concrete pump, truck or equipment mounted; Concrete conveyor, building site; Concrete pump or pumpcrete gun; Drilling equipment, Watson 2000, Texoma 700 or similar; Drilling and boring machinery, horizontal (not to apply to waterliners, wagon drills or jackhammers); Concrete mixer/all; Person and/or material hoist; Mechanical finishers (concrete) (Clary, Johnson, Bidwell Bridge Deck or similar types); Mechanical burm, curb and/or curb and gutter machine, concrete or asphalt); Mine or shaft hoist; Portable crusher; Power jumbo operator (setting slip-forms, etc., in tunnels); Screed (automatic or manual); Self-propelled compactor with dozer; Tractor with boom D6 or smaller; Trenching machine, maximum digging capacity over 5 ft. depth; Vermeer T-600B rock cutter or similar

GROUP 6: Armor-Coater (or similar); Ballast jack tamper; Boom- type backfilling machine; Assistant plant engineer; Bridge and/or gantry crane; Chemical grouting machine, truck-mounted; Chip spreading machine operator; Concrete saw (self-propelled unit on streets, highways, airports and canals); Deck engineer; Drilling equipment Texoma 600, Hughes 200 Series or similar up to and including 30 ft.

m.r.c.; Drill doctor; Helicopter radio operator; Hydro-hammer or similar; Line master; Skidsteer loader, Bobcat larger than 743 series or similar (with attachments); Locomotive; Lull hi-lift or similar; Oiler, truck mounted equipment; Pavement breaker, truck-mounted, with compressor combination; Paving fabric installation and/or laying machine; Pipe bending machine (pipelines only); Pipe wrapping machine (tractor propelled and supported); Screed (except asphaltic concrete paving); Self-propelled pipeline wrapping machine; Tractor; Self-loading chipper; Concrete barrier moving machine

GROUP 7: Ballast regulator; Boom truck or dual-purpose A-frame truck, non-rotating - under 15 tons; Cary lift or similar; Combination slurry mixer and/or cleaner; Drilling equipment, 20 ft. and under m.r.c.; Firetender (hot plant); Grouting machine operator; Highline cableway signalperson; Stationary belt loader (Kolman or similar); Lift slab machine (Vagtborg and similar types); Maginnes internal full slab vibrator; Material hoist (1 drum); Mechanical trench shield; Pavement breaker with or without compressor combination); Pipe cleaning machine (tractor propelled and supported); Post driver; Roller (except asphalt); Chip Seal; Self-propelled automatically applied concrete curing machine (on streets, highways, airports and canals); Self-propelled compactor (without dozer); Signalperson; Slip-form pumps (lifting device for concrete forms); Tie spacer; Tower mobile; Trenching machine, maximum digging capacity up to and including 5 ft. depth; Truck-type loader

GROUP 8: Bit sharpener; Boiler tender; Box operator; Brakeperson; Combination mixer and compressor (shotcrete/gunite); Compressor operator; Deckhand; Fire tender; Forklift (under 20 ft.); Generator; Gunite/shotcrete equipment operator; Hydraulic monitor; Ken seal machine (or similar); Mixermobile; Oiler; Pump operator; Refrigeration plant; Reservoir-debris tug (self-propelled floating); Ross Carrier (construction site); Rotomist operator; Self-propelled tape machine; Shuttlecar; Self-propelled power sweeper operator (includes vacuum sweeper); Slusher operator; Surface heater; Switchperson; Tar pot firetender; Tugger hoist, single drum; Vacuum cooling plant; Welding machine (powered other than by electricity)

GROUP 8-A: Elevator operator; Skidsteer loader-Bobcat 743 series or smaller, and similar (without attachments); Mini excavator under 25 H.P. (backhoe-trencher); Tub grinder wood chipper

ALL CRANES AND ATTACHMENTS

GROUP 1: Clamshell and dragline over 7 cu. yds.; Crane, over 100 tons; Derrick, over 100 tons; Derrick barge pedestal-mounted, over 100 tons; Self-propelled boom-type lifting device, over 100 tons

GROUP 2: Clamshell and dragline over 1 cu. yd. up to and including 7 cu. yds.; Crane, over 45 tons up to and including 100 tons; Derrick barge, 100 tons and under; Self-propelled boom-type lifting device, over 45 tons; Tower crane

GROUP 3: Clamshell and dragline up to and including 1 cu. yd.; Cranes 45 tons and under; Self-propelled boom-type lifting device 45 tons and under;

GROUP 4: Boom Truck or dual purpose A-frame truck, non-rotating over 15 tons; Truck-mounted rotating telescopic boom type lifting device, Manitex or similar (boom truck) over 15 tons; Truck-mounted rotating telescopic boom type lifting device, Manitex or similar (boom truck) - under 15 tons;

PILEDRIVERS

GROUP 1: Derrick barge pedestal mounted over 100 tons; Clamshell over 7 cu. yds.; Self-propelled boom-type lifting device over 100 tons; Truck crane or crawler, land or barge mounted over 100 tons

GROUP 2: Derrick barge pedestal mounted 45 tons to and including 100 tons; Clamshell up to and including 7 cu. yds.; Self-propelled boom-type lifting device over 45 tons; Truck crane or crawler, land or barge mounted, over 45 tons up to and including 100 tons; Fundex F-12 hydraulic pile rig

GROUP 3: Derrick barge pedestal mounted under 45 tons; Self-propelled boom-type lifting device 45 tons and under; Skid/scow piledriver, any tonnage; Truck crane or crawler, land or barge mounted 45 tons and under

GROUP 4: Assistant operator in lieu of assistant to engineer; Forklift, 10 tons and over; Heavy-duty repairperson/welder

GROUP 5: Deck engineer

GROUP 6: Deckhand; Fire tender

STEEL ERECTORS

GROUP 1: Crane over 100 tons; Derrick over 100 tons; Self-

propelled boom-type lifting device over 100 tons

GROUP 2: Crane over 45 tons to 100 tons; Derrick under 100 tons; Self-propelled boom-type lifting device over 45 tons to 100 tons; Tower crane

GROUP 3: Crane, 45 tons and under; Self-propelled boom-type lifting device, 45 tons and under

GROUP 4: Chicago boom; Forklift, 10 tons and over; Heavy-duty repair person/welder

GROUP 5: Boom cat

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TUNNEL AND UNDERGROUND WORK

GROUP 1-A: Tunnel bore machine operator, 20' diameter or more

GROUP 1: Heading shield operator; Heavy-duty repairperson; Mucking machine (rubber tired, rail or track type); Raised bore operator (tunnels); Tunnel mole bore operator

GROUP 2: Combination slusher and motor operator; Concrete pump or pumpcrete gun; Power jumbo operator

GROUP 3: Drill doctor; Mine or shaft hoist

GROUP 4: Combination slurry mixer cleaner; Grouting Machine operator; Motorman

GROUP 5: Bit Sharpener; Brakeman; Combination mixer and compressor (gunite); Compressor operator; Oiler; Pump operator; Slusher operator

AREA DESCRIPTIONS:

POWER EQUIPMENT OPERATORS, CRANES AND ATTACHMENTS, TUNNEL AND UNDERGROUND [These areas do not apply to Piledrivers and Steel Erectors]

AREA 1: DEL NORTE, HUMBOLDT, LAKE, MENDOCINO
AREA 2 -NOTED BELOW

THE REMAINING COUNTIES ARE SPLIT BETWEEN AREA 1 AND AREA 2 AS NOTED BELOW:

DEL NORTE COUNTY:
Area 1: Extreme Southwest corner
Area 2: Remainder

HUMBOLDT COUNTY:

Area 1: Except Eastern and Southwestern parts

Area 2: Remainder

LAKE COUNTY:

Area 1: Southern part

Area 2: Remainder

MENDOCINO COUNTY:

Area 1: Central and Southeastern Parts

Area 2: Remainder

IRON0433-006 07/01/2020

	Rates	Fringes
IRONWORKER		
Fence Erector.....	\$ 34.58	24.81
Ornamental, Reinforcing and Structural.....	\$ 41.00	33.45

PREMIUM PAY:

\$6.00 additional per hour at the following locations:

China Lake Naval Test Station, Chocolate Mountains Naval
Reserve-Niland,
Edwards AFB, Fort Irwin Military Station, Fort Irwin Training
Center-Goldstone, San Clemente Island, San Nicholas Island,
Susanville Federal Prison, 29 Palms - Marine Corps, U.S. Marine
Base - Barstow, U.S. Naval Air Facility - Seale, Vandenberg AFB

\$4.00 additional per hour at the following locations:

Army Defense Language Institute - Monterey, Fallon Air Base,
Naval Post Graduate School - Monterey, Yermo Marine Corps
Logistics Center

\$2.00 additional per hour at the following locations:

Port Hueneme, Port Mugu, U.S. Coast Guard Station - Two Rock

LABO0067-001 06/28/2021

AREA ""A"" - MARIN COUNTY

AREA ""B"" - ALPINE, AMADOR, BUTTE COLUSA EL DORADO, GLENN,
LASSEN, MODOC, NAPA, NEVADA, PLACER, PLUMAS, SACRAMENTO,
SHASTA, SIERRA, SISKIYOU, SOLANO, SONOMA, SUTTER, TEHAMA,
TRINITY, YOLO, AND YUBA COUNTIES

	Rates	Fringes
Asbestos Removal Laborer.....	\$ 26.05	12.75
LABORER (Lead Removal)		
Marin County.....	\$ 34.37	25.95
Remaining Counties.....	\$ 33.37	25.95

LABO0067-005 06/27/2017

AREA ""A"" - ALAMEDA, CONTRA COSTA, SAN FRANCISCO, SAN MATEO AND SANTA CLARA COUNTIES

AREA ""B"" - ALPINE, AMADOR, BUTTE, CALAVERAS, COLUSA, DEL NORTE, EL DORADO, FRESNO, GLENN, HUMBOLDT, KINGS, LAKE, LASSEN, MADERA, MARIPOSA, MENDOCINO, MERCED, MODOC, MONTEREY, NEVADA, PLACER, PLUMAS, SACRAMENTO, SAN BENITO, SAN JOAQUIN, SANTA CRUZ, SIERRA, SHASTA, SISKIYOU, STANISLAUS, TEHAMA, TRINITY, TULARE, TUOLUMNE, YOLO AND YUBA COUNTIES

	Rates	Fringes
LABORER (TRAFFIC CONTROL/LANE CLOSURE)		
Escort Driver, Flag Person		
Area A.....	\$ 29.54	22.17
Area B.....	\$ 28.54	22.17
Traffic Control Person I		
Area A.....	\$ 29.84	22.17
Area B.....	\$ 28.84	22.17
Traffic Control Person II		
Area A.....	\$ 27.34	22.17
Area B.....	\$ 26.34	22.17

TRAFFIC CONTROL PERSON I: Layout of traffic control, crash cushions, construction area and roadside signage.

TRAFFIC CONTROL PERSON II: Installation and removal of temporary/permanent signs, markers, delineators and crash cushions.

LABO0185-002 07/01/2021

ALPINE, AMADOR, BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MODOC, NEVADA, PLACER, PLUMAS, SACRAMENTO, SHASTA, SIERRA, SISKIYOU, SUTTER, TEHAMA, TRINITY, YOLO AND YUBA COUNTIES

	Rates	Fringes
LABORER		

Mason Tender-Brick.....\$ 34.09 24.41

LABO0185-005 07/01/2021

ALPINE, AMADOR, BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MODOC,
NEVADA, PLACER, PLUMAS, SACRAMENTO, SHASTA, SIERRA, SISKIYOU,
SUTTER, TEHAMA, TRINITY, YOLO AND YUBA COUNTIES

Rates Fringes

Tunnel and Shaft Laborers:

GROUP 1.....	\$ 42.00	25.71
GROUP 2.....	\$ 41.77	25.71
GROUP 3.....	\$ 41.52	25.71
GROUP 4.....	\$ 41.07	25.71
GROUP 5.....	\$ 40.53	25.71
Shotcrete Specialist.....	\$ 42.52	25.71

TUNNEL AND SHAFT CLASSIFICATIONS

GROUP 1: Diamond driller; Groundmen; Gunite and shotcrete
nozzlemen

GROUP 2: Rodmen; Shaft work & raise (below actual or
excavated ground level)

GROUP 3: Bit grinder; Blaster, driller, powdermen, heading;
Cherry pickermen - where car is lifted; Concrete finisher
in tunnel; Concrete screedman; Grout pumpman and potman;
Gunite & shotcrete gunman & potman; Headermen; High
pressure nozzleman; Miner - tunnel, including top and
bottom man on shaft and raise work; Nipper; Nozzleman on
slick line; Sandblaster - potman, Robotic Shotcrete Placer,
Segment Erector, Tunnel Muck Hauler, Steel Form raiser and
setter; Timberman, retimberman (wood or steel or substitute
materials therefore); Tugger (for tunnel laborer work);
Cable tender; Chuck tender; Powderman - primer house

GROUP 4: Vibrator operator, pavement breaker; Bull gang -
muckers, trackmen; Concrete crew - includes rodding and
spreading, Dumpmen (any method)

GROUP 5: Grout crew; Reboundman; Swamper/ Brakeman

LABO0185-006 06/25/2018

ALPINE, AMADOR, BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MODOC,
NEVADA, PLACER, PLUMAS, SACRAMENTO, SHIASTA, SIERRA, SISKIYOU,
SUTTER, TEHAMA, TRINITY, YOLO, YUBA COUNTIES

Rates Fringes

LABORER (CONSTRUCTION CRAFT
LABORERS - AREA B:)

Construction Specialist		
Group.....	\$ 30.49	23.20
GROUP 1.....	\$ 29.79	23.20
GROUP 1-a.....	\$ 30.01	23.20
GROUP 1-c.....	\$ 30.01	23.20
GROUP 1-e.....	\$ 30.34	23.20
GROUP 1-f.....	\$ 30.37	23.20
GROUP 2.....	\$ 29.64	23.20
GROUP 3.....	\$ 29.54	23.20
GROUP 4.....	\$ 23.23	23.20

See groups 1-b and 1-d under laborer classifications.

LABORER (GARDENERS,
HORTICULTURAL & LANDSCAPE
LABORERS - AREA B:)

(1) New Construction.....	\$ 29.54	23.20
(2) Establishment Warranty Period.....	\$ 23.23	23.20

LABORER (GUNITE - AREA B:)

GROUP 1.....	\$ 29.75	22.31
GROUP 2.....	\$ 29.25	22.31
GROUP 3.....	\$ 28.66	22.31
GROUP 4.....	\$ 28.54	22.31

LABORER (WRECKING - AREA B:)

GROUP 1.....	\$ 29.79	23.20
GROUP 2.....	\$ 29.64	23.20

FOOTNOTES:

Laborers working off or with or from bos'n chairs, swinging scaffolds, belts shall receive \$0.25 per hour above the applicable wage rate. This shall not apply to workers entitled to receive the wage rate set forth in Group 1-a below.

LABORER CLASSIFICATIONS

CONSTRUCTION SPECIALIST GROUP: Asphalt ironer and raker; Chainsaw; Laser beam in connection with laborers' work; Cast-in- place manhole form setter; Pressure pipelayer; Davis trencher - 300 or similar type (and all small trenchers); Blaster; Diamond driller; Multiple unit drill; Hydraulic drill

GROUP 1: Asphalt spreader boxes (all types); Barko, Wacker and similar type tampers; Buggymobile; Caulker, bander, pipewrapper, conduit layer, plastic pipelayer; Certified hazardous waste worker including Leade Abatement; Compactors of all types; Concrete and magnesite mixer, 1/2 yd. and under; Concrete pan work; Concrete sander; Concrete

saw; Cribber and/or shoring; Cut granite curb setter; Dri-pak-it machine; Faller, logloader and buckler; Form raiser, slip forms; Green cutter; Headerboard, Hubsetter, aligner, by any method; High pressure blow pipe (1-1/2" or over, 100 lbs. pressure/over); Hydro seeder and similar type; Jackhammer operator; Jacking of pipe over 12 inches; Jackson and similar type compactor; Kettle tender, pot and worker applying asphalt, lay-kold, creosote, lime, caustic and similar type materials (applying means applying, dipping or handling of such materials); Lagging, sheeting, whaling, bracing, trenchjacking, lagging hammer; Magnesite, epoxyresin, fiberglass, mastic worker (wet or dry); No joint pipe and stripping of same, including repair of voids; Pavement breaker and spader, including tool grinder; Perma curb; Pipelayer (including grade checking in connection with pipelaying); Precast-manhole setter; Pressure pipe tester; Post hole digger, air, gas and electric; Power broom sweeper; Power tampers of all types (except as shown in Group 2); Ram set gun and stud gun; Riprap stonepaver and rock-slinger, including placing of sacked concrete and/or sand (wet or dry) and gabions and similar type; Rotary scarifier or multiple head concrete chipping scarifier; Roto and Ditch Witch; Rototiller; Sandblaster, pot, gun, nozzle operators; Signalling and rigging; Tank cleaner; Tree climber; Turbo blaster; Vibrascreed, bull float in connection with laborers' work; Vibrator; Hazardous waste worker (lead removal); Asbestos and mold removal worker

GROUP 1-a: Joy drill model TWM-2A; Gardner-Denver model DH143 and similar type drills; Track driller; Jack leg driller; Wagon driller; Mechanical drillers, all types regardless of type or method of power; Mechanical pipe layers, all types regardless of type or method of power; Blaster and powder; All work of loading, placing and blasting of all powder and explosives of whatever type regardless of method used for such loading and placing; High scalers (including drilling of same); Tree topper; Bit grinder

GROUP 1-b: Sewer cleaners shall receive \$4.00 per day above Group 1 wage rates. "Sewer cleaner" means any worker who handles or comes in contact with raw sewage in small diameter sewers. Those who work inside recently active, large diameter sewers, and all recently active sewer manholes shall receive \$5.00 per day above Group 1 wage rates.

GROUP 1-c: Burning and welding in connection with laborers' work; Synthetic thermoplastics and similar type welding

GROUP 1-d: Maintenance and repair track and road beds. All employees performing work covered herein shall receive \$.25 per hour above their regular rate for all work performed on underground structures not specifically

covered herein. This paragraph shall not be construed to apply to work below ground level in open cut. It shall apply to cut and cover work of subway construction after the temporary cover has been placed.

GROUP 1-e: Work on and/or in bell hole footings and shafts thereof, and work on and in deep footings. (A deep footing is a hole 15 feet or more in depth.) In the event the depth of the footing is unknown at the commencement of excavation, and the final depth exceeds 15 feet, the deep footing wage rate would apply to all employees for each and every day worked on or in the excavation of the footing from the date of inception.

GROUP 1-f: Wire winding machine in connection with guniting or shot crete

GROUP 2: Asphalt shoveler; Cement dumper and handling dry cement or gypsum; Choke-setter and rigger (clearing work); Concrete bucket dumper and chute; Concrete chipping and grinding; Concrete laborer (wet or dry); Driller tender, chuck tender, nipper; Guinea chaser (stake), grout crew; High pressure nozzle, adductor; Hydraulic monitor (over 100 lbs. pressure); Loading and unloading, carrying and hauling of all rods and materials for use in reinforcing concrete construction; Pittsburgh chipper and similar type brush shredders; Sloper; Single foot, hand-held, pneumatic tamper; All pneumatic, air, gas and electric tools not listed in Groups 1 through 1-f; Jacking of pipe - under 12 inches

GROUP 3: Construction laborers, including bridge and general laborer; Dump, load spotter; Flag person; Fire watcher; Fence erector; Guardrail erector; Gardener, horticultural and landscape laborer; Jetting; Limber, brush loader and piler; Pavement marker (button setter); Maintenance, repair track and road beds; Streetcar and railroad construction track laborer; Temporary air and water lines, Victaulic or similar; Tool room attendant (jobsite only)

GROUP 4: Final clean-up work of debris, grounds and building including but not limited to: street cleaner; cleaning and washing windows; brick cleaner (jobsite only); material cleaner (jobsite only). The classification ""material cleaner"" is to be utilized under the following conditions:

- A: at demolition site for the salvage of the material.
- B: at the conclusion of a job where the material is to be salvaged and stocked to be reused on another job.
- C: for the cleaning of salvage material at the jobsite or temporary jobsite yard.

The material cleaner classification should not be used in the performance of ""form stripping, cleaning and oiling and moving to the next point of erection"".

GUNITE LABORER CLASSIFICATIONS

GROUP 1: Structural Nozzleman

GROUP 2: Nozzleman, Gunman, Potman, Groundman

GROUP 3: Reboundman

GROUP 4: Guniting laborer

WRECKING WORK LABORER CLASSIFICATIONS

GROUP 1: Skilled wrecker (removing and salvaging of sash, windows and materials)

GROUP 2: Semi-skilled wrecker (salvaging of other building materials)

LABO0185-008 07/01/2021

	Rates	Fringes
Plasterer tender.....	\$ 35.82	28.45

Work on a swing stage scaffold: \$1.00 per hour additional.

LABO0261-002 06/28/2021

MARIN COUNTY

	Rates	Fringes
LABORER (TRAFFIC CONTROL/LANE CLOSURE)		
Escort Driver, Flag Person..	\$ 34.48	26.21
Traffic Control Person I....	\$ 34.78	26.21
Traffic Control Person II...	\$ 32.28	26.21

TRAFFIC CONTROL PERSON I: Layout of traffic control, crash cushions, construction area and roadside signage.

TRAFFIC CONTROL PERSON II: Installation and removal of temporary/permanent signs, markers, delineators and crash cushions.

LABO0261-004 07/01/2021

MARIN COUNTY

	Rates	Fringes
Tunnel and Shaft Laborers:		
GROUP 1.....	\$ 42.00	25.71
GROUP 2.....	\$ 41.77	25.71
GROUP 3.....	\$ 41.52	25.71
GROUP 4.....	\$ 41.07	25.71
GROUP 5.....	\$ 40.53	25.71
Shotcrete Specialist.....	\$ 42.52	25.71

TUNNEL AND SHAFT CLASSIFICATIONS

GROUP 1: Diamond driller; Groundmen; Gunite and shotcrete nozzlemen

GROUP 2: Rodmen; Shaft work & raise (below actual or excavated ground level)

GROUP 3: Bit grinder; Blaster, driller, powdermen, heading; Cherry pickermen - where car is lifted; Concrete finisher in tunnel; Concrete screedman; Grout pumpman and potman; Gunite & shotcrete gunman & potman; Headermen; High pressure nozzleman; Miner - tunnel, including top and bottom man on shaft and raise work; Nipper; Nozzleman on slick line; Sandblaster - potman, Robotic Shotcrete Placer, Segment Erector, Tunnel Muck Hauler, Steel Form raiser and setter; Timberman, retimberman (wood or steel or substitute materials therefore); Tugger (for tunnel laborer work); Cable tender; Chuck tender; Powderman - primer house

GROUP 4: Vibrator operator, pavement breaker; Bull gang - muckers, trackmen; Concrete crew - includes rodding and spreading, Dumpmen (any method)

GROUP 5: Grout crew; Reboundman; Swamper/ Brakeman

LABO0261-007 07/01/2018

MARIN AND NAPA COUNTIES

	Rates	Fringes
LABORER		
Mason Tender-Brick.....	\$ 32.45	22.20

LABO0261-010 06/25/2018

MARIN COUNTY

	Rates	Fringes
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LABORER (CONSTRUCTION CRAFT
LABORERS - AREA A:)

Construction Specialist		
Group.....	\$ 31.49	23.20
GROUP 1.....	\$ 30.79	23.20
GROUP 1-a.....	\$ 31.01	23.20
GROUP 1-c.....	\$ 30.84	23.20
GROUP 1-e.....	\$ 31.34	23.20
GROUP 1-f.....	\$ 31.37	23.20
GROUP 2.....	\$ 30.64	23.20
GROUP 3.....	\$ 30.54	23.20
GROUP 4.....	\$ 24.23	23.20

See groups 1-b and 1-d under laborer classifications.

LABORER (GARDENERS,
HORTICULTURAL & LANDSCAPE
LABORERS - AREA A:)

(1) New Construction.....	\$ 30.54	23.20
(2) Establishment Warranty Period.....	\$ 24.23	23.20

LABORER (GUNITE - AREA A:)

GROUP 1.....	\$ 30.75	22.31
GROUP 2.....	\$ 30.25	22.31
GROUP 3.....	\$ 29.66	22.31
GROUP 4.....	\$ 29.54	22.31

LABORER (WRECKING - AREA A:)

GROUP 1.....	\$ 30.79	23.20
GROUP 2.....	\$ 30.64	23.20

FOOTNOTES:

Laborers working off or with or from bos'n chairs, swinging scaffolds, belts shall receive \$0.25 per hour above the applicable wage rate. This shall not apply to workers entitled to receive the wage rate set forth in Group 1-a below.

LABORER CLASSIFICATIONS

CONSTRUCTION SPECIALIST GROUP: Asphalt ironer and raker; Chainsaw; Laser beam in connection with laborers' work; Cast-in- place manhole form setter; Pressure pipelayer; Davis trencher - 300 or similar type (and all small trenchers); Blaster; Diamond driller; Multiple unit drill; Hydraulic drill

GROUP 1: Asphalt spreader boxes (all types); Barko, Wacker and similar type tampers; Buggymobile; Caulker, bander, pipewrapper, conduit layer, plastic pipelayer; Certified hazardous waste worker including Leade Abatement; Compactors of all types; Concrete and magnesite mixer, 1/2 yd. and under; Concrete pan work; Concrete sander; Concrete saw; Cribber and/or shoring; Cut granite curb setter;

Dri-pak-it machine; Faller, logloader and buckler; Form raiser, slip forms; Green cutter; Headerboard, Hubsetter, aligner, by any method; High pressure blow pipe (1-1/2" or over, 100 lbs. pressure/over); Hydro seeder and similar type; Jackhammer operator; Jacking of pipe over 12 inches; Jackson and similar type compactor; Kettle tender, pot and worker applying asphalt, lay-kold, creosote, lime, caustic and similar type materials (applying means applying, dipping or handling of such materials); Lagging, sheeting, whaling, bracing, trenchjacking, lagging hammer; Magnesite, epoxyresin, fiberglass, mastic worker (wet or dry); No joint pipe and stripping of same, including repair of voids; Pavement breaker and spader, including tool grinder; Perma curb; Pipelayer (including grade checking in connection with pipelaying); Precast-manhole setter; Pressure pipe tester; Post hole digger, air, gas and electric; Power broom sweeper; Power tampers of all types (except as shown in Group 2); Ram set gun and stud gun; Riprap stonepaver and rock-slinger, including placing of sacked concrete and/or sand (wet or dry) and gabions and similar type; Rotary scarifier or multiple head concrete chipping scarifier; Roto and Ditch Witch; Rototiller; Sandblaster, pot, gun, nozzle operators; Signalling and rigging; Tank cleaner; Tree climber; Turbo blaster; Vibrascreed, bull float in connection with laborers' work; Vibrator; Hazardous waste worker (lead removal); Asbestos and mold removal worker

GROUP 1-a: Joy drill model TWM-2A; Gardner-Denver model DH143 and similar type drills; Track driller; Jack leg driller; Wagon driller; Mechanical drillers, all types regardless of type or method of power; Mechanical pipe layers, all types regardless of type or method of power; Blaster and powder; All work of loading, placing and blasting of all powder and explosives of whatever type regardless of method used for such loading and placing; High scalers (including drilling of same); Tree topper; Bit grinder

GROUP 1-b: Sewer cleaners shall receive \$4.00 per day above Group 1 wage rates. "Sewer cleaner" means any worker who handles or comes in contact with raw sewage in small diameter sewers. Those who work inside recently active, large diameter sewers, and all recently active sewer manholes shall receive \$5.00 per day above Group 1 wage rates.

GROUP 1-c: Burning and welding in connection with laborers' work; Synthetic thermoplastics and similar type welding

GROUP 1-d: Maintenance and repair track and road beds. All employees performing work covered herein shall receive \$.25 per hour above their regular rate for all work performed on underground structures not specifically covered herein. This paragraph shall not be construed to

apply to work below ground level in open cut. It shall apply to cut and cover work of subway construction after the temporary cover has been placed.

GROUP 1-e: Work on and/or in bell hole footings and shafts thereof, and work on and in deep footings. (A deep footing is a hole 15 feet or more in depth.) In the event the depth of the footing is unknown at the commencement of excavation, and the final depth exceeds 15 feet, the deep footing wage rate would apply to all employees for each and every day worked on or in the excavation of the footing from the date of inception.

GROUP 1-f: Wire winding machine in connection with guniting or shot crete

GROUP 2: Asphalt shoveler; Cement dumper and handling dry cement or gypsum; Choke-setter and rigger (clearing work); Concrete bucket dumper and chute; Concrete chipping and grinding; Concrete laborer (wet or dry); Driller tender, chuck tender, nipper; Guinea chaser (stake), grout crew; High pressure nozzle, adductor; Hydraulic monitor (over 100 lbs. pressure); Loading and unloading, carrying and hauling of all rods and materials for use in reinforcing concrete construction; Pittsburgh chipper and similar type brush shredders; Sloper; Single foot, hand-held, pneumatic tamper; All pneumatic, air, gas and electric tools not listed in Groups 1 through 1-f; Jacking of pipe - under 12 inches

GROUP 3: Construction laborers, including bridge and general laborer; Dump, load spotter; Flag person; Fire watcher; Fence erector; Guardrail erector; Gardener, horticultural and landscape laborer; Jetting; Limber, brush loader and piler; Pavement marker (button setter); Maintenance, repair track and road beds; Streetcar and railroad construction track laborer; Temporary air and water lines, Victaulic or similar; Tool room attendant (jobsite only)

GROUP 4: Final clean-up work of debris, grounds and building including but not limited to: street cleaner; cleaning and washing windows; brick cleaner (jobsite only); material cleaner (jobsite only). The classification "material cleaner" is to be utilized under the following conditions:

A: at demolition site for the salvage of the material.

B: at the conclusion of a job where the material is to be salvaged and stocked to be reused on another job.

C: for the cleaning of salvage material at the jobsite or temporary jobsite yard.

The material cleaner classification should not be used in the performance of "form stripping, cleaning and oiling and moving to the next point of erection".

GUNITE LABORER CLASSIFICATIONS

GROUP 1: Structural Nozzleman

GROUP 2: Nozzleman, Gunman, Potman, Groundman

GROUP 3: Reboundman

GROUP 4: Gunit laborer

WRECKING WORK LABORER CLASSIFICATIONS

GROUP 1: Skilled wrecker (removing and salvaging of sash, windows and materials)

GROUP 2: Semi-skilled wrecker (salvaging of other building materials)

LABO0261-015 07/01/2021

	Rates	Fringes
Plasterer tender.....	\$ 35.82	28.45

Work on a swing stage scaffold: \$1.00 per hour additional.

LABO0324-004 06/28/2021

NAPA, SOLANO, AND SONOMA, COUNTIES

	Rates	Fringes
LABORER (TRAFFIC CONTROL/LANE CLOSURE)		
Escort Driver, Flag Person..	\$ 33.48	26.21
Traffic Control Person I....	\$ 33.78	26.21
Traffic Control Person II...	\$ 31.28	26.21

TRAFFIC CONTROL PERSON I: Layout of traffic control, crash cushions, construction area and roadside signage.

TRAFFIC CONTROL PERSON II: Installation and removal of temporary/permanent signs, markers, delineators and crash cushions.

LABO0324-008 06/25/2018

NAPA, SOLANO, AND SONOMA COUNTIES

	Rates	Fringes
Tunnel and Shaft Laborers:		
GROUP 1.....	\$ 37.82	24.11
GROUP 2.....	\$ 37.59	24.11
GROUP 3.....	\$ 37.34	24.11
GROUP 4.....	\$ 36.89	24.11
GROUP 5.....	\$ 36.35	24.11
Shotcrete Specialist.....	\$ 38.34	24.11

TUNNEL AND SHAFT CLASSIFICATIONS

GROUP 1: Diamond driller; Groundmen; Gunite and shotcrete nozzlemen

GROUP 2: Rodmen; Shaft work & raise (below actual or excavated ground level)

GROUP 3: Bit grinder; Blaster, driller, powdermen, heading; Cherry pickermen - where car is lifted; Concrete finisher in tunnel; Concrete screedman; Grout pumpman and potman; Gunite & shotcrete gunman & potman; Headermen; High pressure nozzleman; Miner - tunnel, including top and bottom man on shaft and raise work; Nipper; Nozzleman on slick line; Sandblaster - potman, Robotic Shotcrete Placer, Segment Erector, Tunnel Muck Hauler, Steel Form raiser and setter; Timberman, retimberman (wood or steel or substitute materials therefore); Tugger (for tunnel laborer work); Cable tender; Chuck tender; Powderman - primer house

GROUP 4: Vibrator operator, pavement breaker; Bull gang - muckers, trackmen; Concrete crew - includes rodding and spreading, Dumpmen (any method)

GROUP 5: Grout crew; Reboundman; Swamper/ Brakeman

LABO0324-010 07/01/2018

SOLANO AND SONOMA COUNTIES

	Rates	Fringes
LABORER		
Mason Tender-Brick.....	\$ 31.45	22.20

LABO0324-013 06/25/2018

NAPA, SOLANO, AND SONOMA COUNTIES

	Rates	Fringes
LABORER (CONSTRUCTION CRAFT		

LABORERS - AREA B:)

Construction Specialist

Group.....	\$ 30.49	23.20
GROUP 1.....	\$ 29.79	23.20
GROUP 1-a.....	\$ 30.01	23.20
GROUP 1-c.....	\$ 29.84	23.20
GROUP 1-e.....	\$ 30.34	23.20
GROUP 1-f.....	\$ 29.37	23.20
GROUP 2.....	\$ 29.64	23.20
GROUP 3.....	\$ 29.54	23.20
GROUP 4.....	\$ 23.23	23.20

See groups 1-b and 1-d under laborer classifications.

LABORER (GARDENERS,
HORTICULTURAL & LANDSCAPE
LABORERS - AREA B:)

(1) New Construction.....	\$ 29.54	23.20
(2) Establishment Warranty Period.....	\$ 23.23	23.20

LABORER (GUNITE - AREA B:)

GROUP 1.....	\$ 29.75	22.31
GROUP 2.....	\$ 29.25	22.31
GROUP 3.....	\$ 28.66	22.31
GROUP 4.....	\$ 28.54	22.31

LABORER (WRECKING - AREA B:)

GROUP 1.....	\$ 29.79	23.20
GROUP 2.....	\$ 29.64	23.20

FOOTNOTES:

Laborers working off or with or from bos'n chairs, swinging scaffolds, belts shall receive \$0.25 per hour above the applicable wage rate. This shall not apply to workers entitled to receive the wage rate set forth in Group 1-a below.

LABORER CLASSIFICATIONS

CONSTRUCTION SPECIALIST GROUP: Asphalt ironer and raker; Chainsaw; Laser beam in connection with laborers' work; Cast-in- place manhole form setter; Pressure pipelayer; Davis trencher - 300 or similar type (and all small trenchers); Blaster; Diamond driller; Multiple unit drill; Hydraulic drill

GROUP 1: Asphalt spreader boxes (all types); Barko, Wacker and similar type tampers; Buggymobile; Caulker, bander, pipewrapper, conduit layer, plastic pipelayer; Certified hazardous waste worker including Leade Abatement; Compactors of all types; Concrete and magnesite mixer, 1/2 yd. and under; Concrete pan work; Concrete sander; Concrete saw; Cribber and/or shoring; Cut granite curb setter; Dri-pak-it machine; Faller, logloader and buckler; Form

raiser, slip forms; Green cutter; Headerboard, Hubsetter, aligner, by any method; High pressure blow pipe (1-1/2" or over, 100 lbs. pressure/over); Hydro seeder and similar type; Jackhammer operator; Jacking of pipe over 12 inches; Jackson and similar type compactor; Kettle tender, pot and worker applying asphalt, lay-kold, creosote, lime, caustic and similar type materials (applying means applying, dipping or handling of such materials); Lagging, sheeting, whaling, bracing, trenchjacking, lagging hammer; Magnesite, epoxyresin, fiberglass, mastic worker (wet or dry); No joint pipe and stripping of same, including repair of voids; Pavement breaker and spader, including tool grinder; Perma curb; Pipelayer (including grade checking in connection with pipelaying); Precast-manhole setter; Pressure pipe tester; Post hole digger, air, gas and electric; Power broom sweeper; Power tampers of all types (except as shown in Group 2); Ram set gun and stud gun; Riprap stonepaver and rock-slinger, including placing of sacked concrete and/or sand (wet or dry) and gabions and similar type; Rotary scarifier or multiple head concrete chipping scarifier; Roto and Ditch Witch; Rototiller; Sandblaster, pot, gun, nozzle operators; Signalling and rigging; Tank cleaner; Tree climber; Turbo blaster; Vibrascreed, bull float in connection with laborers' work; Vibrator; Hazardous waste worker (lead removal); Asbestos and mold removal worker

GROUP 1-a: Joy drill model TWM-2A; Gardner-Denver model DH143 and similar type drills; Track driller; Jack leg driller; Wagon driller; Mechanical drillers, all types regardless of type or method of power; Mechanical pipe layers, all types regardless of type or method of power; Blaster and powder; All work of loading, placing and blasting of all powder and explosives of whatever type regardless of method used for such loading and placing; High scalers (including drilling of same); Tree topper; Bit grinder

GROUP 1-b: Sewer cleaners shall receive \$4.00 per day above Group 1 wage rates. "Sewer cleaner" means any worker who handles or comes in contact with raw sewage in small diameter sewers. Those who work inside recently active, large diameter sewers, and all recently active sewer manholes shall receive \$5.00 per day above Group 1 wage rates.

GROUP 1-c: Burning and welding in connection with laborers' work; Synthetic thermoplastics and similar type welding

GROUP 1-d: Maintenance and repair track and road beds. All employees performing work covered herein shall receive \$.25 per hour above their regular rate for all work performed on underground structures not specifically covered herein. This paragraph shall not be construed to apply to work below ground level in open cut. It shall

apply to cut and cover work of subway construction after the temporary cover has been placed.

GROUP 1-e: Work on and/or in bell hole footings and shafts thereof, and work on and in deep footings. (A deep footing is a hole 15 feet or more in depth.) In the event the depth of the footing is unknown at the commencement of excavation, and the final depth exceeds 15 feet, the deep footing wage rate would apply to all employees for each and every day worked on or in the excavation of the footing from the date of inception.

GROUP 1-f: Wire winding machine in connection with guniting or shot crete

GROUP 2: Asphalt shoveler; Cement dumper and handling dry cement or gypsum; Choke-setter and rigger (clearing work); Concrete bucket dumper and chute; Concrete chipping and grinding; Concrete laborer (wet or dry); Driller tender, chuck tender, nipper; Guinea chaser (stake), grout crew; High pressure nozzle, adductor; Hydraulic monitor (over 100 lbs. pressure); Loading and unloading, carrying and hauling of all rods and materials for use in reinforcing concrete construction; Pittsburgh chipper and similar type brush shredders; Sloper; Single foot, hand-held, pneumatic tamper; All pneumatic, air, gas and electric tools not listed in Groups 1 through 1-f; Jacking of pipe - under 12 inches

GROUP 3: Construction laborers, including bridge and general laborer; Dump, load spotter; Flag person; Fire watcher; Fence erector; Guardrail erector; Gardener, horticultural and landscape laborer; Jetting; Limber, brush loader and piler; Pavement marker (button setter); Maintenance, repair track and road beds; Streetcar and railroad construction track laborer; Temporary air and water lines, Victaulic or similar; Tool room attendant (jobsite only)

GROUP 4: Final clean-up work of debris, grounds and building including but not limited to: street cleaner; cleaning and washing windows; brick cleaner (jobsite only); material cleaner (jobsite only). The classification ""material cleaner"" is to be utilized under the following conditions:
A: at demolition site for the salvage of the material.
B: at the conclusion of a job where the material is to be salvaged and stocked to be reused on another job.
C: for the cleaning of salvage material at the jobsite or temporary jobsite yard.

The material cleaner classification should not be used in the performance of ""form stripping, cleaning and oiling and moving to the next point of erection"".

GUNITE LABORER CLASSIFICATIONS

GROUP 1: Structural Nozzleman

GROUP 2: Nozzleman, Gunman, Potman, Groundman

GROUP 3: Reboundman

GROUP 4: Guniting laborer

WRECKING WORK LABORER CLASSIFICATIONS

GROUP 1: Skilled wrecker (removing and salvaging of sash, windows and materials)

GROUP 2: Semi-skilled wrecker (salvaging of other building materials)

LABO0324-019 07/01/2021

	Rates	Fringes
Plasterer tender.....	\$ 35.82	28.45

Work on a swing stage scaffold: \$1.00 per hour additional.

PAIN0016-004 01/01/2021

MARIN, NAPA, SOLANO & SONOMA COUNTIES

	Rates	Fringes
Painters:.....	\$ 45.22	25.48

PREMIUMS:

EXOTIC MATERIALS - \$1.25 additional per hour.

SPRAY WORK: - \$0.50 additional per hour.

INDUSTRIAL PAINTING - \$0.25 additional per hour

[Work on industrial buildings used for the manufacture and processing of goods for sale or service; steel construction (bridges), stacks, towers, tanks, and similar structures]

HIGH WORK:

over 50 feet - \$2.00 per hour additional

100 to 180 feet - \$4.00 per hour additional

Over 180 feet - \$6.00 per hour additional

* PAIN0016-005 07/01/2021

ALPINE, BUTTE, COLUSA, EL DORADO (west of the Sierra Nevada Mountains), GLENN, LASSEN (west of Hwy. 395, excluding Honey Lake); MARIN, MODOC, NAPA, NEVADA (west of the Sierra Nevada Mountains), PLACER (west of the Sierra Nevada Mountains), PLUMAS, SACRAMENTO, SHASTA, SIERRA (west of the Sierra Nevada Mountains), SISKIYOU, SOLANO, SONOMA, SUTTER, TEHAMA, TRINITY, YOLO AND YUBA COUNTIES

	Rates	Fringes
DRYWALL FINISHER/TAPER.....	\$ 50.78	28.09

PAIN0016-007 01/01/2021

ALPINE, AMADOR, BUTTE, COLUSA. EL DORADO (west of the Sierra Nevada Mountains), GLENN, LASSEN (west of Highway 395, excluding Honey Lake), MODOC, NEVADA (west of the Sierra Nevada Mountains), PLACER (west of the Sierra Nevada Mountains), PLUMAS, SACRAMENTO, SHASTA, SIERRA (west of the Sierra Nevada Mountains), SISKIYOU, SUTTER, TEHAMA, TRINITY, YOLO & YUBA COUNTIES

	Rates	Fringes
Painters:.....	\$ 35.88	21.16

SPRAY/SANDBLAST: \$0.50 additional per hour.
EXOTIC MATERIALS: \$1.25 additional per hour.
HIGH TIME: Over 50 ft above ground or water level \$2.00 additional per hour. 100 to 180 ft above ground or water level \$4.00 additional per hour. Over 180 ft above ground or water level \$6.00 additional per hour.

PAIN0016-008 01/01/2019

MARIN, NAPA, SOLANO AND SONOMA COUNTIES

	Rates	Fringes
SOFT FLOOR LAYER.....	\$ 48.60	27.43

PAIN0169-004 01/01/2021

MARIN , NAPA & SONOMA COUNTIES; SOLANO COUNTY (west of a line defined as follows: Hwy. 80 corridor beginning at the City of Fairfield, including Travis Air Force Base and Suisun City; going north of Manakas Corner Rd., continue north on Suisun Valley Rd. to the Napa County line; Hwy. 80 corridor south on Grizzly Island Rd. to the Grizzly Island Management area)

	Rates	Fringes
GLAZIER.....	\$ 53.07	31.15

* PAIN0567-001 07/01/2021		

EL DORADO COUNTY (east of the Sierra Nevada Mountains); LASSEN COUNTY (east of Highway 395, beginning at Stacey and including Honey Lake); NEVADA COUNTY (east of the Sierra Nevada Mountains); PLACER COUNTY (east of the Sierra Nevada Mountains); AND SIERRA COUNTY (east of the Sierra Nevada Mountains)

	Rates	Fringes
Painters:		
Brush and Roller.....	\$ 31.80	13.54
Spray Painter & Paperhanger.	\$ 33.39	13.54

PREMIUMS:
 Special Coatings (Brush), and Sandblasting = \$0.50/hr
 Special Coatings (Spray), and Steeplejack = \$1.00/hr
 Special Coating Spray Steel = \$1.25/hr
 Swing Stage = \$2.00/hr

*A special coating is a coating that requires the mixing of 2 or more products.

 PAIN0567-007 07/01/2020

EL DORADO COUNTY (east of the Sierra Nevada Mountains); LASSEN COUNTY (east of Highway 395, beginning at Stacey and including Honey Lake); NEVADA COUNTY (east of the Sierra Nevada Mountains); PLACER COUNTY (east of the Sierra Nevada Mountains) AND SIERRA COUNTY (east of the Sierra Nevada Mountains)

	Rates	Fringes
SOFT FLOOR LAYER.....	\$ 31.01	15.48

PAIN0567-010 07/01/2020		

EL DORADO COUNTY (east of the Sierra Nevada Mountains); LASSEN COUNTY (east of Highway 395, beginning at Stacey and including Honey Lake); NEVADA COUNTY (east of the Sierra Nevada Mountains); PLACER COUNTY (east of the Sierra Nevada Mountains); AND SIERRA COUNTY (east of the Sierra Nevada Mountains)

	Rates	Fringes
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Drywall

(1) Taper.....	\$ 35.20	14.02
(2) Steeplejack - Taper, over 40 ft with open space below.....	\$ 36.70	14.02

PAIN0767-004 01/01/2021

ALPINE, AMADOR, BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MODOC,
NEVADA, PLACER, PLUMAS, SACRAMENTO, SHASTA, SIERRA, SISKIYOU,
SOLANO (Remainder), SUTTER, TEHAMA, TRINITY, YOLO, YUBA

Rates	Fringes
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GLAZIER.....	\$ 41.51	31.36
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PAID HOLIDAYS: New Year's Day, Martin Luther King, Jr. Day,
President's Day, Memorial Day, Independence Day, Labor Day,
Veteran's Day, Thanksgiving Day, and Christmas Day.

Employee required to wear a body harness shall receive \$1.50
per hour above the basic hourly rate at any elevation.

PAIN1176-001 07/01/2020

HIGHWAY IMPROVEMENT

Rates	Fringes
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Parking Lot Striping/Highway
Marking:

GROUP 1.....	\$ 38.48	16.88
GROUP 2.....	\$ 32.71	16.88
GROUP 3.....	\$ 33.09	16.88

CLASSIFICATIONS

GROUP 1: Striper: Layout and application of painted traffic
stripes and marking; hot thermo plastic; tape, traffic
stripes and markings

GROUP 2: Gamecourt & Playground Installer

GROUP 3: Protective Coating, Pavement Sealing

PAIN1237-001 01/01/2021

ALPINE; COLUSA; EL DORADO (west of the Sierra Nevada
Mountains); GLENN; LASSEN (west of Highway 395, beginning at
Stacey and including Honey Lake); MODOC; NEVADA (west of the

Sierra Nevada Mountains); PLACER (west of the Sierra Nevada Mountains); PLUMAS; SACRAMENTO; SHASTA; SIERRA (west of the Sierra Nevada Mountains); SISKIYOU; SUTTER; TEHAMA; TRINITY; YOLO AND YUBA COUNTIES

	Rates	Fringes
SOFT FLOOR LAYER.....	\$ 41.81	23.39

PLAS0300-003 07/01/2018		

	Rates	Fringes
PLASTERER		
AREA 295: Alpine, Amador, Butte, Colusa, El Dorado, Glenn, Lassen, Modoc, Nevada, Placer, Plumas, Sacramento, Shasta, Sierra, Siskiyou, Solano, Sutter, Tehama, Trinity, Yolo & Yuba Counties.....	\$ 32.70	31.68
AREA 355: Marin.....	\$ 36.73	31.68
AREA 355: Napa & Sonoma Counties.....	\$ 32.70	31.68

PLAS0300-005 07/01/2016		

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 32.15	23.27

PLUM0038-002 07/01/2021		

MARIN AND SONOMA COUNTIES

	Rates	Fringes
PLUMBER (Plumber, Steamfitter, Refrigeration Fitter)		
(1) Work on wooden frame structures 5 stories or less excluding high-rise buildings and commercial work such as hospitals, prisons, hotels, schools, casinos, wastewater treatment plants, and research facilities as well as refrigeration pipefitting, service and repair work - MARKET		

RECOVERY RATE.....\$ 67.15	44.21
(2) All other work - NEW	
CONSTRUCTION RATE.....\$ 79.00	46.01

PLUM0038-006 07/01/2021

MARIN & SONOMA COUNTIES

	Rates	Fringes
Landscape/Irrigation Fitter (Underground/Utility Fitter).....\$ 67.15		32.67

PLUM0228-001 07/01/2021

BUTTE, COLUSA, GLENN, LASSEN, MODOC, PLUMAS, SHASTA, SIERRA,
SISKIYOU, SUTTER, TEHAMA, TRINITY & YUBA COUNTIES

	Rates	Fringes
PLUMBER.....\$ 42.50		35.89

PLUM0343-001 07/01/2021

NAPA AND SOLANO COUNTIES

	Rates	Fringes
PLUMBER/PIPEFITTER		
Light Commercial.....\$ 30.85		20.40
All Other Work.....\$ 56.00		39.61

DEFINITION OF LIGHT COMMERCIAL:

Work shall include strip shopping centers, office buildings, schools and other commercial structures which the total plumbing bid does not exceed Two Hundred and Fifty Thousand (\$250,000) and the total heating and cooling does not exceed Two Hundred Fifty Thousand (\$250,000); or Any projects bid in phases shall not qualify unless the total project is less than Two Hundred Fifty Thousand (\$250,000) for the plumbing bid; and Two Hundred Fifty Thousand (\$250,000) for the heating and cooling bid. Excluded are hospitals, jails, institutions and industrial projects, regardless size of the project

FOOTNOTES: While fitting galvanized material: \$.75 per hour additional. Work from trusses, temporary staging, unguarded structures 35' from the ground or water: \$.75 per hour additional. Work from swinging scaffolds, boatswains chairs or similar devices: \$.75 per hour additional.

PLUM0350-001 08/01/2021

EL DORADO COUNTY (Lake Tahoe area only); NEVADA COUNTY (Lake Tahoe area only); AND PLACER COUNTY (Lake Tahoe area only)

	Rates	Fringes
PLUMBER/PIPEFITTER.....	\$ 47.54	17.11

PLUM0355-001 07/01/2021		

ALPINE, AMADOR, BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MODOC, NAPA, NEVADA, PLACER, PLUMAS, SACRAMENTO, SHASTA, SIERRA, SISKIYOU, SOLANO, SUTTER, TEHAMA, TRINITY, YOLO, AND YUBA COUNTIES

	Rates	Fringes
Underground Utility Worker /Landscape Fitter.....	\$ 30.90	16.80

PLUM0442-003 07/01/2021		

AMADOR (South of San Joaquin River) and ALPINE COUNTIES

	Rates	Fringes
PLUMBER.....	\$ 47.50	33.39

PLUM0447-001 07/01/2021		

AMADOR (north of San Joaquin River), EL DORADO (excluding Lake Tahoe area), NEVADA (excluding Lake Tahoe area); PLACER (excluding Lake Tahoe area), SACRAMENTO AND YOLO COUNTIES

	Rates	Fringes
PLUMBER/PIPEFITTER		
Journeyman.....	\$ 56.37	26.75
Light Commercial Work.....	\$ 36.23	17.72

ROOF0081-006 08/01/2021		

MARIN, NAPA, SOLANO AND SONOMA COUNTIES

	Rates	Fringes
Roofer.....	\$ 47.17	19.86

ROOF0081-007 08/01/2021		

ALPINE, BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MODOC, NEVADA,

PLACER, PLUMAS, SACRAMENTO, SHASTA, SIERRA, SISKIYOU, SUTTER,
TEHAMA, TRINITY, YOLO, AND YUBA COUNTIES

	Rates	Fringes
Roofer.....	\$ 41.23	19.61

SFCA0483-003 08/02/2021		

MARIN, NAPA, SOLANO AND SONOMA COUNTIES

	Rates	Fringes
SPRINKLER FITTER (Fire Sprinklers).....	\$ 70.99	34.85

SFCA0669-003 04/01/2021		

ALPINE, BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MODOC, NEVADA,
PLACER, PLUMAS, SACRAMENTO, SHASTA, SIERRA, SISKIYOU, SUTTER,
TEHAMA, TRINITY, YOLO AND YUBA COUNTIES

	Rates	Fringes
SPRINKLER FITTER.....	\$ 42.34	26.29

SHEE0104-006 06/29/2020		

MARIN, NAPA, SOLANO SONOMA & TRINITY COUNTIES

	Rates	Fringes
Sheet Metal Worker Mechanical Contracts \$200,000 or less.....	\$ 55.92	45.29
All other work.....	\$ 64.06	46.83

SHEE0104-009 07/01/2021		

AMADOR, COLUSA, EL DORADO, NEVADA, PLACER, SACRAMENTO, SUTTER,
YOLO AND YUBA COUNTIES

	Rates	Fringes
SHEET METAL WORKER.....	\$ 47.85	41.90

SHEE0104-010 07/01/2020		

ALPINE COUNTY

Rates	Fringes
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SHEET METAL WORKER.....\$ 43.50 37.42

SHEE0104-011 07/01/2020

BUTTE, COLUSA, EL DORADO, GLENN, LASSEN, MODOC, NEVADA, PLACER,
PLUMAS, SACRAMENTO, SHASTA, SIERRA, SISKIYOU, SUTTER, TEHAMA,
YOLO AND YUBA COUNTIES

Rates Fringes

Sheet Metal Worker (Metal
decking and siding only).....\$ 44.45 35.55

SHEE0104-014 07/01/2020

MARIN, NAPA, SOLANO, SONOMA AND TRINITY COUNTIES

Rates Fringes

SHEET METAL WORKER (Metal
Decking and Siding only).....\$ 44.45 35.55

SHEE0104-019 07/01/2020

BUTTE, GLENN, LASSEN, MODOC, PLUMAS, SHASTA, SIERRA, SISKIYOU
AND TEHAMA COUNTIES

Rates Fringes

SHEET METAL WORKER
Mechanical Jobs \$200,000 &
under.....\$ 35.16 35.88
Mechanical Jobs over
\$200,000.....\$ 46.60 40.21

TEAM0094-001 07/01/2021

Rates Fringes

Truck drivers:
GROUP 1.....\$ 35.15 31.42
GROUP 2.....\$ 35.45 31.42
GROUP 3.....\$ 35.75 31.42
GROUP 4.....\$ 36.10 31.42
GROUP 5.....\$ 36.45 31.42

FOOTNOTES:

Articulated dump truck; Bulk cement spreader (with or without
auger); Dumpcrete truck; Skid truck (debris box); Dry
pre-batch concrete mix trucks; Dumpster or similar type;
Slurry truck: Use dump truck yardage rate.

Heater planer; Asphalt burner; Scarifier burner; Industrial lift truck (mechanical tailgate); Utility and clean-up truck: Use appropriate rate for the power unit or the equipment utilized.

TRUCK DRIVER CLASSIFICATIONS

GROUP 1: Dump trucks, under 6 yds.; Single unit flat rack (2-axle unit); Nipper truck (when flat rack truck is used appropriate flat rack shall apply); Concrete pump truck (when flat rack truck is used appropriate flat rack shall apply); Concrete pump machine; Fork lift and lift jitneys; Fuel and/or grease truck driver or fuel person; Snow buggy; Steam cleaning; Bus or personhaul driver; Escort or pilot car driver; Pickup truck; Teamster oiler/greaser and/or serviceperson; Hook tender (including loading and unloading); Team driver; Tool room attendant (refineries)

GROUP 2: Dump trucks, 6 yds. and under 8 yds.; Transit mixers, through 10 yds.; Water trucks, under 7,000 gals.; Jetting trucks, under 7,000 gals.; Single-unit flat rack (3-axle unit); Highbed heavy duty transport; Scissor truck; Rubber-tired muck car (not self-loaded); Rubber-tired truck jumbo; Winch truck and "A" frame drivers; Combination winch truck with hoist; Road oil truck or bootperson; Buggymobile; Ross, Hyster and similar straddle carriers; Small rubber-tired tractor

GROUP 3: Dump trucks, 8 yds. and including 24 yds.; Transit mixers, over 10 yds.; Water trucks, 7,000 gals. and over; Jetting trucks, 7,000 gals. and over; Vacuum trucks under 7500 gals. Trucks towing tilt bed or flat bed pull trailers; Lowbed heavy duty transport; Heavy duty transport tiller person; Self-propelled street sweeper with self-contained refuse bin; Boom truck - hydro-lift or Swedish type extension or retracting crane; P.B. or similar type self-loading truck; Tire repairperson; Combination bootperson and road oiler; Dry distribution truck (A bootperson when employed on such equipment, shall receive the rate specified for the classification of road oil trucks or bootperson); Ammonia nitrate distributor, driver and mixer; Snow Go and/or plow

GROUP 4: Dump trucks, over 25 yds. and under 65 yds.; Water pulls - DW 10's, 20's, 21's and other similar equipment when pulling Aqua/pak or water tank trailers; Helicopter pilots (when transporting men and materials); Lowbed Heavy Duty Transport up to including 7 axles; DW10's, 20's, 21's and other similar Cat type, Terra Cobra, LeTourneau Pulls, Tournorocker, Euclid and similar type equipment when pulling fuel and/or grease tank trailers or other miscellaneous trailers; Vacuum Trucks 7500 gals and over and truck repairman

GROUP 5: Dump trucks, 65 yds. and over; Holland hauler; Low bed Heavy Duty Transport over 7 axles

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example:

PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

SECTION 01110

SUMMARY OF WORK

PART 1 - GENERAL

1.1 LOCATION AND DESCRIPTION OF WORK

- A. The Work covers the construction of the Zone A Pump Station and the Zone A Transmission Main, Improvements to Pump Station 2, and performing related required work, located as shown on these Drawings and Specifications.
- B. The Work is located in Paradise CA, at the Paradise Water Treatment Plant (13888 Pine Needle Drive), along Pine Needle Drive, Skyway and New Skyway (from Coutolenc Road to approximately 1000' west of Pentz Road) and adjoining roadways, and at Pump Station 2 (6650 Moore Road).
- C. The Work includes the following general scope items:
 - 1. Facility 20 – Zone A Pump Station. Located at the Paradise Water Treatment Plant. Pulls water from the Treated Water Storage Tank (TWIST) and pumps through the new Zone A Transmission Main to the existing A-Zone distribution system near Reservoir A.
 - 2. Facility 25 – Pump Station 2 – Installation of piping and valves which allow for the backfeed of B-Zone from A-Zone if necessary.
 - 3. Facility 30 – Zone A Transmission Main. Approximately 7350-ft of 16" PVC C900 or Ductile Iron water transmission main installed in Pine Needle Drive, Skyway and New Skyway with the majority of the pipeline in New Skyway. The work in New Skyway will involve traffic control, diversion of traffic using Skyway, and night work.
- D. The total project work will be completed within 220 working days from Notice to Proceed.
 - 1. A portion of the Facility 30 work, specifically the 16" pipeline installation work in New Skyway in Butte County (outside of the Town of Paradise limits) to be an early completion milestone. This section, from Station 23+19.30 to 70+00 (approximately 4681-ft), will be required to be substantially complete within 70 working days of Notice to Proceed. Notice to Proceed is expected by February 22, 2023 with this work to be completed before June 1, 2023.
- E. In order to facilitate the early completion milestone for the noted portion of the Zone A Transmission Main work, OWNER will pre-purchase and Owner-supply the pipe, valves and appurtenances required for that work. Owner-supplied pipe, valves and appurtenances are expected to be available to CONTRACTOR by March 15, 2023.
- F. The Work will be constructed under one contract. The Contract Documents include the following:
 - 1. Volume 1 – Bid Documents and Specifications.
 - 2. Volume 2 – Drawings
 - 3. Volume 3 – Geotechnical Report

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1.2 COORDINATION

- A. The CONTRACTOR shall be solely responsible for coordination of all of the Work of this Contract.
- B. The CONTRACTOR shall supervise, direct and cooperate fully with all Subcontractors, manufacturers, fabricators, suppliers, distributors, installers, testing agencies and all others whose services, materials or equipment are required to ensure completion of the Work within the Contract Time.
- C. Work of Others:
 - 1. The CONTRACTOR shall cooperate with and coordinate CONTRACTOR's Work with the work of any other contractor, utility service companies, or OWNER's employees performing work at the site.
 - 2. The CONTRACTOR shall also coordinate their Work with the work of others to assure compliance with schedules.
 - 3. The CONTRACTOR shall attend and participate in all project coordination or progress meetings and report on the progress of all Work and compliance with schedules.
 - 4. If any part of the work depends upon the work of others for proper execution or results, the CONTRACTOR shall inspect and promptly report to the ENGINEER any apparent discrepancies or defects in such work of others that render it unsuitable for such proper execution and results.
 - 5. Failure of the CONTRACTOR to so inspect and report shall constitute an acceptance of the work of others as fit and proper except as to defects which may develop in the work of others after execution of the work by the CONTRACTOR.
- D. Interference with work on utilities:
 - 1. The CONTRACTOR shall cooperate fully with all utility forces of the OWNER or forces of other public or private agencies engaged in the relocation, altering, or otherwise rearranging of any facilities which interfere with the progress of the work.
 - 2. The CONTRACTOR shall schedule the work so as to minimize interference with said relocation, altering, or other rearranging of facilities.
- E. Responsibility for Damage:
 - 1. The CONTRACTOR shall not be responsible for damage done by CONTRACTORS not under their jurisdiction.
 - 2. The CONTRACTOR will not be liable for any such loss or damage, unless it is through the negligence of the CONTRACTOR.

1.3 SITE CONDITIONS

- A. Site Investigation and Representation
 - 1. The CONTRACTOR acknowledges that it has satisfied itself as to the nature and location of the work, the general and local conditions, particularly those bearing upon availability of transportation, disposal, handling and storage of materials, availability of labor, water, electric power, roads, and uncertainties of weather, tide stages, or similar physical conditions at the site, the conformation and conditions of the ground, the character of equipment and facilities needed preliminary to and during the

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prosecution of the work and all other matters which can in any way affect the work or the cost thereof under this Contract.

2. The CONTRACTOR further acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials to be encountered from inspecting the site and from evaluating information derived from exploratory work that may have been done by the OWNER or included in these Contract Documents. Any failure by the CONTRACTOR to become acquainted with all the available information will not relieve the CONTRACTOR from responsibility for properly estimating the difficulty or cost of successfully performing the work.
3. Field Verification:
 - a. Before undertaking each part of the work, the CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements.
 - b. As the work proceeds, the CONTRACTOR shall field verify the depth and location of all buried utilities, and existing systems, and location of hazardous waste and contaminants.
 - c. The CONTRACTOR shall promptly report in writing to the ENGINEER any conflict, error, or discrepancy which the CONTRACTOR may discover and shall obtain a written interpretation or clarification from the ENGINEER before proceeding with any work affected thereby.

B. Existing Utilities and Improvements

1. Location of Underground Utilities:
 - a. Known existing underground conduits, pipelines and other utilities have been shown on the contract drawings in their approximate locations (within 3 feet of actual location). However, the accuracy or completeness of utilities indicated on the drawings is not guaranteed.
 - b. It shall be the responsibility of the CONTRACTOR to determine the exact location of all utilities and their service connections.
 - c. All potholing or other procedures for verifying utility location shall be performed by the CONTRACTOR as necessary to prepare for excavation at least 10 working days in advance of scheduled excavation.
 - d. The CONTRACTOR shall immediately notify the ENGINEER as to any utility located by him which has been incorrectly shown or omitted from the drawings.
 - e. If the CONTRACTOR cannot locate an underground utility whose presence is indicated on the Drawings, the ENGINEER shall be notified in writing.
 - f. The CONTRACTOR shall ascertain the exact locations of underground utilities whose presence is indicated on the Drawings, the locations of their service laterals work and of service laterals or appurtenances of any other underground utilities which can be inferred from the presence of visible facilities such as buildings, meters and junction boxes prior to doing work that may damage such utilities or interfere with their service.
- g. Utilities Not Shown on Drawings:
 - 1) Attention is directed to the possible existence of underground utilities not indicated on the Drawings and to the possibility that underground utilities may be in a location different from that indicated on the Drawings.
 - 2) If the ENGINEER determines that the underground utility for which such notice has been given has not been depicted on the Drawings with reasonable accuracy (within 3 feet of actual location), the additional cost incurred in locating the utility will be paid for as extra work as provided in the General Conditions.

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- 3) If the CONTRACTOR discovers underground an utility not indicated on the Drawings, the CONTRACTOR shall immediately give the ENGINEER and the Utility Company written notification of the existence of such utility.
 - 4) Such utilities shall be located and protected from damages as directed by the ENGINEER and the cost of such work will be paid for as extra work as provided in the General Conditions.
2. Utility Coordination:
 - a. The CONTRACTOR shall notify Underground Service Alert (USA) at least 4 days prior to excavation, telephone (800) 642-2444.
 - b. The CONTRACTOR shall also contact all utility owners not registered with USA but known to have utilities in the project area to field locate underground utilities at least 4 days prior to excavation.
 - c. The CONTRACTOR shall notify all owners of utilities when the Work is in progress and shall make arrangements as are necessary to make any emergency repairs.
 - d. Existing utilities that are shown or that are made known and located to the CONTRACTOR prior to excavation, and that are to be retained; and all utilities that are constructed during excavation operations shall be properly supported and protected from damage during the progress of the work.
3. Utility Protection and Damage:
 - a. Existing utilities that are shown or that are made known and located to the CONTRACTOR prior to excavation, and that are to be retained, and all utilities that are constructed during excavation operations shall be properly supported and protected from damage during the progress of the work.
 - b. Should any damage to a utility occur during the progress of the work, the CONTRACTOR shall notify the OWNER or the utility at once and render all assistance possible to repair the damage and restore the service.
 - c. No extra compensation will be made for the repair of any services or utility damaged by the CONTRACTOR nor for any damage incurred through neglect or failure to provide adequate protection to existing utilities.
 - d. The provisions of this Section shall not be abated even in the event such damage occurs after backfilling or is not discovered until after completion of the backfilling.
 - e. Damaged water pipelines will be repaired by the OWNER at the CONTRACTOR's expense. If the CONTRACTOR fails to pay the cost of repairs to water pipelines within thirty days of receipt of the invoice, the OWNER reserves the right to withhold the amount owed from the CONTRACTOR's Progress Payment.
 - f. Damage Report:
 - 1) In the event that the CONTRACTOR damages any underground utilities not shown on the Drawings or not depicted on the Drawings with reasonable accuracy (within 3 feet of actual location) or any lateral service the location of which could not be inferred by the CONTRACTOR, a written report thereof shall be made immediately to the ENGINEER.
 - 2) The CONTRACTOR's report shall also advise the ENGINEER of any schedule delays. Compensation for such delays will be determined in accordance with the General Conditions. The CONTRACTOR shall be entitled to no other compensation for any such damage.
4. All utilities encountered along the line of the work shall remain continuously in service during all work under the Contract, unless otherwise shown on the drawings, or unless other arrangements satisfactory to the ENGINEER are made with the owner of said utilities.

C. CONTRACTOR's Responsibility for Utility Facilities and Service

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1. Where the CONTRACTOR's operations could cause damage or inconvenience to railway, telephone, television, power, oil, gas, water, sewer, or irrigation systems, the CONTRACTOR shall make all arrangements necessary for the protection of these utilities and services.
2. The CONTRACTOR shall be solely and directly responsible to the owner and operators of such properties for any damage, injury, expense, loss, inconvenience, delay, suits, actions, or claims of any character brought because of any injuries or damage which may result from the construction operations under this Contract.
3. Neither the OWNER nor its officers or agents shall be responsible to the CONTRACTOR for damages as a result of the CONTRACTOR's failure to protect utilities encountered in the work.
4. In no event shall interruption of any utility service be allowed outside working hours unless granted by the owner of the utility.
5. No sand, mud, rocks or other construction debris shall be disposed of in the sanitary sewers or storm sewers.
6. Where bypassing of sewage is required to perform sewer repairs or service relocations and where temporary pumps are required to bypass any sewage across traffic lanes, the discharge lines crossing the traffic lanes shall be buried a minimum of 4 inches below the pavement surface and backfilled with temporary asphalt concrete surfacing. The CONTRACTOR shall take all necessary steps to assure continuous flow of sewage. Bypassing of untreated wastewater to surface waters or courses will not be permitted.
7. The CONTRACTOR shall replace, at its own expense, any and all existing utilities or structures removed or damaged during construction, to their existing condition unless otherwise provided for in these Contract Documents.
8. The CONTRACTOR shall repair or replace, at its own expense, all pavement damaged during the construction, to its existing condition unless otherwise provided for in these Contract Documents.

D. Names of Known Utilities Serving the Area

1. The following is a list of the known public utilities serving the area:
 - a. Water – Paradise Irrigation District, Del Oro Water Company
 - b. Sewer – None
 - c. Telephone – AT&T
 - d. Electric – PG&E
 - e. Gas – PG&E

E. Railroads

1. The CONTRACTOR shall not perform work or occupy any part of railroad property without a permit authorizing the same.

F. Interfering Structures

1. The CONTRACTOR shall take necessary precautions to prevent damage to existing structures whether on the surface, aboveground, or underground. An attempt has been made to show major structures on the Drawings. While the information has been compiled from the best available sources, its completeness and accuracy cannot be guaranteed, and it is presented as a guide to avoid possible difficulties.
2. The CONTRACTOR shall protect all existing structures, trees, shrubs, and other items on the project site that are to be preserved, by substantial barricades or other devices commensurate with the hazard, from injury or destruction by vehicles, equipment, workmen, or other agents.

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3. Where existing fences, gates, buildings, or any other structure must be removed to properly carry out the work, or are damaged during the work, they shall be restored at the CONTRACTOR's expense to their original condition or better.
 4. Without additional compensation, the CONTRACTOR may remove and replace in a condition as good as or better than original, any small structures such as fences, and signposts that interfere with the CONTRACTOR's operations.
- G. Field Relocation
1. During the progress of construction, it is expected that minor relocations of the work will be necessary.
 2. Such relocations shall be made only by direction of the ENGINEER.
 3. If existing structures are encountered that will prevent construction as shown, notify the ENGINEER before continuing with the work in order that the ENGINEER may make such field revisions as necessary to avoid conflict with the existing structures.
 4. If the CONTRACTOR shall fail to notify the ENGINEER when an existing structure is encountered, and shall proceed with the work despite this interference, CONTRACTOR shall do so at their own risk.
 5. Any CONTRACTOR request(s) for additional compensation or contract time resulting from necessary field relocations will be considered as set forth in the General Conditions.
 6. If the CONTRACTOR fails to notify the ENGINEER when a structure which interferes with construction is encountered, and proceeds with the work despite this obstruction, the CONTRACTOR shall do so at their own risk and at no additional cost to the OWNER.

1.4 REFERENCE POINTS AND SURVEYS

- A. Location and elevation of bench marks are shown on Drawings.
- B. Dimensions for lines and elevations for grades of structures, appurtenances, and utilities are indicated on Drawings, together with other pertinent information required for laying out Work. If conditions vary from those indicated, notify OWNER immediately, who will make minor adjustments required.
- C. OWNER may perform checks to verify accuracy of CONTRACTOR's layout Work and that completed Work complies with Contract Documents.
- D. Any existing survey points or other control markers destroyed without proper authorization will be replaced by owner of the survey points or control markers at CONTRACTOR's expense.
- E. CONTRACTOR's Responsibilities:
1. Provide all survey and layout required.
 2. Locate and protect reference points prior to starting site preparation.
 3. Notify OWNER at least 3 working days in advance of time when grade and line to be provided by others will be needed.
 4. Check and establish exact location of existing facilities prior to construction of new facilities and any connections thereto.
 5. In event of discrepancy in data provided by OWNER, request clarification before proceeding with Work.
 6. Provide cut sheets for all staking.

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7. Preserve and leave undisturbed control staking until ENGINEER has completed checks it deems necessary.
8. Re-establish reference points resulting from destruction by CONTRACTOR's operations.
9. Cooperate with ENGINEER so that checking and measuring may be accomplished with least interference to CONTRACTOR's operations.

1.5 SEQUENCE AND PROGRESS OF WORK

- A. The CONTRACTOR shall submit a Construction Schedule covering the entire Work in accordance with Section 01320, Progress Schedule.
- B. The CONTRACTOR shall incorporate the requirements of Section 01130, Special Project Constraints, into the Construction Schedule.
- C. Alternate Sequence:
 1. The CONTRACTOR's schedule may use a different sequence from that shown or specified, if techniques and methods known to the CONTRACTOR will result in cost and time savings to the OWNER, still achieve the required objective and maintain the same or greater level of treatment.
 2. The ENGINEER's determination on the acceptability of any alternative sequence from that shown or specified shall be final.

1.6 CONTRACTOR'S USE OF PREMISES

- A. The CONTRACTOR shall coordinate use of the premises, for the CONTRACTOR's storage and the operations of the CONTRACTOR's workmen, with OWNER and utility service companies.
- B. Restriction of Work Area:
 1. The full use of the premises for storage, the operations of workmen and for all other construction activities will not be available to the CONTRACTOR.
 2. The CONTRACTOR must operate entirely within the space allowed to the CONTRACTOR.
 3. The Drawings defines the area allocated to the CONTRACTOR.
- C. The CONTRACTOR shall be solely responsible for obtaining and paying all costs in connection with any additional work area, storage sites, access to the site or temporary right-of-way, which may be required for proper completion of the Work.
- D. Limitations on Use of Work Area:
 1. It shall be understood that responsibility for protection and safe-keeping of equipment and materials on or near the site will be entirely that of the CONTRACTOR and that no claim shall be made against the OWNER or their authorized representatives by reason of any act.
 2. It shall be further understood that should any occasion arise necessitating access to the sites occupied by these stored materials or equipment, the ENGINEER shall direct the CONTRACTOR owning or responsible for the stored materials and equipment to immediately move the same.
 3. No materials or equipment may be placed upon the property of the OWNER, other than in the designated areas as shown on the Drawings, unless the ENGINEER has agreed to the location contemplated by the CONTRACTOR to be used for storage.

4. All stored materials shall be labeled according to the appropriate contractor or Subcontractor with the manufacturer's label as well.
 5. Appropriate material safety data sheets (e.g., MSDS) shall be provided.
- E. The CONTRACTOR shall be required to share use of the premises with other Contractors whose services the OWNER has obtained or will obtain for construction of other facilities on the site.

1.7 USE OF OWNER'S FACILITIES

- A. The CONTRACTOR may use existing facilities or equipment in the Work for construction purposes, only if the OWNER's written permission is obtained.
- B. Restore existing facilities and equipment used for temporary purposes to original condition in a manner satisfactory to OWNER.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

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SECTION 01130

SPECIAL PROJECT CONSTRAINTS

PART 1 - GENERAL

1.1 LIMIT OF CONSTRUCTION ACTIVITIES ON WORK SITE

- A. Work Hours:
 - 1. All work in New Skyway must be completed between the hours of 8:00 pm and 6:00 am, Sunday through Thursday.
 - 2. No work to be conducted in New Skyway during the following holidays:
 - a. Memorial Day Weekend: May 27-29, 2023
 - b. 4th of July, 2023
 - c. Labor Day Weekend: September 2-4, 2023 (note it is anticipated that all work in New Skyway will be completed well prior to this date, but this is included in case of significant project delay, or to account for installation of pipeline appurtenances)
- B. Traffic Control:
 - 1. During work hours, CONTRACTOR may divert southbound traffic onto Old Skyway (Skyway) from Coutolenc to Pence and northbound traffic into the southbound lane of New Skyway.
 - 2. During non-work hours, the CONTRACTOR shall keep all lanes of traffic in New Skyway open and clear. All trenches shall be backfilled or covered with suitable steel plates and open to traffic.
 - 3. On Pine Needle Drive and the short section of Old Skyway (Skyway) connecting Pine Needle Drive to New Skyway, contractor shall maintain single-lane traffic at all times.
 - 4. No equipment, construction material or excavated material that will interfere with traffic shall be stored on streets or roadways at any time.

1.2 SEQUENCE OF WORK

- A. General:
 - 1. The CONTRACTOR shall schedule and sequence their work in order to complete the Work by the specified completion date.
 - 2. The OWNER's water distribution system must remain operational at all times.
 - 3. Re-vegetation of graded areas shall take place as quickly as possible as weather permits.

1.3 PROJECT CONSTRAINTS

- A. Maintenance of OWNER's Operations:
 - 1. Constraints listed herein involve limits on activities during construction. These limits relate to the critical nature of the existing water system.
 - 2. Continuous operation of OWNER's facilities is of critical importance. Schedule and conduct activities to enable existing facilities to operate continuously, unless otherwise specified.
 - 3. Work Plan:
 - a. The CONTRACTOR shall submit a detailed Work Plan and time schedule for all construction activities that will make it necessary to remove a tank, pipeline,

- electrical circuit, equipment, structure, road or other facilities from service, including the critical outages identified herein.
 - b. The Work Plan shall, at a minimum, identifying:
 - 1) the date and time when each activity will occur;
 - 2) what equipment will be present including standby equipment;
 - 3) what assistance will be required by OWNER's operating personnel;
 - 4) an emergency backup plan identifying what action will be taken if Work cannot be completed within the allotted time; and
 - 5) what individual will be in charge of the activity.
 - c. Submit Work Plan 10 days prior to the scheduled activity.
 - 4. Perform Work continuously during critical connections and changeovers, and as required to prevent interruption of OWNER's operations.
 - 5. Shutdowns:
 - a. Coordinate proposed Work with OWNER and facility operations personnel before affecting unit shutdowns. The CONTRACTOR shall provide written confirmation of the shutdown date and time two (2) working days prior to the actual shutdown.
 - b. Under no circumstances shall the CONTRACTOR cease Work at the end of a normal working day or at the end of a working week if such actions may inadvertently cause a cessation of any facility operating process, in which case, remain onsite until necessary repairs are complete.
 - 6. Do not close lines, open valves or gates, shut down equipment, or take other action which would affect the operation of existing systems, except as specifically required by the Contract Documents and after approval of OWNER.
 - 7. Do not proceed with Work affecting a facility's operation without obtaining OWNER's advance approval of the need for and duration of such Work.
- B. Relocation of Existing Facilities:
- 1. During construction, it is expected that minor relocations of Work will be necessary.
 - 2. Provide complete relocation of existing structures and Underground Facilities, including piping, utilities, equipment, structures, electrical conduit wiring, electrical duct bank, and other necessary items.
 - 3. Use only new materials for relocated facility. Match materials of existing facility, unless otherwise shown or specified.
 - 4. Perform relocations to minimize downtime of existing facilities.
 - 5. Install new portions of existing facilities in their relocated position prior to removal of existing facilities, unless otherwise accepted by OWNER.
- C. Overtime:
- 1. Conduct Work outside regular working hours on prior written consent of OWNER to meet Project schedule and avoid undesirable conditions.
 - 2. All overtime Work by the CONTRACTOR necessary to conform to the requirements of this Section and related Sections shall be performed by the CONTRACTOR, at no cost to the OWNER and shall be performed in accordance with the General Conditions. The CONTRACTOR shall make no claims for extra compensation as a result thereof.

1.4 SCHEDULED SHUTDOWNS AND CONSTRUCTION SEQUENCING CONSTRAINTS

- A. Scheduled Shutdowns:
- 1. All Work requiring the OWNER's facilities to be out-of-service shall be performed during the scheduled shutdowns.
 - 2. The OWNER's staff will continue to perform administrative, operation and maintenance functions during shutdowns.

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- B. Critical work sequencing constraints are described in this paragraph. Work not specifically covered in this Section may, in general, be done anytime during the contract period.
- C. Key work sequencing constraints are defined in Table 01130A

PART 2 - RODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

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Table 01130-A						
Facility		Constraints ¹			Distribution System Operational Sequence During Facility Construction	
No.	Name	Prior Facility Completion	Construction Time Frame	Season	Zone A Supply	Zone B-E Supply
20	Zone A Pump Station (ZAPS)	None	2023	Any	TWST - 42" - Res B - PS #2 - Res A	TWST - 42" - Res B - Zone B
20	ZAPS Tie in to TWST, Level Switch Installation	None	1 Month	Low	TWST Bypass - 42" - Res B - PS #2 - Res A	TWST - 42" - Res B - Zone B
20	Switchgear A/B	Emergency Generator must be online	8 Hours	Any	TWST - 42" - Res B - PS #2 - Res A	TWST - 42" - Res B - Zone B
20	MCC E Tie in	Emergency Generator must be online	8 Hours	Any	TWST - 42" - Res B - PS #2 - Res A	TWST - 42" - Res B - Zone B
30	Zone A Transmission Main (ZATM)	None	March-July 2023	Any	TWST - 42" - Res B - PS #2 - Res A	TWST - 42" - Res B - Zone B
30	ZATM Tie in to Zone A	None	4 Hours	Low	TWST - 42" - Res B - PS #2 - Zone A	TWST - 42" - Res B - Zone B
25	Pump Station #2	Facility 20 and 30	2023-2024	Any	TWST – ZAPS – ZATM – Res A	TWST - 42" - Res B - Zone B

Footnotes

1. The WTP must continually be able to produce and supply treated water to its constituents during all portions of the construction project. Bypass and shut down operations of TWST must be coordinated during lowest demand periods to ensure CT is met in transmission main.

SECTION 01135

PROJECT ENVIRONMENTAL MITIGATION MEASURES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. Comply with conservation and mitigation measures required under the project's Mitigation Monitoring and Reporting Program, from the Mitigated Negative Declaration and Initial Study.

1.2 MITIGATION MONITORING AND REPORTING PROGRAM

- A. The OWNER has completed environmental documentation required under the California Environmental Quality Act (CEQA) by preparing having a Mitigated Negative Declaration and Initial Study (IS/MND) prepared (Stantec, September 2021).
- B. The IS/MND includes specific conservation and mitigation measures that are required to be followed during execution of the project. These measures are summarized in Chapter 5 of the IS/MND under the Mitigation Monitoring and Reporting Program (MMRP) heading. This MMRP is attached to this Section and incorporated herein by reference.
- C. A copy of the MMRP shall be maintained on site by the CONTRACTOR. Upon completion of each conservation and mitigation measure, the responsible party shall site and date the verification section of the MMRP. The completed MMRP shall be delivered to ENGINEER upon completion of the items contained in the MMRP.
- D. Responsibilities of the OWNER and the CONTRACTOR to comply with the MMRP are summarized below:

Item¹	Measure	Responsibility	Notes
CM1	Air Quality/Fugitive Dust and Emission Controls	CONTRACTOR	
CM2	Erosion and Sediment Controls	CONTRACTOR	Implement BMPs for erosion and sediment control as approved by ENGINEER
CM3	Prevention of Accidental Spill Control	CONTRACTOR	
CM4	Greenhouse Gas Emissions	CONTRACTOR	
CM5	Construction Noise	CONTRACTOR	Construction activities limited to 7:00 a.m. to 7:00 p.m. Monday through Friday except for critical shutdowns and tie-ins
MM1	Pre-construction Migratory Bird and Raptor Surveys	OWNER	OWNER to conduct pre-construction survey(s)

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MM2	Prevent Spread of Invasive Species	CONTRACTOR	
MM3	Greenhouse Gas Emissions	CONTRACTOR	

¹ CM = Conservation Measure; MM = Mitigation Measure

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SUPPLEMENTS

- A. The following supplements are attached to this Specification Section and incorporated herein by reference:
 - 1. Mitigation Monitoring and Reporting Program

++ END OF SECTION ++

01135-2

SECTION 01200

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 GENERAL

- A. Payment will be made at the price bid for each item listed on the bidding form or as extra work as provided in the General Conditions.
- B. No initial progress payment (other than a single mobilization payment as described in Article 1.3 below) will be made prior to acceptance by the ENGINEER of the CPM Construction Schedule, the associated Schedule of Costs, and the list of anticipated submittals.
- C. No subsequent progress payment will be made prior to receipt by the ENGINEER of the monthly update of the Construction Progress Schedule, as specified in Sections 01310, Project Meetings and 01320, Progress Schedule.
- D. No subsequent progress payment will be made prior to receipt by the ENGINEER of Certified Payrolls for the previous month.

1.2 SCHEDULE OF COSTS FOR PAYMENTS

- A. Submit to the ENGINEER, within 5 days of acceptance of the Construction Schedule, five (5) copies of a Schedule of Costs. The Schedule of Costs shall be a form showing a detailed breakdown of quantities and prices of work and materials required to perform and complete the contract.
- B. The Schedule of Costs shall provide a cost breakdown for each element detailed in the approved Construction Schedule. The total of the price breakdown must agree with the lump-sum price bid. The elements listed and price breakdown shall not be front end loaded or unbalanced, shall be subject to adjustment between the ENGINEER and the CONTRACTOR, and will be used as a basis for progress payments.
- C. The Schedule of Costs will be used as a basis for determining the amount of the monthly progress payments.
- D. Acceptance of the Schedule of Costs by the ENGINEER shall not relieve the CONTRACTOR of the responsibility of performing all the work needed to complete the project at the lump-sum price bid.

1.3 PAYMENT FOR MOBILIZATION

- A. Mobilization Cost Breakdown:
 - 1. As soon as practicable after receipt of the Notice to Proceed, the CONTRACTOR shall submit a breakdown to the ENGINEER for approval, which shall show the estimated value of each major component of mobilization.
 - 2. When approved by the ENGINEER, the breakdown will be the basis for initial progress payments in which mobilization is included.

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3. Said breakdown shall not be "front end loaded" or unbalanced.
- B. One CONTRACTOR payment may be made prior to acceptance of the Construction Schedule, Schedule of Costs, and list of anticipated submittals.
 1. Payment shall be limited to mobilization items only.
 2. The Construction Schedule is described in Section 01320, Construction Schedule.
 3. Mobilization items are described in Section 01505, Mobilization.
 4. The Schedule of Costs is described in Article 1.2 of this Section.
 5. The list of anticipated submittals is described in Section 01330, Submittal Procedures.

1.4 DESCRIPTION OF UNIT PRICE BID ITEM

- A. Item 8, Hard Rock Excavation (BCY): Rock and boulder excavation will include all labor, materials, equipment and supplies required to excavate and disposal of the rocks and boulders in project excavated areas. The unit price includes rock and/or boulder removal via chipping/chiseling/hammering/hoe-rams/nonexplosive expansive mortar removal methods from the pipe trench area measured in its bank or original condition as described in the Contract Specification section 02310. Blasting is PROHIBITED under this bid item.
 1. Measurement and payment: The CONTRACTOR shall be paid for the actual volume measured by cross-sectional method of rock and boulder excavation from the pipe trench area via open-cut construction method as approved and accepted by the OWNER and ENGINEER during the construction of the Work.

1.5 PROGRESS PAYMENTS

- A. Progress Payment Request Submittal:
 1. Unless otherwise mutually agreed, by the 25th of each month, the CONTRACTOR shall prepare and submit monthly progress payment requests for work completed through the 25th day of the month.
 2. Said payment request shall be based on the breakdown of activities as specified in the Schedule of Costs described in Article 1.2 above.
 3. The monthly schedule update shall be submitted as part of the monthly progress payment report.
- B. The ENGINEER will review progress payment requests and make a determination of the percent completion of all activities (rounded to the nearest whole percent) based on an approximate measurement of all materials supplied and work performed.
- C. In the event that the CONTRACTOR fails to provide the OWNER with an acceptable Monthly Contract Record Drawing Submittal in accordance with Section 01330, the OWNER shall deduct compensation for such monthly submittal as provided in Section 01320. Said deduction shall become the sole property of the OWNER.
- D. Retention:
 1. From the amount thus determined, five percent thereof will be deducted as retention by OWNER for performance security.
 2. Acceptance of separate components shall not operate to release performance retention.

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3. The amount of all payments previously made to the CONTRACTOR and any amounts due the OWNER from the CONTRACTOR for supplies, materials, services, damages, or otherwise deductible under the terms of the contract will be deducted from the remainder.
 4. The remaining amount will be paid as a progress payment by the OWNER to the CONTRACTOR on the third Friday of the succeeding month or as soon thereafter as is practical.
- E. In addition to the retention under Paragraph D above, the whole or part of any payment of the estimated amount due the CONTRACTOR may be withheld as an additional retention if such course be deemed necessary to protect the OWNER from loss due to the CONTRACTOR's failure to perform any of the following: (1) meet CONTRACTOR's payment obligations; (2) execute the work; (3) correct defective work; (4) settle damages as provided; or (5) produce substantial evidence that no stop notices will or have been filed, and/or if it has been determined that unpaid balances may be insufficient to complete the work.
- F. All material and work covered by progress payments thereupon become the sole property of the OWNER, but this provision shall not be construed as relieving the CONTRACTOR from sole responsibility for all materials and work upon which payments have been made or the restoration of any damaged work or as a waiver of the OWNER's right to require fulfillment of all of the contract terms. Said CONTRACTOR's obligation extends through the close of the warranty period.
- G. Payment for Materials:
1. No payment shall be made for materials stored offsite.
 2. Payment may be made for those materials delivered to the site but not incorporated in the work to the extent that the materials are included in the Construction Schedule as cost-loaded material delivery activities.
 3. Only material items manufactured specifically for this project and that cost individually in excess of \$20,000 will be considered for partial payment as stored materials.
 4. Partial payment for materials delivered will not be made before the respective shop drawings, installation instructions and O&M manuals have been submitted, reviewed, and accepted in accordance with Section 01330, Submittal Procedures.
 5. To receive partial payment for materials delivered to the site, but not incorporated in the work, it shall be necessary for the CONTRACTOR to submit to the ENGINEER, at least 7 days prior to the end of said month, a list of such materials.
 6. At their sole discretion, the ENGINEER will approve items for which partial payment is to be made.
 7. The list of materials and invoices shall be clearly identified by referencing the associated activity or item on the price breakdown.
 8. Partial payment for materials delivered to the site or a bonded warehouse will be made in an amount equal to 75% of the respective suppliers' invoices(s) for the actual net cost for the item(s) delivered plus delivery charges.
 9. The CONTRACTOR's actual net cost for the materials must be supported by invoices of suppliers.
 10. Proper storage and protection of materials shall be provided by the CONTRACTOR. Final payment shall be made only for materials actually incorporated in the work and, upon acceptance of the work, all materials remaining for which advance payments had been made shall revert to the CONTRACTOR, unless otherwise agreed, and

partial payments made for these items shall be deducted from the final payment for the work.

1.6 FINAL PAYMENT AND RELEASE OF CLAIMS

1. Upon the completion of the work as determined by the ENGINEER, a Notice of Acceptance will be issued and recorded with the County.
2. The OWNER will pay to the CONTRACTOR within 35 days after filing of the Notice of Acceptance, or as soon thereafter as practicable, the remaining amount due the CONTRACTOR including retainage, less all prior payments and advances whatsoever to or for the account of the CONTRACTOR for supplies, materials, services, damages, stop notices, or otherwise deductible under the terms of the contract.
3. All prior estimates and payments including those relating to extra work shall be subject to correction by this payment, which throughout this contract is called "Final Payment".

1.7 RELEASE OF CLAIMS:

- A. Neither the final payment nor any part of the retained percentage shall become due until the CONTRACTOR shall have delivered to the OWNER a complete release of all claims against the OWNER arising under and by virtue of this contract and related to undisputed amounts, including claims of Subcontractors and suppliers of either materials or labor.
- B. If disputed contract claims in stated amounts are unresolved 35 days after issuance of the Notice of Acceptance, a progress payment of undisputed amounts and retained funds will be made by OWNER upon receipt of a release specifically excluding the disputed contract claims.
- C. Claims by the OWNER against the CONTRACTOR for liquidated damages or actual damages or other causes will be a valid basis for withholding of funds by the OWNER.
- D. Upon resolution of disputed claims the CONTRACTOR shall execute a supplemental release and, upon delivery the OWNER will make final payment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

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SECTION 01310
PROJECT MEETINGS

PART 1 - GENERAL

1.1 PRE-CONSTRUCTION CONFERENCE

- A. Upon receipt of the Notice to Proceed, or at an earlier time if mutually agreeable, the ENGINEER will arrange a preconstruction conference to be attended by the CONTRACTOR's superintendent or other project representative authorized to commit on the behalf of the CONTRACTOR and to direct the performance of the work by others, the OWNER, the ENGINEER or ENGINEER's representative, and representatives of utilities, major subcontractors, and others involved in the execution of the work.
- B. The purpose of this conference will be to establish a working relationship and understanding between the parties and to discuss subjects as may be pertinent for the execution of the work.
- C. CONTRACTOR shall be prepared to discuss the following subjects, as a minimum:
 - 1. Required schedules.
 - 2. Status of Bonds and insurance.
 - 3. Sequencing of critical path work items.
 - 4. Progress payment procedures.
 - 5. Project changes and clarification procedures.
 - 6. Use of site, access, office and storage areas, security and temporary facilities.
 - 7. Major product delivery and priorities.
 - 8. CONTRACTOR's safety plan and representative.

1.2 PROGRESS MEETINGS

- A. The ENGINEER will arrange and conduct progress meetings. The ENGINEER will prepare and circulate a draft agenda of each meeting. The CONTRACTOR may add items as appropriate to the draft agenda.
- B. Progress meetings will be conducted on a regular basis, at such frequency as the OWNER and CONTRACTOR may mutually agree. Progress meetings shall be attended by the ENGINEER, OWNER Operations personnel, CONTRACTOR's superintendent or other project representative, and representatives of all subcontractors involved in the work at the time of the meeting, required by the CONTRACTOR, or requested by the OWNER.
- C. The purpose of the meetings will be to facilitate the work of the CONTRACTOR and any subcontractor or other organization that is not up to schedule, resolve conflicts, identify and resolve any potential delays or necessary changes in the work and in general, coordinate and facilitate the execution of the work.
- D. The agenda of progress meetings shall include review of work progress, the latest Construction Schedule submittal (monthly), potential project delays, the status of key shop drawings, submittal reviews, information requests, safety concerns, record drawings, and extra work items.

1.3 CONSTRUCTION SCHEDULE REVIEW

- A. The Construction Schedule will be reviewed monthly during an agreed upon progress meeting to verify at a minimum:
 - 1. Actual start and finish dates of completed activities since the last progress meeting.
 - 2. Durations and progress of all activities not completed.
 - 3. Critical submittals/materials delivery problems.
 - 4. Potential project delays.
 - 5. Any activity behind schedule and CONTRACTOR's plan to bring it back on schedule.
 - 6. Reason, logic, time, and cost data for Change Order work that is to be incorporated into the Construction Schedule or payment request form.
 - 7. Payment due to the CONTRACTOR based on percentage complete of items in the submittal payment request form.
- B. At the progress meeting, the CONTRACTOR shall provide an update of the Construction Schedule as described in Section 01320, Progress Schedule.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01320
PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. The work specified in this Section includes the CONTRACTOR's preparation, submittal, maintenance and use of a computerized Critical Path Method (CPM) Construction Schedule to plan and monitor construction progress for the project.
- B. The computerized CPM schedule shall be completed using Microsoft Project for Windows or another software package acceptable to the ENGINEER.
- C. The requirements specified under Section 01330, Submittal Procedures, also apply to the Construction Schedule initial submittal(s) and subsequent updates and revisions.

1.2 PREPARATION AND SUBMITTAL PROCEDURE

- A. Schedule Preparation and Submittal:
 - 1. The CONTRACTOR's on-site construction supervisor (superintendent, project manager, etc.) shall be directly involved in preparation of the Construction Schedule.
 - 2. The Construction Schedule shall be completed and submitted to the ENGINEER within 30 days after Notice to Proceed.
 - a. By preparing and submitting the Construction Schedule the CONTRACTOR represents that the CONTRACTOR can and intends to execute the work and portions thereof within the specified times and constraints and that the CONTRACTOR's bid covers the costs associated with the execution of work in accordance with the Construction Schedule.
 - 3. At the time of submittal of the Construction Schedule, CONTRACTOR's on-site construction supervisor shall review the schedule with ENGINEER's construction project representative.
 - 4. If the initial Construction Schedule submittal is not acceptable to the ENGINEER, it shall be revised in coordination with observations and comments from the ENGINEER and resubmitted within 7 days of the return of the schedule to the CONTRACTOR.

1.3 CONSTRUCTION SCHEDULE CONTENT

- A. The Construction Schedule shall be calendar-based, time-scaled, and show the durations of and relationships between the various work activities.
- B. Work activities shall be selected which reflect actual work to be performed for this specific project. No generic work activities shall be allowed.
 - 1. Work activities shall include non-construction activities such as submittal preparation and review, manufacturing, equipment delivery, mobilization, preparation of Contract Record Drawings, etc. for a complete picture of the CONTRACTOR's plan for project execution.
 - 2. Information on each activity shall include:
 - a. Concise description of the activity.
 - b. Duration in working days.

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- c. The dates for the beginning and completion of each activity.
 - d. The relationship of each activity to other activities.
 - 3. No work activity shall be longer than 10 working days.
 - a. Work tasks which will take longer than 10 working days shall be broken down into several work activities which are no longer than 10 working days.
 - b. Each work activity must be defined clearly and measurable. For example, a series of work activities such as "Building 1, east wall piping; Building 1, west wall piping; Building 1, north and south wall piping", each with a duration less than 10 days would be acceptable. A series of work activities all labeled "Building 1 Piping", even if each had a duration less than 10 days, would not be acceptable because the tasks are not defined clearly or measurable.
 - 4. Provide a monthly activity for preparation of Contract Record Drawings, in accordance with Section 01330, Submittal Procedures with a minimum monthly cost of \$2,500.
- C. The schedule shall be referenced to calendar dates, and the beginning of the contract time shall be the date of receipt of the Notice to Proceed.
- D. Failure to include an activity required for the execution of the work shall not excuse the CONTRACTOR from completing the work and portions thereof within the specified times and at the price specified in the Agreement, and from meeting the constraints specified for sequence of work and control dates.

1.4 UPDATING THE CONSTRUCTION SCHEDULE

- A. The CONTRACTOR shall review and discuss the project progress relative to the most up to date Construction Schedule (updated monthly) at the weekly progress meetings, as specified in Section 01310, Project Meetings.
- B. The schedule update shall reflect progress to date. The schedule update shall incorporate all revisions to logic and duration.

1.5 ADJUSTMENT OF THE CONTRACT TIME AND CHANGE ORDERS

- A. Adjustments of the contract time due to delays, additional work, or any other cause will only be issued through a contract change order in accordance with the General Conditions.
 - 1. The CONTRACTOR shall include, as part of each change order proposal for which the CONTRACTOR is requesting an adjustment in the contract duration, a proposed revised Construction Schedule.
 - 2. The proposed revised Construction Schedule shall be compared to the most recent Construction Schedule to assess overall schedule impact.
 - 3. If a Change Order is issued by the OWNER, the CONTRACTOR shall incorporate the Change Order into the Construction Schedule.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

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SECTION 01330
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 GENERAL

- A. General:
1. This Section outlines in general the items that the CONTRACTOR must prepare or assemble for submittal during the progress of the work.
 2. There is no attempt herein to state in detail all of the procedures and requirements for each submittal.
 3. The CONTRACTOR's attention is directed to the individual Specification Sections in these Contract Documents, which may contain additional and special submittal requirements.
 4. The OWNER reserves the right to direct and modify the procedures and requirements for submittals as necessary to accomplish the specific purpose of each submittal.
 5. The CONTRACTOR shall anticipate resubmitting submittals for major pieces of equipment and for control systems.
 6. Should the CONTRACTOR be in doubt as to the procedure, purpose, or extent of any submittal, inquiries shall be directed to the ENGINEER.
- B. Schedule of Submittals:
1. Within 30 days of the Notice to Proceed, the CONTRACTOR shall submit a complete list of anticipated submittals, including specification/drawing references.
 2. This list shall be updated with "late start" submittal dates within 15 days of submittal of the CONTRACTOR's Construction Schedule.
 3. The submittal dates shall be updated upon approval of the Construction Schedule and periodically thereafter.
 4. Any additional submittals shall also be included in updates.

1.2 ADMINISTRATIVE SUBMITTALS

- A. The CONTRACTOR is reminded of their obligation as required by law to make required submittals promptly to the applicable federal, state, or local agency. Failure to comply with this requirement may result in the withholding of progress payments and make the CONTRACTOR liable for other prescribed action and sanctions.
- B. The CONTRACTOR shall submit to the ENGINEER a copy of all letters relative to the Contract, transmitting notifications, reports, certifications, certified payrolls, and the like, that the CONTRACTOR submits directly to a federal, state, or other governing agency.
- C. During the performance of the Contract, the CONTRACTOR shall maintain on a daily basis, and submit to the ENGINEER as requested, full and correct information as to the number of persons employed in connection with each subdivision of the work, the classification, rate of pay, citizenship status, and address of each person, and the cost, source, and amount of each class of materials delivered, equipment received, and major construction equipment used in each subdivision of the work.
- D. Certified Payroll:

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1. No later than the 25th day of each month, the CONTRACTOR shall submit to the ENGINEER a copy of the CONTRACTOR's certified payroll for the previous month, and if requested, copies of certified payrolls for Subcontractors.
2. The payrolls shall include for each employee the full name, address and social security number; the correct classification and rate of pay (including rates of contributions for, or costs assumed to provide various fringe benefits); daily and weekly hours worked; itemized deductions and actual wages paid.
3. The certified payrolls shall be on State of California forms.

1.3 TECHNICAL SUBMITTALS

A. General:

1. Requirements in this Section are in addition to any specific requirements for submittals specified in other divisions and Sections of these Contract Documents.
2. Submittal Contents and Numbering:
 - a. Each submittal shall contain material pertaining to no more than one equipment or material item and shall have the specification Section and applicable paragraph number clearly identified on the front of the submittal transmittal form.
 - b. Each submittal shall be sequentially numbered starting with the first one delivered.
 - c. Resubmittals shall include the number of the original submittal plus the suffix ".1" for the first resubmittal, ".2" for the second resubmittal, etc. (e.g. submittal 3.0, 3.1, 3.2, etc.).
 - d. Submittals not conforming to these requirements will be rejected.
3. Submitted data shall be fully sufficient in detail for determination of compliance with the provisions and intent of the Contract Documents.
4. Coordination Responsibilities:
 - a. Shop drawing submittal and coordination are the responsibility of the CONTRACTOR; this responsibility shall not be delegated in whole or in part to Subcontractors or suppliers.
 - b. Designation of work "by others," if shown on shop drawings, shall mean that the work will be the responsibility of the CONTRACTOR rather than the Subcontractor or supplier who has prepared the shop drawings.
5. No equipment or material for which listings, drawings, or descriptive material is required shall be fabricated, purchased, or installed until the ENGINEER has reviewed and accepted such lists, final shop drawings, or other descriptive material. Installation of such equipment or material without accepted submittals will be considered defective work.
6. Submittal Review Time:
 - a. Submittals will be acted upon by the ENGINEER as promptly as possible, and returned to the CONTRACTOR not later than the time allowed for review in Paragraph B.2 below.
 - b. The CONTRACTOR shall provide in their Construction Schedule the time for OWNER review of each submittal (and resubmittal for major equipment and control systems) in accordance with the allowable time specified herein and in Section 01320, Progress Schedule.
 - c. This required time for OWNER review shall not be a cause for delay in contract completion nor shall it be a reason for an extension of contract time.
 - d. If the CONTRACTOR is required by the OWNER to resubmit data, then neither the time required for the CONTRACTOR to prepare and resubmit such data, nor the required time for OWNER review, shall be a cause for delay in contract completion or for an extension of contract time.

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- e. Responsibility for time required for preparing and submitting required data shall be assigned solely to the CONTRACTOR.
- 7. Excessive Submittal Review:
 - a. It is considered reasonable that the CONTRACTOR shall make a complete and acceptable submittal to the ENGINEER by the second submission of a submittal item.
 - b. Additional costs of the ENGINEER's review beyond the second submission shall be the responsibility of the CONTRACTOR and may be deducted from the monthly progress payments.
 - c. This applies to all submittals including shop drawings.
- 8. Changes After Review:
 - a. After a submittal has been reviewed and accepted, no changes or substitutions in that submittal will be allowed without the ENGINEER's approval.
 - b. If allowed, the CONTRACTOR will be responsible for the additional costs for engineering, administrative, clerical or other work required for additional review.
- 9. Intent of Review:
 - a. Shop drawings will be reviewed for general conformance with the drawings and specifications.
 - b. The intent of the review is to determine if the CONTRACTOR is submitting materials and equipment which are in general conformance with the Contract Documents.
 - c. Detailed review of dimensions, sizes, space requirements, coordination with other equipment, and other construction details is not performed.
 - d. Additional work and costs, resulting from errors in the shop drawings shall be the CONTRACTOR's responsibility and liability.
 - e. Accuracy, coordination, and completeness of shop drawings shall be the sole responsibility of the CONTRACTOR, including responsibility to backcheck comments, corrections, and modifications from the ENGINEER's review before fabrication.
- 10. The CONTRACTOR shall indicate on the submittal transmittal form if and how the submittal deviates from the contract requirements.
- 11. Rebar Shop Drawings:
 - a. The CONTRACTOR shall supply the ENGINEER with a copy of all reinforcing steel detail drawings.
 - b. Changes to the Contract Documents made by the CONTRACTOR in reinforcing steel shop drawings shall be called out in the letter of submittal.
 - c. Such changes will not be acceptable unless the ENGINEER has expressed consent to such changes in writing.
- 12. Shop drawings, layout diagrams, catalog cuts and data, test reports, and information in sufficient detail to show complete compliance with all specified requirements shall be furnished to the ENGINEER, covering but not limited to the following items:
 - Aggregate Base Course
 - Air compressors
 - Asphalt mixes
 - Block masonry
 - Building specialties
 - Cabinets
 - Caulking and sealing compounds
 - Chemical systems
 - Concrete mixes
 - Control panels
 - Demolition plan

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Detection systems
Doors and frames
Electrical conduit, wire and specials
Electrical fixtures and appliances
Electrical load centers
Electrical substations
Electrical conduit, wire and specials
Engineered fill
Engines and appurtenances
Equipment provided by the CONTRACTOR
Fences, barricades and gates
Gas monitoring systems
Generators and appurtenances
Glazing
Grating
Gravel bedding
Grout
Hardware
Heating, ventilating and air conditioning equipment
Imported fill
Indicators
Instrumentation
Landscaping
Lights and lighting fixtures
Louvers
Meters
Miscellaneous fabricated metals
Miscellaneous furnishings
Mixers
Motor control centers
Motors, starters and controls
Office equipment and furnishings provided by CONTRACTOR
Paints, coatings and finishes
Piles
Pipe, fittings and specials
Pipe supports and anchors
Plumbing fixtures
Precast concrete elements
Pressure gauges
Primary elements
Programmable logic controllers
Pumps
Recorders
Reinforcing steel and layout drawings
Roofing and waterproofing
Sheet pile, shoring and bracing
Shelving
Signs
Structural steel
Tanks
Temporary bypasses
Temporary dewatering systems and equipment

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Valve and gate operators and controllers
Valves and gates
Variable frequency drives
Water heaters
Windows
Workstations

B. Submittal Procedure:

1. The CONTRACTOR shall submit to the ENGINEER for review eight (8) copies of each submittal (shop drawings, electrical diagrams, and catalog cuts for fabricated items and manufactured items furnished under this Contract, etc.) Three (3) copies will be returned to the CONTRACTOR.
2. Shop drawings shall be submitted in sufficient time to allow the ENGINEER not less than twenty (20) working days for examining the shop drawings except for designs for turnkey items for which thirty (30) working days will be allowed, and substitutions for which (40) working days will be allowed.
3. Shop drawings shall be accurate, distinct, and complete, and shall contain all required information, including satisfactory identification of items, units, and assemblies in relation to the Contract Drawings and Specifications.
4. CONTRACTOR Certification:
 - a. Shop drawings shall be submitted only by the CONTRACTOR, who shall indicate by a signed stamp on the shop drawings, or other approved means, that the CONTRACTOR has checked and approved the shop drawings, and that the work shown is in accordance with Contract requirements and has been checked for dimensions and relationship with work of all other trades involved.
 - b. Submitting incomplete or unchecked shop drawings for the ENGINEER to correct or finish will not be acceptable, and shop drawings that, in the opinion of the ENGINEER, indicate that they have not been checked by the CONTRACTOR will be rejected and returned to the CONTRACTOR for resubmission in the proper form.
5. Return of Reviewed Submittals:
 - a. When the shop drawings have been reviewed by the ENGINEER, the appropriate number of submittals will be returned to the CONTRACTOR appropriately stamped.
 - b. If major changes or corrections are necessary, the shop drawing will be rejected and returned to the CONTRACTOR with the need for such changes or corrections indicated.
 - c. The CONTRACTOR shall correct and resubmit rejected shop drawings in the same manner and quantity as specified for the original submittal.
 - d. If changes are made by the CONTRACTOR (in addition to those requested by the ENGINEER) on the resubmitted shop drawings, such changes shall be clearly explained in a transmittal letter accompanying the resubmitted shop drawings.
6. The review of such shop drawings and catalog cuts by the ENGINEER shall not relieve the CONTRACTOR from responsibility for correctness of dimensions, fabrication details, coordination with other work, and space requirements, or for deviations from the Contract Drawings or Specifications, unless the CONTRACTOR has called attention to such deviations in writing by a letter accompanying the shop drawings and the ENGINEER approves the change or deviation in writing at the time of submission; nor shall review by the ENGINEER relieve the CONTRACTOR from the responsibility for errors in the shop drawings.
7. The CONTRACTOR agrees that shop drawing submittals processed by the ENGINEER do not become Contract Documents and are not Change Orders; that the purpose of

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the shop drawing review is to establish a reporting procedure and to permit the ENGINEER to monitor the CONTRACTOR's progress and understanding of the design.

C. Shop Drawing Requirements: Shop drawings referred to herein shall include shop drawings, catalog cuts and information schematic diagrams, and other submittals for both shop and field-fabricated items. The CONTRACTOR shall submit, as applicable, the following for all prefabricated or manufactured structural items, material, and equipment:

1. General:

- a. For structures, submit all shop, setting, equipment, miscellaneous iron and reinforcement drawings and schedules necessary for construction. The foregoing shall include detailed "pour drawings" which shall show the sequence of concrete placement, and the type, quantity and location of all embedment items (sleeves, anchor bolts, door frames, etc.)
- b. For pipelines, submit a detailed layout of the pipeline with details of bends, closure pieces and fabricated specials and furnish any other details necessary.
- c. For trench excavation, submit detailed plan showing the design of shoring, bracing, sloping or other provisions necessary for safety.
- d. For boring and jacking, submit a detailed description of the process to be used.
- e. For equipment which requires electrical service, submit detailed information to show power supply requirements, MCC and control panel, elevations, wiring diagrams, control and protection schematics, shop test data, operation and maintenance procedures, outline drawings, and manufacturer's recommendation of the interface/interlock among the equipment.
- f. For mechanical equipment submit all data pertinent to the installation and maintenance of the equipment including shop drawings, anchorage requirements, manufacturer's recommended installation procedure, detailed installation drawings, test data and curves, operation and maintenance manuals, and other details necessary.
- g. For architectural fabrication submit all data pertinent to the installation of the fabrications, including shop drawings, manufacturer's recommended installation procedure, detailed installation drawings, and other details necessary.
- h. For shop drawings or equipment drawings, including dimensions, size and location of connections to other work, and weight of equipment.
- i. Installation or placing drawings for equipment, drives, and bases.
- j. Supporting calculations for equipment and associated supports, or hangers required or specified to be designed by equipment manufacturers, including seismic restraint information and details.
- k. Complete coating manufacturer's specifications, including materials description and paint system.
- l. Performance data and head vs. flow curves for compressor and pumps.
- m. Suggested spare parts list with current price information.
- n. List of special tools required for checking, testing, parts replacement, and maintenance. (Special tools are those which have been specially designed or adapted for use on parts of the equipment, and which are not customarily and routinely carried by maintenance mechanics.)
- o. List of special tools furnished with the equipment.
- p. List of materials and supplies required for the equipment prior to and during startup.
- q. Installation instructions.
- r. List of materials and supplies furnished with the equipment.
- s. Samples of finish colors for selection.

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- t. Special handling instructions.
 - u. Requirements for storage and protection prior to installation.
 - v. Requirements for routine maintenance required prior to plant startup.
 - w. Startup and operating instructions.
- x. Seismic design calculations and restraint details for equipment and piping supports. Calculations shall be stamped by a Civil or Structural Engineer registered in the State of California.
- 2. Electrical:
 - a. Wiring and control diagrams of systems and equipment. Local control panel details.
 - b. List of special motor features being provided (e.g., space heaters, altitude corrections, thermal protectors, mounting arrangement, etc.).
 - c. Complete motor rating for all motors, including motor no-load, starting, and full-load current at rated voltage; full-load speed and full-load current at 110 percent voltage; motor service factor; motor efficiency and power factor at 1/2, 3/4, and full-load at rated voltage; recommended maximum kVAR of power factor correction capacitors when capacitors are switched with motor.
 - d. See Division 16, ELECTRICAL, for additional specific submittal requirements.
 - 3. Instrumentation and Control:
 - a. See Technical Sections for additional specific submittal requirements.
 - b. The submittals shall include satisfactory identification of items, units, and assemblies in relation to the Specification Section number, and the system or equipment identification or tag number shown on the Drawings, the Process and Instrumentation Diagram (P&ID), or as provided in applicable Specification Section.
- D. Submittals required for foreign-manufactured items:
 - 1. In addition to the submittal requirements stated above, suppliers of foreign-manufactured items shall submit the names and addresses of companies within the United States that maintain technical service representatives and a complete inventory of spare parts and accessories for each foreign-made item proposed for incorporation into the work. Failure to provide the foregoing capabilities shall be just cause for rejection of the foreign-manufactured items.
- E. Final shop drawings to be submitted to OWNER:
 - 1. Complete sets of reproducible (full size mylar or vellum base) final shop drawings shall be submitted to the OWNER before, or at the time of, delivery of equipment onto the site.
- F. Seismic loading design provisions:
 - 1. All equipment supports that are not specifically detailed on the Drawings or specified herein shall be the responsibility of the equipment manufacturers and shall be designed by a Civil or Structural Engineer registered in the State of California.
 - 2. The design shall be in accordance with the seismic provisions of the latest edition of the International Building Code and of the seismic design requirements listed in Section 01610, General Equipment Requirements, in addition to all other loading conditions.
- G. Submittal of interface information (connection and correlation with other work):

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1. Where called for in the Specifications, and as determined necessary by the ENGINEER to provide proper correlation with other equipment, complete interface information shall be submitted.
2. This interface information shall be accurate, and contain all information necessary to allow the completion of detailed design and construction of the interfacing or connecting work.
3. The CONTRACTOR shall include in their negotiation for subcontract work, such agreements as may be necessary to ensure the accuracy of Subcontractor's interface submittal information.
4. In the event additional costs are incurred due to subsequent changes to information given in said interface information, such additional costs shall be borne by the CONTRACTOR.

H. Record Drawings

1. The CONTRACTOR shall deliver to the OWNER one complete set of final Record Drawings for OWNER records before the contract will be accepted by the OWNER. The Record Drawings will consist of a set of reproducible drawings of all CONTRACTOR supplied equipment (including control systems) and a marked-up set of Contract Record Drawings.
2. Record Drawings of CONTRACTOR-Supplied Equipment
 - a. Provide a photocopy of scaled record drawings as part of the Operation and Maintenance Manual for each equipment supplied
 - a. The legibility and contrast of each drawing submitted to the OWNER shall be such that every line, number, letter, and character is clearly readable in a full size blow back from a 35 mm microfilm negative of the drawing.
 - b. The overall dimensions of each drawing submitted to the ENGINEER shall be equal to one of the OWNER's standard sheet sizes. The title block area in the lower right hand corner of each drawing shall be clear of all linework, dimensions, details, and notes, except for the CONTRACTOR's title block. The dimensions of the title block area are minimum and are measured from the edges of the drawing sheet.

DRAWING FORMAT	
Sheet Sizes Height x Width	Title Block Area Height x Width
11" x 8-1/2"	2-1/2" x 3-3/4"
11" x 17"	3" x 4"
22" x 34"	3-1/2" x 8"

3. Contract Record Drawings
 - a. The CONTRACTOR shall keep an up-to-date set of marked-up Contract Drawings on an OWNER-supplied set of Drawings.
 - b. The OWNER-supplied set of Drawings will consist of one set of full-size sepia reproductions of the Contract Drawings, supplied to the CONTRACTOR at the start of the work.

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- c. During the progress of the work, the CONTRACTOR shall record on the Contract Record Drawings any changes from or additions to the work described in the Plans and Specifications.
 - d. All information recorded on the Contract Record Drawings shall be clearly legible.
 - e. Information to be recorded on the Contract Record Drawings shall include, but not be limited to, the following:
 - 1) Actual routing of electrical conduits, whose routing is only indicated in general on the Drawings.
 - 2) Actual location of manhole structures.
 - 3) Actual alignment of all installed pipe.
 - 4) Specific details of pipe connections, and manhole structures.
 - 5) Specific details on the installation and connection of mechanical and electrical equipment.
 - 6) Field dimensions where they differ from those shown on the Drawings.
 - 7) Additions to and/or deletions from the work, including all contract change orders.
 - 8) Other details showing as-built conditions, which are shown differently or only in general on the Drawings.
 - 9) Addenda.
 - 10) Location of buried features located during construction except utility service connections.
 - f. It is the CONTRACTOR's responsibility to ensure that any changes, deletions, specific construction details, etc., performed by a Subcontractor are recorded on the Contract Record Drawings.
 - g. Location Survey:
 - 1) The CONTRACTOR shall professionally survey the lateral and vertical position of anything buried underground as part of this Contract to within one inch accuracy of the benchmark and baseline provided by the OWNER.
 - 2) The survey information shall be included on the record drawings and the CONTRACTOR shall not be allowed to cover the buried materials until after the OWNER's inspector has verified the information as accurate and complete, and is shown on the record drawings.
 - h. Once every month, starting from the completion of mobilization as defined in Section 01505, Mobilization, the CONTRACTOR shall provide the OWNER with a copy of the then up-to-date set of marked-up Contract Record Drawings in accordance with the provisions under Section 01200, Measurement and Payment, and Section 01320, Project Schedule.
 - i. At the end of the work, prior to Project Closeout, the CONTRACTOR shall provide the OWNER with the Contract Record Drawings, showing all "as-built" conditions.
 - j. See also Section 01800, Operational Completion and Project Closeout.
- I. Operation and Maintenance (O&M) Manuals:
- 1. The CONTRACTOR shall furnish five (5) hard-copies and one (1) electronic copy of a complete instruction manual for installation, operation, maintenance, and lubrication requirements for each component of mechanical and electrical equipment or system.
 - 2. All equipment manufacturers shall be made aware of these requirements and all associated costs shall be included in the costs for furnishing the equipment or system.
 - 3. O&M Submittal Review Checklist:

- a. The CONTRACTOR shall include a completed O&M Manual Submittal Review Checklist (copy included at the end of this Section) with each O&M manual submittal.
- b. The checklist shall indicate that the O&M manual as submitted complies in all respects to the contract requirements.
- c. Any O&M manual submitted without a completed checklist will be rejected.
4. The manuals shall be furnished to the ENGINEER upon the delivery of the respective equipment.
5. No payment will be made for equipment or materials or equipment installation before the respective O&M manuals have been approved by the ENGINEER.
6. Each O&M manual shall be complete in all respects for all equipment, controls, accessories, and associated appurtenances.
7. Each O&M manual shall include, but not be limited to, the following:
 - a. Diagrams and illustrations, including pump curves indicating operating points.
 - b. Detailed description of the function of each principal component of the system.
 - c. Performance and nameplate data.
 - d. Installation instructions.
 - e. Starting procedure
 - f. Proper adjustment procedure.
 - g. Test procedures.
 - h. Operating procedure.
 - i. Shutdown instructions.
 - j. Emergency operating instructions and troubleshooting guide.
 - k. Safety instructions.
 - l. Maintenance and overhaul instructions which shall include detailed assembly drawings with part numbers, parts list, instructions for ordering spare parts, and complete preventive maintenance instructions required to ensure satisfactory performance and longevity of the equipment.
 - m. Lubrication instructions which shall list points to be greased or oiled, shall recommend type, grade, and temperature range of lubricants, and shall recommend frequency of lubrication.
 - n. List of electrical relay settings and control and alarm contact settings.
 - o. Electrical interconnection wiring diagram for equipment furnished, including all control and lighting systems.
 - p. Recommendations for spare parts and special tools.
8. Hard-Copy O&M Manuals:
 - a. Each copy of the manual shall be assembled in one or more hard-back type three-ring binders, each with title page, typed table of contents, and heavy section dividers with numbered plastic index tabs.
 - b. Cover label and title page shall be clearly labeled to designate the project title, project number, Specification Section where the item is specified, system or equipment for which it is intended with reference to the facility, equipment number, and equipment manufacturer name.
 - c. Typed table of contents for the entire set, identified by volume number, shall appear in each binder.
 - d. Each manual shall be divided into sections paralleling the equipment specifications.
 - e. All data shall be hole-punched for binding and composition and printing shall be arranged so that punching does not obliterate any data.
 - f. Pages larger than 8-1/2" x 11" shall be folded, showing title block or optionally included in binder pockets.

- g. Where more than one binder is required, they shall be labeled "Vol. 1", "Vol. 2", and so on.
- h. Submit manual organization and format to the ENGINEER for approval prior to manual preparation.
- 9. Electronic O&M Manuals:
 - a. In addition to the designated number of hard-copies for each required Manufacturer's O&M manual, provide an electronic copy, each on its own separate compact disc/s (CD-ROM).
 - b. The CD-ROM shall contain one full version of the O&M manual in Adobe's Portable Document File (PDF) format.
 - c. In addition, the CD-ROM shall contain the separate text and drawing files used to create the PDF O&M manual.
 - d. An index shall be provided on the CD-ROM as a separate text file with the name "index" and shall include the file name and detailed description of each individual file included on the CD-ROM.
 - e. The CD-ROM and the CD-ROM case shall be labeled with the Project title, Project number, Specification section, equipment number, equipment name, and equipment manufacturer name.
- 10. Manuals shall be transmitted to the ENGINEER upon delivery of the equipment and all equipment shall be serviced in accordance with the manufacturer's recommendations prior to operation. A service record shall be maintained on each item of equipment and shall be delivered to the ENGINEER prior to final acceptance of the project.
- J. Manufacturers' certificates and proper installation:
 - 1. The CONTRACTOR shall submit manufacturers' certificates of proper installation for items of equipment as specified under Section 01750, Testing, Training and Startup.
- K. Samples and test specimens:
 - 1. Where required in the Specifications, and as determined necessary by the ENGINEER, test specimens or samples of materials, appliances, and fittings to be used or offered for use in connection with the work shall be submitted to the ENGINEER at the CONTRACTOR's expense, with information as to their sources, with all cartage charges prepaid, and in such quantities and sizes as may be required for proper examination and tests to establish the quality or equality thereof, as applicable.
 - 2. All samples and test specimens shall be submitted in ample time to enable the ENGINEER to make any tests or examinations necessary, without delay to the work. The CONTRACTOR will be held responsible for any loss of time due to their neglect or failure to deliver the required samples to the ENGINEER, as specified.
 - 3. The CONTRACTOR shall submit additional samples as required by the ENGINEER to ensure equality with the original approved sample and/or for determination of Specification compliance.
 - 4. Laboratory tests and examinations that the OWNER elects to make in its own laboratory will be made at no cost to the CONTRACTOR, except that, if a sample of any material or equipment proposed for use by the CONTRACTOR fails to meet the Specifications, the cost of testing subsequent samples shall be borne by the CONTRACTOR.
 - 5. All tests required by the Specifications to be performed by an independent laboratory shall be made by a laboratory approved by the ENGINEER. Certified test results of all specified tests shall be submitted in duplicate to the ENGINEER. The samples furnished and the cost for the laboratory services shall be at the expense of the CONTRACTOR and included in the prices bid for the associated work.

6. Approved sample items (fixtures, hardware, etc.) may be incorporated into the work upon approval, and when no longer needed by the ENGINEER for reference.
- L. Material and equipment colors:
1. The ENGINEER will provide a schedule of selected colors within 30 days after approval of materials and equipment, and after receiving samples of the manufacturers' standard colors for those items requiring OWNER's selection.
- M. Certificates of Compliance:
1. A Certificate of Compliance shall be furnished for materials specified to a recognized standard or code prior to the use of any such materials in the work.
 2. The ENGINEER may permit the use of certain materials or assemblies prior to sampling and testing if accompanied by a Certificate of Compliance.
 3. The certificate shall be signed by the manufacturer of the material or the manufacturer of assembled materials and shall state that the materials involved comply in all respects with the requirements of the Specifications.
 4. A Certificate of Compliance shall be furnished with each lot of material delivered to the work and the lot so certified shall be clearly identified in the certificate.
- N. Quality Assurance
1. Source limitations: To the greatest extent possible for each unit of work, the CONTRACTOR shall provide products, materials, or equipment of a singular generic kind from a single source.
 2. Compatibility of options:
 - a. Where more than one choice is available as options for CONTRACTOR's selection of a product, material, or equipment, the CONTRACTOR shall select an option which is compatible with other products, materials, or equipment already selected.
 - b. Compatibility is a basic general requirement of product/material selections.
- O. Review by ENGINEER
1. After review by the ENGINEER of each of the CONTRACTOR's submissions, the material will be returned to the CONTRACTOR with actions defined as follows:
 - a. NO EXCEPTIONS TAKEN: Accepted subject to its compatibility with further submittals and additional partial submittals for portions of the work not covered in this submittal. Does not constitute approval or deletion of specified or required items not shown in the partial submittal.
 - b. MAKE CORRECTIONS NOTED: Same as 1.a., except that minor corrections as noted shall be made by the CONTRACTOR.
 - c. REVISE AND RESUBMIT: Rejected because of major inconsistencies or errors which shall be resolved or corrected by the CONTRACTOR prior to subsequent review by the ENGINEER.
 - d. REJECTED - RESUBMIT: Submitted material does not conform to Plans and Specifications in major respect, e.g., wrong item, wrong size, model, capacity, or material.
 2. Review actions (a) and (b) above constitute acceptance by the ENGINEER of the submittal.
- P. Requests for Information
1. Requests for Information about the Contract Documents shall be directed by the CONTRACTOR to the ENGINEER using a Request for Information (RFI) form as agreed

to by the OWNER and the ENGINEER. Such requests shall not be transmitted directly to the ENGINEER from a Subcontractor or Supplier.

2. A separate form shall be used for each specific item for which information is required. Requests for Information for more than one item using a single RFI form will be permitted only when the items are so functionally related that expediency indicates review of the group of items as a whole.
3. The ENGINEER will reply to the CONTRACTOR's Request for Information as soon thereafter as practicable.

Q. Construction Photographs

1. Provide photographs showing the preconstruction site, construction progress, and the post-construction site.
2. Format: Photographs shall be digital format
 - a. Digital Format:
 - 1) Digital photos shall be taken with a minimum 3.5 mega pixel density and provided in JPG format.
 - 2) Digital photo files shall be provide on a CD accompanied by a text file that lists the file name, date photo was taken, and brief description of the photograph and location where the photograph was taken.
3. Take a minimum of 36 photos of the preconstruction site and the property adjacent to the perimeter of the construction site. Particular emphasis shall be directed to structures both inside and outside the site, or as directed by OWNER.
4. Take a minimum of 72 photos monthly showing the progress of construction. The location of these photographs shall be determined by OWNER.
5. Take a minimum of 36 photos of the post-construction site and the property adjacent to the perimeter of the site. Particular emphasis shall be directed to structures both inside and outside the plant boundary, or as indicated by OWNER.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

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O&M MANUAL REVIEW CHECKLIST

SUBMITTAL NO. _____ SPEC. SECTION. _____ SUBJECT _____ EQUIP. ITEM _____ _____	DATED _____ REVIEW DATE _____ REVIEWER _____ SUPPLIER _____ MANUFACTURER _____
--	---

ACCEPTABLE _____ UNACCEPTABLE _____	PROJECT TITLE: _____ PROJECT NO. 17-041
--	--

DISPOSITION	ACCEPTABLE?			COMMENTS
	YES	NO	NA	
HARD-COPY O&M MANUALS				
▪ Minimum five (5) copies.....				
▪ Three-ring binder with hard-back cover.....				
▪ Cover Label and Title Page:				
Project title and Project number				
Specification section				
System/Equipment names				
Facility				
Equipment number				
▪ Typed table of contents.....				
▪ Heavy section dividers w/numbered plastic index tabs .				
▪ Sections parallel equipment specifications				
▪ Pages punched for 3 ring binder (punching does not obliterate data)				
▪ Info larger than 8-1/2"x11" folded showing title block, or included in binder pockets				
▪ Multiple volumes labeled "Vol. 1", "Vol. 2", etc.....				
▪ Table of contents for entire set in each binder.....				
ELECTRONIC O&M MANUALS				
▪ Minimum one (1) copy on CD-ROM.....				
▪ Full version of O&M manual in PDF format				
▪ Separate text and drawing files used to create PDF O&M manual.....				
▪ Index on CD-ROM as separate file titled "index"				
▪ CD-ROM and case labeled				
TECHNICAL CONTENT				
▪ Diagrams and illustrations, including pump curves				
▪ Detailed description of function of principal components.....				
▪ Performance and nameplate data				
▪ Installation instructions.....				

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DISPOSITION	ACCEPTABLE?			COMMENTS
	YES	NO	NA	
▪ Starting procedure	_____	_____	_____	_____
▪ Proper adjustment procedure.....	_____	_____	_____	_____
▪ Test procedures	_____	_____	_____	_____
▪ Operating procedure.....	_____	_____	_____	_____
▪ Shutdown instructions	_____	_____	_____	_____
▪ Emergency operating instructions & troubleshooting	_____	_____	_____	_____
▪ Safety instructions	_____	_____	_____	_____
▪ Maintenance and overhaul instructions.....	_____	_____	_____	_____
▪ Lubrication instructions	_____	_____	_____	_____
▪ List of electrical relay settings and control and alarm contact settings	_____	_____	_____	_____
▪ Electrical interconnection wiring diagrams, including control and lighting systems	_____	_____	_____	_____
▪ Recommended spare parts and special tools.....	_____	_____	_____	_____
▪ Project specific warranty statement	_____	_____	_____	_____

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SECTION 01400
QUALITY CONTROL

PART 1 - GENERAL

1.1 OBSERVATION AND SUPERVISION

- A. The ENGINEER or ENGINEER's appointed representative will review the Work and the CONTRACTOR shall provide facilities and access to the Work at all times as required to facilitate this review.
- B. Responsibility:
 - 1. The CONTRACTOR shall be solely responsible to supervise and direct the entire Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to complete the Work in accordance with the Contract Documents.
 - 2. The CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences, quality control, and procedures of construction and safety precautions and programs incidental thereto.
 - 3. The foregoing includes work performed by the CONTRACTOR's Subcontractors.
 - 4. The CONTRACTOR shall be responsible to see that the finished Work complies accurately with the Contract Documents.
- C. Superintendent:
 - 1. The CONTRACTOR shall designate in writing and keep on the work site at all times during its progress a technically qualified, English-speaking superintendent, who shall not be replaced without written acceptance of the ENGINEER.
 - 2. The superintendent shall be the CONTRACTOR's representative at the job site and shall have authority to act on behalf of the CONTRACTOR.
 - 3. All communications given to the superintendent shall be as binding as if given to the CONTRACTOR.
 - 4. The CONTRACTOR's superintendent shall be present at the site of the Work at all times while work is in progress. Failure to observe this requirement shall be considered as suspension of the Work by the CONTRACTOR until such time as such superintendent is again present at the site.

1.2 RESPONSIBILITY

- A. The CONTRACTOR is responsible for conducting all testing and inspection specifically required by the Specifications and otherwise necessary to ensure compliance with the Contract Documents.
 - 1. Approval of Testing Laboratories:
 - a. All laboratory work under this contract shall be performed by a laboratory approved by the ENGINEER, whether the laboratory is employed by the CONTRACTOR, or is owned and operated by the CONTRACTOR.
 - b. The basis of approval includes the following:
 - 1) Testing laboratories performing work in connection with concrete, steel, and bituminous materials shall comply with ASTM E 329 and ASTM D 3666, respectively.

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- 2) Testing laboratories performing work not in connection with concrete, steel, bituminous materials, soils and non-destructive testing shall comply with ASTM E 548.
- B. The ENGINEER may conduct periodic independent testing and inspection to verify compliance with the Contract Documents.
- C. Retesting:
 1. The OWNER reserves the right to back-charge the CONTRACTOR for retesting of deficient or defective work or products upon written notification.
 2. Compensation for retesting on behalf of the OWNER will be made through deductions from the Progress Payments.
- D. The CONTRACTOR is responsible for correcting all defective work discovered prior to final acceptance of the Contract, despite the failure of the Inspector(s) to discover it.

1.3 TESTS AND INSPECTIONS

- A. The CONTRACTOR shall be responsible for scheduling all inspections and tests required.
 1. The ENGINEER shall be given a minimum 48 business hours notice prior to any inspections or tests.
- B. The CONTRACTOR shall pay for all tests including, but not limited to:
 1. Inspections and tests necessary to comply with laws, ordinances, rules, regulations and orders of public authorities pursuant to General Conditions.
 2. Mix designs, including tests of trial batches, on concrete mixes.
 3. Tests of materials, inspections, and certifications required by the Specifications.
 4. Testing, adjusting, and balancing of equipment and systems required by the Specifications.
 5. One tension and elongation test for each 5 tons of steel or fractional part thereof for each size will be required, unless the steel can be identified by heat or melt numbers and is accompanied by mill analysis and test reports. Commercial stock may be used, subject to approval of the ENGINEER.
 6. Any testing performed by the CONTRACTOR for their own quality control (e.g., compaction tests).
 7. Retests or re-inspections by the OWNER, if required, and tests or inspections required due to CONTRACTOR error or lack of required identifications of material.
 8. Any and all water used by the CONTRACTOR in any testing.
- C. Two copies of the agency or laboratory report of each test or inspection shall be provided to the ENGINEER. All tests of materials shall be made in accordance with the commonly recognized standards of national technical organizations, and such other special methods and tests as are prescribed in the Contract Documents.
- D. Purchase Orders:
 1. One copy of each of the CONTRACTOR's purchase orders for materials forming a portion of the work shall be furnished to the ENGINEER, if requested.
 2. Each such purchase order shall contain a statement that the materials included in the order are subject to inspection by the OWNER.
 3. Materials purchased locally will be inspected at the point of manufacture or supply, and materials supplied from points more than 50 miles from the job site will be

inspected upon arrival at the job, except when other inspection requirements are provided for specific materials in other Sections of this Specification.

E. Samples:

1. The CONTRACTOR shall furnish samples of materials as are required by the ENGINEER, without charge.
2. No material shall be used until the ENGINEER has had the opportunity to test or examine such materials.
3. Samples will be secured and tested whenever necessary to determine the quality of the material.
4. Samples and test specimens prepared at the job site, such as concrete test cylinders, shall be taken or prepared by the ENGINEER in the presence and with the assistance of the CONTRACTOR.

1.4 AUTHORITY AND DUTIES OF INSPECTOR

- A. Inspectors employed by the OWNER shall be authorized to inspect all work done and materials and equipment furnished to complement the CONTRACTOR furnished independent inspector.
1. Such inspection may extend to all or any part of the work, and to the preparation, fabrication, or manufacture of the materials and equipment to be used.
 2. The Inspector will not alter or waive the provisions of the Contract Documents.
 3. The Inspector will keep the ENGINEER informed as to the progress of the work and the manner in which it is being done.
 4. The Inspector will call the CONTRACTOR's attention to nonconformance with the Contract Documents that the Inspector may have observed.
 5. The Inspector will not be responsible for the adequacy or correctness of the CONTRACTOR's means, methods, techniques, sequences, or procedures for construction.
 6. The Inspector will not approve or accept any portion of the work, issue instructions contrary to the Contract Documents, or act as foreman for the CONTRACTOR.
 7. The Inspector may reject defective materials, equipment, or work when it is not in compliance with the Contract Documents.
 8. The Inspector will not be responsible for:
 - a. The CONTRACTOR's quality control program.
 - b. The CONTRACTOR's safety program.
 - c. Coordinating the work or activities of the CONTRACTOR or their Subcontractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

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SECTION 01420

REFERENCE STANDARDS AND ABBREVIATIONS

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

- A. The standards referred to, except as modified, shall have full force and effect as though printed in this Specification, and shall be the latest edition or revision thereof in effect on the bid opening date, unless a particular edition or issue is indicated. Copies of these standards are not available from the OWNER.
- B. The ENGINEER will furnish, upon request, information as to how copies may be obtained.
- C. Abbreviations and terms, or pronouns in place of them, shall be interpreted as follows:

AAMA:	Architectural Aluminum Manufacturer's Association
AAN:	American Association of Nurserymen
AAR:	Association of American Railroads
AASHTO:	American Association of State Highway and Transportation Officials, Standard Specifications
AATCC:	American Association of Textile Chemists and Colorists
ACI:	American Concrete Institute, Standards
AFBMA:	Anti-Friction Bearing Manufacturer's Association, Inc.
AGA:	American Gas Association
AGC:	Associated General Contractors
AGMA:	American Gear Manufacturer's Association
AHAM:	Association of Home Appliance Manufacturer's
AI:	The Asphalt Institute
AIA:	American Institute of Architects
AISC:	American Institute of Steel Construction, Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, and the AISC Code of Standard Practice
AISI:	American Iron and Steel Institute
AITC:	American Institute of Timber Construction
AMCA:	Air Moving and Conditioning Association, Standards
ANS:	American Nuclear Society
ANSI:	American National Standards Institute
APA:	American Plywood Association
API:	American Petroleum Institute
APWA:	American Public Works Association, Standard Specifications for Public Works Construction
ASA:	Acoustical Society of America
ASAE:	American Society of Agriculture Engineers
ASCE:	American Society of Civil Engineers
ASHRAE:	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASLE:	American Society of Lubricating Engineers

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ASME:	American Society of Mechanical Engineers
ASQC:	American Society of Quality Control
ASSE:	American Society of Sanitary Engineers
ASTM:	American Society for Testing and Materials, Standards
AWG:	American Wire Gauge
AWPA:	American Wood-Preservers' Association, Standards
AWPI:	American Wood Preservers Institute
AWS:	American Welding Society
AWWA:	American Water Works Association, Standards
BBC:	Basic Building Code, Building Officials and Code Administrators International
BHMA:	Builders Hardware Manufacturer's Association
CAL/OSHA:	California/Occupational Safety and Health Administration, Standards
CBM:	Certified Ballast Manufacturer's
CCR:	California Code of Regulations
CEMA:	Conveyors Equipment Manufacturer's Association
CGA:	Compressed Gas Association
CISPI:	Cast Iron Soil Pipe Institute, Standards
CLPCA:	California Lathing and Plastering Contractors Association
CLFMI:	Chain Link Fence Manufacturer's Institute
CMAA:	Crane Manufacturers' Association of America
CMA:	Concrete Masonry Association
CRSI:	Concrete Reinforcing Steel Institute, Standards
CSS:	CalTrans Standard Specifications, State of California, Department of Transportation
DCDMA:	Diamond Core Drill Manufacturer's Association
DOSH:	Division of Occupational Safety and Health, State of California, Department of Industrial Relations
EIA:	Electronic Industries Association
ETL:	Electrical Test Laboratories
FED/OSHA:	Federal Occupational Safety and Health Administration, Standards
FM:	Factory Mutual
ICBO:	International Conference of Building Officials
ICEA:	Insulated Cable Engineers Association
IEEE:	Institute of Electrical and Electronic Engineers
IES:	Illuminating Engineering Society
IME:	Institute of Makers of Explosives
IP:	Institute of Petroleum (London)
IPC:	Institute of Printed Circuits
IPCEA:	Insulated Power Cable Engineers Association
ISA:	Instrument Society of America
ISO:	International Organization of Standardization
ITE:	Institute of Traffic Engineers
MAG:	Maricopa Association of Governments, Uniform Standard Specifications for Public Works Construction. References to MAG Standard Details refer to the "Uniform Standard Details for Public Works Construction" sponsored and distributed by the Maricopa Association of Governments, Arizona.

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MBMA:	Metal Building Manufacturer's Association
MPTA:	Mechanical Power Transmission of Association
MTI:	Marine Testing Institute
MSS:	Manufacturers Standardization Society
NAAM:	National Association of Architectural Metal Manufacturers
NACE:	National Association of Corrosion Engineers, Standards
NBS:	National Bureau of Standards
NCCLS:	National Committee for Clinical Laboratory Standards
NEC:	National Electric Code
NEMA:	National Electrical Manufacturers' Association, Standards
NFPA:	National Fire Protection Association
NFPA:	National Forest Products Association
NGLI:	National Lubricating Grease Institute
NMA:	National Microfilm Association
NWMA:	National Woodwork Manufacturers Association
OSHA:	Occupational Safety and Health Administration
PCA:	Portland Cement Association
PCI:	Prestressed Concrete Institute
RIS:	Redwood Inspection Service, Standard Specifications
RVIA:	Recreational Vehicle Industry Association
RWMA:	Resistance Welder Manufacturer's Association
SAE:	Society of Automotive Engineers
SAMA:	Scientific Apparatus Makers Association
SDI:	Steel Door Institute
SIS:	Swedish Standards Association
SMA:	Screen Manufacturer's Association
SMACNA:	Sheet Metal and Air Conditioning Contractors National Association
SPR:	Simplified Practice Recommendation
SSBC:	Southern Standard Building Code, Southern Building Code Congress
SSPC:	Steel Structures Painting Council, Specifications
SSPWC:	Standard Specifications for Public Works Construction
TAPPI:	Technical Association of the Pulp and Paper Industry
TFI:	The Fertilizer Institute
UBC:	Uniform Building Code of the International Conference of Building Officials
UPC:	Uniform Plumbing Code
UL:	Underwriters Laboratories
WCLA:	West Coast Lumbermen's Association, Standard Grading and Dressing Rules
WCLIB:	West Coast Lumber Inspection Bureau
WCRSI:	Western Concrete Reinforcing Steel Institute
WIC:	Woodwork Institute of California
WRI:	Wire Reinforcement Institute, Inc.
WWPA:	Western Wood Products Association

1.2 OTHER ABBREVIATIONS

- A. Other common abbreviations that may be found in the Specifications are, but may not be limited to:

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acrylonitrile butadiene styrene	ABS	gallons per hour	gph, gal/hr
alternating current	a-c, AC	gallons per minute	gpm, gal/min
American wire gauge	AWG	gallons per second	gps, gal/s
ante meridiem	am	gram	g
ampere	A, amp	ground fault current interrupter	GFCI
average	avg	hand/off/automatic heating, ventilating, and air conditioning	HOA HVAC
biochemical oxygen demand	BOD	Hertz	Hz
brake horsepower	bhp	hour	hr
British thermal unit	Btu	horsepower	hp
Centigrade	C	inch	in
chlorinated polyvinyl chloride	CPVC	inch-pound	in-lb
company	Co	input/output	I/O
cubic inch	cu in, in ³	inside diameter	ID
cubic foot	cu ft, CF, ft ³	instrumentation and control	I&C
cubic yard	cu yd, CY, yd ³	kilovolt	kV
cubic feet per minute	cfm, ft ³ /min	kilovolt-ampere	kVA
cubic feet per second	cfs, ft ³ /s	kilowatt	kW
decibel	dB	kilowatt-hour	kWhr
decibels, A-weighted	dBA	length	L
degree Centigrade (Celsius)	°C, C	length to least radius of gyration	L/r
degree Fahrenheit	°F, F	light emitting diode	LED
diameter	diam, ø	linear	lin
direct current	d-c, DC	linear foot	lin ft
dollars	\$	liter	l
ductile iron	DI	manhole	MH
each	ea, @	maximum	max
efficiency	eff	mean sea level	MSL
elevation	El., Elev	mercury	Hg
ethylene propylene rubber	EPDM	miles per hour	mph
exhaust fan	EF	milli-amp	mA
Fahrenheit	F	milliampere DC	mAdc
feet	ft	milligram	mg
feet per hour	fph, ft/h	milligrams per liter	mg/l
feet per minute	fpm, ft/min	milliliter	ml
feet per second	fps, ft/s	millimeter	mm
fiberglass reinforced plastic	FRP	million gallon	mil
figure	Fig.	million gallons per day	mgd
flange	flg	minimum	min
foot-pound	ft-lb	motor control center	MCC
gallon	gal	net positive suction	

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head available	NPSHA	revolutions per minute	rpm
net positive suction			
head required	NPSHR	second	sec, s
number	No., #	specific gravity	sp gr
National Pipe Thread	NPT	square foot	sq ft, SF, ft ²
		square inch	sq in, in ²
Operation and Maintenance	O&M	square yard	sq yd, SY, yd ²
ounce	oz	stainless steel	SS
outside diameter	OD	standard	std
		standard cubic feet	
parts per million	ppm	per minute	scfm
post meridiem	pm	symmetrical	sym.
plus or minus	+/-, ±		
polytetrafluorethylene	PTFE	total dynamic head	tdh
polyvinyl chloride	PVC	totally-enclosed, fan-	
pound	lb	cooled	TEFC
pounds per square foot	psf, lb/ft ²	totally-enclosed, non-	
pounds per square inch	psi, lb/in ²	ventilated	TENV
pounds per square inch		twisted shielded	TWSH
absolute	psia		
pounds per square inch		ultraviolet	UV
gage	psig	United States	US, USA
Process and Instrumentation			
Diagrams	P&ID	variable frequency drive	VFD, AFD
		volt	V
random access memory	RAM	volts alternating current	VAC
reinforced concrete pipe	RCP	volts direct current	VDC
reinforced concrete cylinder			
pipe	RCCP	water to cement	W/C, wc
relative humidity	RH	water column	W.C.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

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SECTION 01500

TEMPORARY CONSTRUCTION FACILITIES AND UTILITIES

PART 1 - GENERAL

1.1 CONTRACTOR'S STAGING AREA AND WORK ACCESS PLAN

- A. The CONTRACTOR shall limit the location of the storage of equipment and materials to the staging area(s) designated on the Drawings and as directed by the ENGINEER.
- B. The CONTRACTOR shall make their own arrangements for additional space that may be required and shall bear all associated costs.
- C. The CONTRACTOR shall submit a work access plan showing the planned access route for deliveries of supplies and mobilization of work force for ENGINEER's approval prior to mobilization.
- D. On-Site Project Office:
 - 1. The CONTRACTOR shall maintain near the work in progress a suitable office or other protected area in which shall be kept project copies of the Contract Documents, project progress records, project schedule, shop drawings and other relevant documents which shall be accessible to the OWNER and ENGINEER during normal working hours.
 - 2. The CONTRACTOR shall make their own arrangements for additional space that may be required and bear all associated costs.
- E. Temporary Facilities Plan:
 - 1. The CONTRACTOR shall submit to the ENGINEER for approval, as part of the mobilization effort, the proposed plan and layout for all temporary offices, sanitary facilities, temporary construction roads, storage buildings, storage yards, temporary water service and distribution, temporary telephone and temporary power service and distribution.
 - 2. The plan shall show all temporary fencing and gates and all proposed access to the work areas.
 - 3. Prior to the removal of existing fence, the CONTRACTOR shall provide temporary security fencing at least equal to the existing chain link and barbed wire fencing to protect the existing facilities and structures.
- F. Access Roads:
 - 1. The CONTRACTOR shall "winterize" all access roads to provide a surface reasonably satisfactory for traffic during wet winter months.
 - 2. The roads shall be gravel surfaced, even, free from humps and depressions.
 - 3. All costs of complying with this requirement shall be included in the lump sum bid.

1.2 STORAGE - GENERAL

- A. The CONTRACTOR shall provide any temporary storage required for the protection of equipment and materials as recommended by manufacturers of such materials.

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1.3 STORAGE BUILDINGS

- A. The CONTRACTOR shall erect or provide temporary storage buildings of the various sizes as required for the protection of mechanical and electrical equipment and materials as recommended by manufacturers of such equipment and materials.
- B. The buildings shall be provided with such environmental control systems that meet recommendations of manufacturers of all equipment and materials stored in the buildings.
- C. The buildings shall be of sufficient size and so arranged or partitioned to provide security for their contents and provide ready access for inspection and inventory.
- D. At or near the completion of the work, and as directed by the ENGINEER, the temporary storage buildings shall be dismantled, removed from the site, and remain the property of the CONTRACTOR.
- E. Combustible materials (paints, solvents, fuels, etc.) shall be safely stored and separated in accordance with the manufacturer's requirements and in compliance with hazardous material storage requirements. CONTRACTOR shall be responsible for providing proper storage buildings for combustible materials.

1.4 STORAGE YARDS

- A. The CONTRACTOR shall provide temporary storage yards as required for the storage of materials that are not subject to damage by weather conditions.
- B. Materials such as pipe, reinforcing and structural steel, shall be stored on pallets or racks, off the ground, and stored in a manner to allow ready access for inspection and inventory.
- C. Temporary gravel surfacing of the storage yards shall meet with the approval of the ENGINEER.

1.5 PARKING AREAS

- A. Control vehicular parking to preclude interference with public traffic or parking, access by emergency vehicles, OWNER's operations, or construction operations.

1.6 VEHICULAR TRAFFIC

- A. Comply with Laws and Regulations regarding closing or restricting use of public streets or highways. No public or private road shall be closed, except by written permission of proper authority. Assure the least possible obstruction to traffic and normal commercial pursuits.
- B. Conduct the Work to interfere as little as possible with public travel, whether vehicular or pedestrian.
- C. Whenever it is necessary to cross, close, or obstruct roads, driveways, and walks, whether public or private, provide and maintain suitable and safe bridges, detours, or other temporary expedients for accommodation of public and private travel.

1.7 DELIVERY-STORAGE-HANDLING

A. General:

1. The CONTRACTOR shall deliver, handle, and store materials and equipment in accordance with supplier's written recommendations and by methods and means which will prevent damage, deterioration, and loss including theft.
2. Delivery schedules shall be controlled to minimize long-term storage at the site and overcrowding of construction spaces.
3. In particular, the CONTRACTOR shall provide delivery/ installation coordination to ensure minimum holding or storage for material or equipment recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other sources of loss.

B. Transportation and Handling:

1. Materials and equipment shall be transported by methods to avoid damage and shall be delivered in dry, undamaged condition in supplier's unopened containers or packaging.
2. The CONTRACTOR shall provide equipment and personnel to handle the materials, and equipment by methods that will prevent soiling and damage.
3. The CONTRACTOR shall provide additional protection during handling to prevent marring and otherwise damaging packaging, and surrounding surfaces.

C. Storage and Protection:

1. Materials and equipment shall be stored in accordance with supplier's written instructions, with seals and labels intact and legible. Exposed metal surfaces of valves, fittings and similar materials shall be coated with grease in accordance with manufacturer's recommendations to prevent corrosion. Sensitive materials and equipment shall be stored in weather-tight enclosures and temperature and humidity ranges shall be maintained within tolerances required by supplier's written instructions.
2. For exterior storage of fabricated materials, they shall be placed on sloped support above ground. Materials or equipment subject to deterioration shall be covered with impervious sheet covering; ventilation shall be provided to avoid condensation.
3. Loose granular materials shall be stored on solid surfaces in a well-drained area and shall be prevented from mixing with foreign matter.
4. Inspection:
 - a. Storage shall be arranged to provide access for inspection.
 - b. The CONTRACTOR shall periodically inspect to assure materials and equipment are undamaged and are maintained under required conditions.
5. Storage shall be arranged in a manner to provide access for maintenance of stored items.

1.8 PROJECT SECURITY

- A. The CONTRACTOR shall make adequate provision for the protection of the work area against fire, theft and vandalism, and for the protection of the public and OWNER personnel against exposure to injury, and for the security of any off-site storage areas.
- B. All costs for this protection shall be included within the CONTRACTOR's bid.

1.9 TEMPORARY UTILITIES

- A. The CONTRACTOR shall provide and pay for all necessary temporary telephones, fuel, power, potable water, sanitary, and proper toilet accommodations. CONTRACTOR shall not use OWNER-owned utilities.
- B. The temporary facilities to be provided by the CONTRACTOR as described above shall conform to all requirements in regard to operation, safety, and fire hazards of State and local authorities and of Underwriters.
- C. CONTRACTOR shall return the site and facilities to their original "as-found" condition, unless otherwise specified in the Contract Documents, at the completion of the project.

1.10 SOUND CONTROL

- A. The CONTRACTOR shall comply with all local sound control and noise level rules, regulations and ordinances which apply to any work performed pursuant to the contract.
- B. Each internal combustion engine, used for any purpose on the job or related to the job, shall be equipped with a muffler of a type recommended by the manufacturer, so as to produce a maximum noise level of 85 dBA at 5 feet.
- C. No internal combustion engine shall be operated on the project without said muffler.
- D. Special Precautions for Inhabited Areas:
 - 1. In inhabited areas, particularly residential, operations shall be performed in a manner to minimize unnecessary noise generation.
 - 2. In residential areas, special measures shall be taken to suppress noise generated by repair and service activities during the night hours.

1.11 DUST/AIR POLLUTION CONTROL

- A. The CONTRACTOR shall take whatever steps, procedures, or means as are required to prevent dust conditions being caused by operations in connection with the execution of the Work; and on any road which the CONTRACTOR or any of their Subcontractors are using, excavation or fill areas, demolition operations, or other activities.
- B. Control shall be by sprinkling, use of dust palliatives, modification of operations, or any other means acceptable to agencies having jurisdiction.
- C. Damage to personal property, etc., resulting from the CONTRACTOR's construction operations shall be borne by the CONTRACTOR at no cost to the OWNER.
- D. The CONTRACTOR shall keep the streets and work area clean at all times by means of mechanical sweepers or hand sweeping. Water will be used for dust control only, and not for cleaning streets.
- E. Burning of waste, rubbish, or other debris will not be permitted on or adjacent to site.

1.12 WASTE DISPOSAL

- A. The CONTRACTOR shall dispose of surplus materials, waste products, and debris and shall make necessary arrangements for such disposal. The CONTRACTOR shall obtain written permission from property owner prior to disposing surplus materials, waste products, or debris on private property.
- B. All waste disposal shall be done in accordance with applicable laws and regulations.
- C. Landfill Disposal:
 - 1. If the CONTRACTOR proposes to dispose of construction debris, trench spoils, excavation spoils, etc., at a landfill, the CONTRACTOR shall be responsible to provide and pay for all permits and analyses required by the landfill.
 - 2. If the analyses determine that the material is hazardous, then an equitable adjustment of the Contract for the cost of hazardous waste disposal will be made in accordance with the General Conditions, and the following:
 - a. Time extension or contract costs will not be granted for delays that could have been avoided by the CONTRACTOR redirecting their forces and equipment to perform other work on the contract.
- D. Ditches, washes, or drainageways shall not be filled.
- E. Disposal operations shall not create unsightly or unsanitary nuisances.
- F. The CONTRACTOR shall maintain the disposal site in a condition of good appearance and safety during the construction period.
- G. Prior to final acceptance of the work, the CONTRACTOR shall have completed the leveling and cleanup of the disposal site.

1.13 FIELD OFFICES AND SHEDS

- A. Contractor's field office:
 - 1. Maintain on Project Site weather tight 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.
- B. Construction Manager field office:
 - 1. Provide separate field office on project site for the exclusive use of the Construction Manager. Specific layout shall be submitted to, and acceptable to the Construction Manager prior to placement on site, however, the general requirements are as follows:
 - a. Size: Approximately 20 feet by 8 feet with 8-foot minimum ceiling height.
 - b. Construction: Weather tight building constructed at the site, or like new pre-manufactured building, or trailer.
 - c. Layout:
 - 1) Private offices: 1
 - 2) Conference area: 1
 - 3) Toilet room: 1
 - a) Containing a water closet and lavatory, partitioned off from the working area. The water closet may be of the chemical type provided that it is a

flush type with an approved holding tank, if no direct hook-up existing sewer line is available.

- 4) Closet with shelving: 1
 - d. Exterior materials: Weather-resistant and finished in one color acceptable to Engineer. Skirting for under pinning of field office.
 - e. Provide wood or metal stairs with handrails for each entry.
 - 1) Porch landing 5 feet by 5 feet for each entry.
 - f. Interior materials in offices: Sheet-type materials for walls and ceilings, prefinished or painted; resilient floors and bases. Interior walls shall be insulated for noise attenuation.
 - g. Openings: At least 1 window (with operable sash, insect screens, and blinds) and 1 entrance door, with keyed alike cylinder locks and 4 keys.
 - h. Exterior lighting over entrance door
 - i. Fire extinguishers: Appropriate type fire extinguisher(s) for field office.
 - j. Construction Manager will approve office layout of rooms for Construction Manager staff, restroom(s), closet, etc.
 - k. Twenty 110 volts AC duplex receptacles with at least 4 in each office.
2. Arrange and Pay for:
 - a. Weekly janitorial service, including dusting, floor cleaning (sweeping, vacuuming or mopping), and trash removal, and monthly comprehensive cleaning, including windows.
 - b. Heating, ventilating, and air conditioning equipment in operating condition.
 - 1) Furnish all maintenance and consumables.
 - c. Electric wiring, power, and lighting fixtures capable of providing at least 75-foot candles of light on work surfaces.
 - d. A continuous supply of toilet paper, paper hand towels and hand soap for each restroom.
 - e. Bottled drinking water service with hot and cold dispenser including water cups.
 - f. Suitable restroom facilities with sinks with hot and cold water.
 - g. Provide and maintain First Aid Kit and Cabinet in accordance with ANSI and OSHA requirements.
 3. Provide following furnishings and equipment:
 - a. Office desks: One 36 inches by 72 inches with 3 drawers
 - b. Padded, upholstered swivel arm chairs: 1.
 - c. Plan/conference table: 1, not less than 48 inches by 72 inches.
 - d. Straight chairs (fully padded): 6.
 - e. Supply cabinet: 1, with not less than 15 square feet of shelves.
 - f. Bookcases: 1, with not less than 12 linear feet of shelves for each bookcase.
 - g. Wastebaskets: 2.
 - h. Dry erase board 96 by 48 inches, magnetic: 1.
 - i. Refrigerator: 15.0 cubic feet capacity.
 - j. Microwave oven: 1.0 cubic feet.
 4. Field office data service and network equipment:
 - a. Provide the following data services for the duration of the project.
 - b. Contractor is responsible for all maintenance of service and hardware.
 - c. Data service will be dedicated to the Construction Manager and not shared with any other party.
 - d. The Contractor shall provide a durable and weather tight system for connecting the Construction Manager trailer to the service provider's facilities at the jobsite boundary:
 - e. Contractor is responsible for all maintenance of service and hardware:
 - 1) Provide high-speed Internet access (DSL, wireless internet, or cable modem):

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- a) Requirements: Minimum 6 Gb per second download/ upload. This access must have a minimum of 8 (5 usable) IP address. In addition, it must provide an average round-trip delay of less than 150 ms to the Construction Manager Internet gateway.
- b) Equipment: Provide appropriate modem device. In addition, provide the following:
 - 1. Cisco ASA 5505 firewall with 3DES software, part number ASA5505-SEC-BUN-K9 and Cisco 4-hour response onsite Smartnet Maintenance for duration of project.
- c) Cisco Aironet 3500 Series Wireless Access Point Model No. AIR-CAP3502I-A-K9.]
- d) Or Equal
- f. Field office local area network: Provide the following to create a local area network for the Construction Manager:
 - 1) Install Category 5e cabling to support all specified computers, printers, and other network device. This cabling should be home-run to a patch panel and meet all applicable installation standards for CAT5e. Patch panel and jack locations to be coordinated with Construction Manager.
 - 2) Provide 10/100/1000 Ethernet Switch sized to support all specified network devices for Construction Manager with an allowance for 50 percent growth/spare ports.
 - 3) Provide APC SmartUPS RT 1500 uninterruptable power supply, model SURTA1500XL.
 - 4) Provide Category 5e patch cables for all networking equipment; both for patch panel to switch connection and for wall jack to network device connection.
- 5. Locate field office where directed.
- 6. Have field office ready for occupancy within 2 weeks after Notice to Proceed.
- 7. Parking: 5 gravel parking spaces for use by Construction Manager connected to office by a gravel walkway.

1.14 REMOVAL

- A. Remove temporary buildings and furnishings before inspection for final 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.

1.15 CLEAN UP

- A. Throughout the period of construction, the CONTRACTOR shall keep the work site free and clean of all rubbish and debris, and shall promptly remove from the site, or from property adjacent to the site of the work, all unused and rejected materials, surplus earth, concrete, plaster, and debris.
- B. Upon completion of the work, and prior to final acceptance, the CONTRACTOR shall remove from the vicinity of the work all plant, surplus material, and equipment belonging to the CONTRACTOR or used under their direction during construction.

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1.16 TEMPORARY ENCLOSURES

- A. When sandblasting, spray painting, spraying of insulation, or other activities inconveniencing or dangerous to property or the health of employees, the public or construction workers, are in progress, the area of activity shall be enclosed adequately to contain the dust, over spray, or other hazard.
- B. In the event there are no permanent enclosures of the area, or such enclosures are incomplete or inadequate, the CONTRACTOR shall provide suitable temporary enclosures as required by the ENGINEER to meet field conditions in accordance with the recommendations of the owner-furnished equipment supplier (if applicable) and the CONTRACTOR's equipment supplier requirements.
- C. Said temporary or permanent enclosures shall be adequately ventilated to ensure the safety of the workers.

1.17 DRAINAGE

- A. The CONTRACTOR shall take all necessary actions as required to meet discharge requirements of the California Storm Water Program (California State Water Resources Control Board) and other pertinent local ordinances and regulations pertaining to dewatering and/or site drainage discharged into storm drains and creeks. This may include, but may not be limited to, the use of retention basins and silt basins to settle most of the solids prior to discharge.
- B. In excavation, fill, and grading operations, care shall be taken to disturb the pre-existing drainage pattern as little as possible.
- C. Particular care shall be taken not to direct drainage water onto private property or into streets or drainageways inadequate for the increased flow.
- D. Drainage means shall be provided to protect the work.

1.18 TEMPORARY LIGHTING

- A. The CONTRACTOR shall provide temporary lighting in all work areas sufficient to maintain a lighting level during working hours not less than the lighting level required by OSHA standards.

1.19 CONSTRUCTION FACILITIES

- A. Construction hoists, elevators, scaffolds, stages, shoring, and similar temporary facilities shall be of ample size and capacity to adequately support and move the loads to which they will be subjected. Railings, enclosures, safety devices, and controls required by law or for adequate protection of life and property shall be provided.
- B. Temporary supports shall be designed with an adequate safety factor to assure adequate load bearing capability. Whenever required by safety regulations, the CONTRACTOR shall submit design calculations for staging and shoring prior to application of loads.

1.20 REMOVAL OF TEMPORARY FACILITIES AND UTILITIES

- A. At such time or times as any temporary construction facilities and utilities are no longer required for the work, the CONTRACTOR shall notify the ENGINEER of their intent and schedule for removal of the temporary facilities and utilities, and obtain the ENGINEER's approval before removing the same.
- B. As approved, the CONTRACTOR shall remove the temporary facilities and utilities from the site as CONTRACTOR's property and leave the site in such condition as specified, as directed by the ENGINEER, and/or as shown on the Drawings.
- C. In unfinished areas, such as planted medians, the condition of the site shall be left in a condition that will restore original drainage, evenly graded, seeded or planted as necessary, and left with an appearance equal to, or better than original.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

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SECTION 01505

MOBILIZATION

PART 1 - GENERAL

1.1 GENERAL

- A. Mobilization shall include the obtaining of all bonds, insurance, and licenses; moving onto the site of all plant and equipment; furnishing and erecting plants, temporary buildings, and other construction facilities; all as required for the proper performance and completion of the work.
- B. Mobilization shall include but not be limited to the following principal items:
 - 1. Moving on to the site of all CONTRACTOR's plant and equipment.
 - 2. Installing temporary construction power, wiring, and lighting facilities.
 - 3. Establishing fire protection system.
 - 4. Developing construction water supply.
 - 5. Furnishing the work access plan as specified in Section 01500, Temporary Construction Facilities and Utilities.
 - 6. Providing all on-site CONTRACTOR communication facilities, including telephones, and radio pagers and any radio communications facilities required for the CONTRACTOR to coordinate their forces.
 - 7. Providing on-site sanitary facilities and potable water facilities as specified in Section 01500, Temporary Construction Facilities and Utilities.
 - 8. Arranging for and erection of the CONTRACTOR's work and storage yard, including site security.
 - 9. Posting all EPA and OSHA required notices and establishment of safety programs.
 - 10. Post all required labor and EEOE notices.
 - 11. Have the CONTRACTOR's superintendent at the job site full time.
 - 12. Submittal and OWNER acceptance of the Construction Schedule.
 - 13. Establishing site security, lighting, fencing, and signing.
 - 14. Obtaining all bonds, insurance and licenses.
 - 15. Providing an organization chart of the project and for the CONTRACTOR's firm. The project chart shall include the name, title and responsibilities of each position which is involved in the work.
 - 16. Other mobilization items approved by the ENGINEER required to support the complete work (e.g., Health and Safety Plans for Hazardous Waste).

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

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SECTION 01610

GENERAL PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE

- A. All products furnished and installed under this contract shall conform to the general stipulations set forth in this Section except as otherwise specified in other Sections.

1.2 COORDINATION

- A. The CONTRACTOR shall coordinate all details of the products and equipment with other related parts of the work, including verification that all structures, piping, wiring, and equipment components are compatible. The CONTRACTOR shall be responsible for all structural and other alterations in the work required to accommodate products or equipment differing in dimensions or other characteristics from that contemplated in the Contract Drawings or Specifications.

1.3 DESIGN REQUIREMENTS

- A. Where CONTRACTOR design is specified, design and installation of systems, equipment, and components, including supports and anchorage, shall be in accordance with provisions of 2016 edition of the California Building Code (CBC).
 - 1. Basic Wind Speed: 115 mph, Exposure C.
 - 2. Tank Site Flat Roof Snow: 36-psf
 - 3. Tank Site Seismic:
 - a. S_S (maximum short-term spectral response acceleration) = 0.692
 - b. S_1 (maximum 1-second spectral response acceleration) = 0.289
 - c. S_{DS} (design short-term spectral response acceleration) = 0.564
 - d. S_{D1} (design 1-second spectral response acceleration) = 0.289
 - e. Site Case = C
 - f. I_e (Seismic Importance Factor) = 1.5
 - g. Risk Category = IV
 - h. Seismic Use Group = III
 - 4. Maximum Rain Intensity: 3-inches/hour
- B. Proof of Compliance:
 - 1. Structural integrity and anchorage shall be certified by an approved calculation that demonstrates the adequacy of the anchorage system for seismic forces. This calculation may be based on principles of structural analysis and engineering mechanics, or based on similarity to approved shake-table tests.
 - 2. The CONTRACTOR shall submit for review and approval test data or calculations certified by a Civil or Structural Engineer registered in the State of California to show compliance with the above requirements.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Altitude: Provide materials and equipment suitable for installation and operation under rated conditions at 2150 feet above sea level.

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- B. Provide equipment and devices installed outdoors or in unheated enclosures capable of continuous operation within an ambient temperature range of -10 degrees F to 120 degrees F.

1.5 WORKMANSHIP AND MATERIALS

- A. The CONTRACTOR shall guarantee all equipment against faulty or inadequate design, improper assembly or erection, defective workmanship or materials, and leakage, breakage, or other failure. Materials shall be suitable for service conditions.
- B. All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sizes and gages so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except as required by tests.
- C. Except where otherwise specified, structural and miscellaneous fabricated steel used in equipment shall conform to AISC standards. All structural members shall be designed for shock or vibratory loads. Unless otherwise specified, all steel which will be submerged, all or in part, during normal operation of the equipment shall be at least 1/4 inch thick.
- D. Except where otherwise specified, all metal which will be exposed to weather, submerged or otherwise exposed to moisture shall be either non-ferrous or stainless steel, as the application may require.

1.6 LUBRICATION

- A. Equipment shall be adequately lubricated by systems which require attention no more frequently than weekly during continuous operation. Lubrication systems shall not require attention during startup or shutdown and shall not waste lubricants.
- B. Lubricants of the type recommended by the equipment manufacturer shall be provided in sufficient quantity to fill all lubricant reservoirs and to replace all consumption during testing, startup, and operation prior to acceptance of equipment by OWNER. Unless otherwise specified or permitted, the use of synthetic lubricants will not be acceptable.
- C. Lubrication facilities shall be convenient and accessible. Oil drains and fill openings shall be easily accessible from the normal operating area or platform. Drains shall allow for convenient collection of waste oil in containers from the normal operating area or platform without removing the unit from its normal installed position.

1.7 ELECTRIC MOTORS

- A. Unless otherwise specified, motors furnished with equipment shall meet the following requirements:
 - 1. Designed and applied in accordance with NEMA, ANSI, IEEE, AFBMA, and NEC for the duty service imposed by the driven equipment, such as frequent starting, intermittent overload, high inertia, mounting configuration, or service environment.
 - 2. Rated for continuous duty at 40 °C ambient, unless the application is well recognized for intermittent duty service as a standard industry practice.

3. Insulated with Class F insulation and designed for a service factor of 1.15, or greater.
4. Three phase motors used in conjunction with variable speed drives shall have Class F insulation with a Class B temperature rise at rated nameplate horsepower, and 1.15 service factor.
5. When operating at service factor load, maximum observable temperature rise of insulation and motor parts, as determined by resistance or thermometer methods, shall not exceed the NEMA allowable limits for the type of motor, the type of enclosure, and the particular application with regard to continuous or intermittent duty.
6. To ensure long motor life, nameplate horsepower, regardless of service factor, shall be at least 115 percent of the maximum load imposed by the driven equipment.
7. Designed for full voltage starting.
8. Designed to operate from an electrical system that may have a maximum of 5 percent voltage distortion per IEEE Standard 519.
9. Derated, if required, for the altitude at which the equipment is installed.
10. Clamp-type grounding terminal shall be inside motor conduit box.
11. External conduit boxes shall be oversized at least one size larger than NEMA standard.
12. Totally enclosed motors shall have a continuous moisture drain which also excludes insects.
13. Bearings shall be either oil or grease lubricated.
14. Manufacturer's standard motor may be supplied on integrally constructed, packaged assemblies such as appliances, tools, unit heaters, and similar equipment specified by model number, in which case a redesign of the unit would be required to furnish motors of other than the manufacturer's standard design. However, in all cases, totally enclosed motors are preferred and shall be furnished if offered by the manufacturer as a standard option.
15. Totally enclosed motors shall be furnished on:
 - a. Equipment for installation below grade.
 - b. Equipment operating in wet or dust-laden locations.
16. Drip-proof motors, or totally enclosed motors at the supplier's option, shall be furnished on equipment in indoor, above-grade, clean, and dry locations.
17. Explosion-proof or submersible motors shall be furnished as required by applicable codes, as specified in other Sections, or at the supplier's option.
18. Motors shall be rated and constructed as follows:
 - a. Below 1/2 hp:
 - 1) 115 volts, 60 Hz, single phase.
 - 2) Built-in manual-reset thermal protector, or integrally mounted stainless steel enclosed manual motor starter.
 - b. 1/2 hp and above:
 - 1) 460 volts, 60 Hz, 3 phase.
 - 2) Where specified or required by the drawings, motors used on 240 volt systems shall be 230 volts, 60 Hz, 3 phase.

1.8 DRIVE UNITS

- A. The nominal input horsepower rating of each gear or speed reducer shall be at least equal to the nameplate horsepower of the drive motor. Drive units shall be designed for 24 hours continuous service.
- B. Unless otherwise specified, the use of gearmotors will not be acceptable.

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C. Gear reducers:

1. Each gear reducer shall be a totally enclosed unit with oil or grease lubricated antifriction, rolling element bearings throughout.
2. Helical, spiral bevel, combination bevel-helical, and worm gear reducers shall have a service factor of at least 1.50 based on the nameplate horsepower of the drive motor. Shaft-mounted and flange-mounted gear reducers shall be rated AGMA Class II. Helical gear reducers shall have a gear strength rating to catalog rating of 1.5. Each gear reducer shall bear an AGMA nameplate.
3. The thermal horsepower rating of each unit shall equal or exceed the nameplate horsepower of the drive motor. During continuous operation, the maximum sump oil temperature shall not rise more than 100°F above the ambient air temperature in the vicinity of the unit and shall not exceed 200°F.
4. Bearings:
 - a. Each grease lubricated bearing shall be installed in a bearing housing designed to facilitate periodic regreasing of the bearing by means of a manually operated grease gun.
 - b. Each bearing housing shall be designed to evenly distribute new grease, to properly dispose of old grease, and to prevent overgreasing of the bearing.
 - c. The use of permanently sealed, grease lubricated bearings will not be acceptable.
 - d. An internal or external oil pump and appurtenances shall be provided if required to properly lubricate oil lubricated bearings.
 - e. A dipstick or sight glass arranged to permit visual inspection of lubricant level shall be provided on each unit.
5. Gear reducers that require the removal of parts or periodic disassembly of the unit for cleaning and manual regreasing of bearings will not be acceptable.
6. Certification shall be furnished by the gear reducer manufacturer indicating that the intended application of each unit has been reviewed in detail by the manufacturer and that the unit provided is fully compatible with the conditions of installation and service.

D. V-belt drives:

1. Each V-belt drive shall include a sliding base or other suitable tension adjustment. V-belt drives shall have a service factor of at least 1.6 at maximum speed based on the nameplate horsepower of the drive motor.

1.9 SAFETY GUARDS

- A. All belt or chain drives, fan blades, couplings, and other moving or rotating parts shall be covered on all sides by a safety guard.
- B. Safety guards shall be fabricated from 16 USS gauge or heavier galvanized or aluminum-clad sheet steel or 1/2 inch mesh galvanized expanded metal.
- C. Each guard shall be designed for easy installation and removal.
- D. All necessary supports and accessories shall be provided for each guard. Supports and accessories, including bolts, shall be galvanized.
- E. All safety guards in outdoor locations shall be designed to prevent the entrance of rain and dripping water.

1.10 ANCHOR BOLTS

- A. Equipment suppliers shall furnish suitable anchor bolts for each item of equipment.
- B. Anchor bolts, together with templates or setting drawings, shall be delivered sufficiently early to permit setting the anchor bolts when the structural concrete is placed.
- C. Anchor bolts shall comply with Section 05051, Anchors, Inserts and Epoxy Dowels and, unless otherwise specified, shall have a minimum diameter of 1/2-inch.
- D. Unless otherwise indicated or specified, anchor bolts for items of equipment mounted on baseplates shall be long enough to permit 1-1/2 inches of grout beneath the baseplate and to provide adequate anchorage into structural concrete.

1.11 EQUIPMENT BASES

- A. Unless otherwise indicated or specified, all equipment shall be installed on concrete bases at least 6 inches high.
- B. Cast iron or welded steel baseplates shall be provided for pumps, compressors, and other equipment.
- C. Each unit and its drive assembly shall be supported on a single baseplate of neat design.
- D. Baseplates shall have pads for anchoring all components and adequate grout holes.
- E. Baseplates for pumps shall have a means for collecting leakage and a threaded drain connection.
- F. Baseplates shall be anchored to the concrete base with suitable anchor bolts and the space beneath filled with grout as specified in Section 03600, Grout.

1.12 SPECIAL TOOLS AND ACCESSORIES

- A. Equipment requiring periodic repair and adjustment shall be furnished complete with all special tools, instruments, and accessories required for proper maintenance. Equipment requiring special devices for lifting or handling shall be furnished complete with those devices.

1.13 SHOP PAINTING

- A. Surface Protection:
 - 1. All steel and iron surfaces shall be protected by suitable paint or coatings applied in the shop.
 - 2. Surfaces that will be inaccessible after assembly shall be protected for the life of the equipment.
 - 3. Exposed surfaces shall be finished smooth, thoroughly cleaned, and filled as necessary to provide a smooth uniform base for painting.
 - 4. Electric motors, speed reducers, starters, and other self-contained or enclosed components shall be shop primed or finished with a high-grade oil-resistant enamel suitable for coating in the field with an alkyd enamel.
 - 5. Coatings shall be suitable for the environment where the equipment is installed.

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- B. Shop Primer:
 - 1. Surfaces to be painted after installation shall be prepared for painting as recommended by the paint manufacturer for the intended service, and then shop painted with one or more coats of the specified primer.
 - 2. Unless otherwise specified, the shop primer for steel and iron surfaces shall be:
 - a. Cook "391-N-167 Barrier Coat",
 - b. Koppers "No. 10 Inhibitive Primer",
 - c. Tnemec "37H Chem-Prime HS",
 - d. Valspar "13-R-28 Chromox Primer",
 - e. Or equal.
- C. Machined, polished, and nonferrous surfaces which are not to be painted shall be coated with rust-preventive compound, Houghton "Rust Veto 344", Rust-Oleum "R-9", or equal.

1.14 PREPARATION FOR SHIPMENT

- A. All equipment shall be suitably packaged to facilitate handling and protect against damage during transit and storage. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage. All equipment shall be protected from exposure to the elements and shall be kept thoroughly dry at all times.
- B. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. All painted surfaces which are damaged prior to acceptance of equipment shall be repainted to the satisfaction of ENGINEER.
- C. Grease and lubricating oil shall be applied to all bearings and similar items.
- D. Each item of equipment shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.

1.15 STORAGE

- A. Upon delivery, all equipment and material shall immediately be stored and protected until installed in the work.
- B. Pumps, motors, electrical equipment, and all equipment with antifriction or sleeve bearings shall be stored in weathertight structures maintained at a temperature above 60°F. Equipment, controls, and insulation shall be protected against moisture and water damage. All space heaters furnished in equipment shall be connected and operated continuously.
- C. Equipment and materials shall not show any pitting, rust, decay, or other deleterious effects of storage when installed in the work.

1.16 INSTALLATION AND OPERATION

- A. Equipment shall not be installed or operated except by, or with the guidance of, qualified personnel having the knowledge and experience necessary for proper results. When so specified, or when employees of the CONTRACTOR or their subcontractors are not

qualified, such personnel shall be field representatives of the manufacturer of the equipment or materials being installed.

- B. Qualified field representatives shall be provided by the equipment manufacturers as required by Section 01750, Testing, Training and Startup.
- C. All equipment installed under this Contract, including that furnished by OWNER shall be placed into successful operation according to the written instructions of the manufacturer or the instructions of the manufacturer's field representative. All required adjustments, tests, operation checks, and other startup activity shall be provided.
- D. Acceptance of work in connection with the installation of equipment furnished by others will be subject to approval of the field representative. The CONTRACTOR shall be responsible for planning, supervising, and executing the installation of work, and the approval or acceptance of ENGINEER or the field representative will not relieve the CONTRACTOR of responsibility for defective work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

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SECTION 01643

OWNER-FURNISHED EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The work specified in this Section includes the unloading, handling, installation, connection, and testing of OWNER-furnished equipment as indicated on the Plans and as specified herein.
- B. OWNER-furnished equipment:
 - 1. ZATM Pipeline Materials
 - a. All ZATM related equipment and materials conforming to the following specifications from Sta 10+00 to Sta 83+25:
 - 1) SECTION 15100 – PIPE AND FITTINGS
 - 2) SECTION 15100 PSDS - PVC2
 - 3) SECTION 15200 – VALVES AND OPERATORS
 - 4) SECTION 15200 VS – VALVE SCHEDULE
- C. Definitions: As used in this Section, the following terms have the meaning indicated:
 - 1. Equipment Manufacturer:
 - a. The Company with whom the OWNER has a contract to procure the equipment items.
 - 2. Defective:
 - a. An adjective which when modifying the word "equipment" refers to OWNER-furnished equipment and indicates that such equipment is unsatisfactory, faulty or deficient; that such equipment does not conform to the provisions of the Equipment Specifications; that such equipment does not meet the requirements of any inspection, test, or approval referred to in the Equipment Specifications; or that such equipment is damaged.
 - 3. Equipment specifications:
 - a. The specifications and other Contract Documents covering the purchase and delivery of OWNER-furnished equipment are included in the separate agreement between the OWNER and the Equipment Manufacturer.
 - 4. Approved shop drawings:
 - a. The drawings and data supplied by the Equipment Manufacturer for OWNER-furnished equipment, as approved by the ENGINEER.

1.2 CONTRACTOR COORDINATION WITH EQUIPMENT MANUFACTURER

- A. CONTRACTOR shall be in close coordination with service representatives of the manufacturer of the OWNER-furnished equipment in every phase of installation.
- B. Both the CONTRACTOR and the Equipment Manufacturer have separate responsibilities, both of which must necessarily be interwoven as regards the installation, testing and acceptance of the equipment.

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Owner-Furnished Equipment

- C. The Agreement between the OWNER and the Equipment Manufacturer, plus approved shop drawings, are available for inspection at the ENGINEER's Office. All prospective Contractors shall review said Agreement and shop drawings.

1.3 QUALITY ASSURANCE

- A. Equipment specifications and approved shop drawings:
 - 1. The CONTRACTOR will be presumed cognizant, prior to entering into the Contract, of the provisions of the Equipment Specifications and approved Shop Drawings.
 - 2. One copy of the approved shop drawings will be made available to the CONTRACTOR to whom the Contract is awarded.
- B. Installation:
 - 1. OWNER-furnished equipment shall be installed as specified in Paragraph 3.1.
- C. Operation:
 - 1. OWNER-furnished equipment shall be operated in accordance with the written instructions furnished with the equipment, and with the instructions issued by representatives of equipment manufacturers.
- D. Testing:
 - 1. After installation, and following certification in writing by Equipment Manufacturer that the installation is ready for electrical testing, the CONTRACTOR shall make electrical tests on OWNER-furnished equipment.
 - 2. The tests shall prove that the equipment has been properly installed; that power, control, instrumentation, and alarms are properly connected and wired from the equipment to points of supply or receipt of signals and are properly calibrated; and that all other work performed by the CONTRACTOR renders the equipment operational as intended.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Delivery of OWNER-furnished equipment:
 - 1. Equipment will be delivered to the CONTRACTOR at the site of the work as specified in the Equipment Specifications and identified in Section 01110, Summary of Work.
 - 2. Changes to the delivery procedure and schedule may be made if mutually agreed between the CONTRACTOR and the OWNER, and if approved by the Equipment Manufacturer.
 - 3. Inspection and Acceptance:
 - a. Upon delivery, conduct with OWNER or ENGINEER a joint inspection for the purpose of identifying product, general verification of quantities, and observation of apparent condition.
 - b. Such inspection will not be construed as final or as receipt of any product that, as a result of subsequent inspections and tests, are determined to be nonconforming.
 - c. Damaged or incomplete products to be returned for replacement will not be unloaded, except as necessary to expedite return shipment.
 - d. OWNER will submit claims for transportation damage and expedite replacement of damaged, defective, or deficient items.
 - e. Indicate signed acceptance of delivery on a copy of the invoice.

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Owner-Furnished Equipment

- f. Upon CONTRACTOR's acceptance of OWNER-furnished equipment, it shall be understood that the CONTRACTOR assumes the responsibilities assigned to him in these Specifications in relation to the installation, testing and operation of OWNER furnished equipment.
4. Defective Equipment Notice:
- a. The CONTRACTOR shall verify the conditions of OWNER-furnished equipment and shall submit to the ENGINEER within 7 days after delivery date a statement listing all defective equipment items.
 - b. The list shall include the cost and extension to the Contract Time that the CONTRACTOR estimates for the correction and repair of each defective equipment item and a statement of the CONTRACTOR's opinion as to the cause of the defective equipment items.
 - c. If the CONTRACTOR makes no submittal within the time period specified, it shall be understood that the OWNER-furnished equipment is in satisfactory condition and that the CONTRACTOR's acceptance has occurred as of the date of delivery.
 - d. If the CONTRACTOR makes a submittal listing defective equipment items within the time period specified, the ENGINEER will decide on the course of action to be taken. The possible courses of action by the ENGINEER include:
 - 1) Correction By Change Order:
 - a) To authorize the CONTRACTOR to proceed with the correction and repair of defective equipment items through the issuance of a Change Order.
 - b) The CONTRACTOR's consent to perform such repair and correction shall be construed as CONTRACTOR's acceptance for the items included in the Change Order.
 - 2) Correction By Force Account:
 - a) To direct the CONTRACTOR to proceed with the correction and repair of defective equipment items through the procedures specified for force account work.
 - b) It shall be understood that CONTRACTOR's acceptance has occurred for the items covered under force account work on the date of the issuance of the ENGINEER's directive.
 - 3) Correction By Others:
 - a) To have others perform the correction and repair of defective equipment items.
 - b) The CONTRACTOR shall observe the work done by others and notify the ENGINEER in writing of all irregularities, faulty workmanship, or unsatisfactory work done by others.
 - c) The CONTRACTOR observations shall be carried out without obstruction or interference to others performing work.
 - d) Upon completion of the correction and repair, the ENGINEER will notify the CONTRACTOR and it shall be understood that CONTRACTOR's acceptance has occurred for items repaired by others upon receipt of the ENGINEER's notification.
 - 4) Modify the Installation Contract:
 - a) To modify the Plans and Specifications in order to meet changing conditions.
 - b) It shall be understood that CONTRACTOR's acceptance has occurred upon receipt of the ENGINEER's modifications to Plans and Specifications.
 - 5) Reject the Characterization:
 - a) To state to the CONTRACTOR that an item listed by the CONTRACTOR is not a defective equipment item.

- e. Regarding such items, it shall be understood that CONTRACTOR's acceptance has occurred on the delivery date.
 - 5. If CONTRACTOR is not prepared to accept delivery of OWNER-furnished equipment by either the specified Estimated Date of Arrival or such OWNER-confirmed delivery date, as specified herein, associated costs incurred by OWNER shall be borne by CONTRACTOR. Such costs may include, but not be limited to, demurrage, interest, insurance costs, additional administrative and engineering costs, additional factory and field technical support, additional storage and reshipping costs, cost escalation, and extended warranty costs due.
 - 6. The CONTRACTOR shall unload the equipment from the delivery vehicle within 24 hours after arrival of the vehicle transporting such equipment to the site. The equipment shall be unloaded in accordance with manufacturers' instructions, or as specified.
 - 7. The CONTRACTOR shall assume responsibility for storage and handling of equipment after the delivery has been accepted.
- B. Protection of OWNER-furnished equipment:
- 1. The CONTRACTOR shall protect the equipment in accordance with the Equipment Manufacturer's recommendations against weather conditions, including construction of a temporary cover, and periodic lubrication, if required.
 - 2. From the time of receipt until the equipment is energized for operations, unless such equipment is being worked on, equipment shall be considered in storage.
 - 3. While in storage, a 120V, 1 phase source of power shall be provided and connected to space heaters in all items of equipment so equipped. Equipment not provided with space heaters shall be provided with a light bulb or electric heater while in storage to prevent moisture condensation.

1.5 SCHEDULING:

- A. It shall be understood that the CONTRACTOR's review of the Equipment Specifications has allowed the scheduling of their operations in accordance with the dates for the delivery of OWNER-furnished equipment anticipated in said Equipment Specifications.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. The CONTRACTOR shall install OWNER-furnished equipment in accordance with the instructions and recommendations furnished with the equipment, approved shop drawings, instructions of the representatives of equipment manufacturers and installation manuals, and as indicated on the Plans.
- B. The CONTRACTOR shall be responsible to include in their bid all labor, materials, and equipment required to install the OWNER-furnished equipment and make the complete system operate satisfactorily.

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- C. Equipment shall not be installed or operated except by, or with the guidance of, qualified personnel having the knowledge and experience necessary to obtain proper results. Such personnel shall be field representatives of the Equipment Manufacturer.
- D. Factory Service Representatives:
 - 1. Qualified factory service representatives will be provided by the Equipment Manufacturer as required to perform all manufacturers' field services called for in these Specifications.
 - 2. Equipment Manufacturer will submit resumes of the proposed factory service representatives to the ENGINEER for review and acceptance not less than 21 days prior to the factory services representative's first site visit.
 - 3. Factory service representatives will observe, instruct, guide, and direct CONTRACTOR's erection or installation procedures, and perform an installation check, as required herein or as requested by the ENGINEER.
 - 4. Each factory service representative will revisit the site as often as necessary to attain installation satisfactory to ENGINEER.
- E. The CONTRACTOR shall furnish and install all piping, electrical and instrumentation work, interconnections, finish painting and accessories as required to make the OWNER-furnished equipment and system complete and functional.
- F. Provide foundation pads for OWNER-furnished products as shown. Verify exact dimensions and configuration of all pads, including penetrations, with OWNER-furnished product shop drawings.
- G. Anchor Bolts:
 - 1. Where required, provide anchor bolts, fasteners, washers, and templates needed for installation of OWNER-furnished equipment.
 - 2. Size and locate anchor bolts in accordance with OWNER-furnished product shop drawings and installation instructions.
- H. Mechanical and electrical equipment shall be properly aligned, plumb and level, with no stresses on connecting piping or conduit.

3.2 FIELD FINISHING

- A. Products will be delivered with prime coat(s) applied.
- B. Finish coat as specified in Section 09900 - PAINTING.
- C. Touch up or repair damage to coatings resulting from unloading, storage, installation, testing, and startup.
- D. If finish coats are damaged extensively after transfer, completely repaint.
- E. Touch up, repair, or complete repainting shall match color of original paint, and shall be fully compatible with applied primers and finish.

3.3 EQUIPMENT FIELD TESTING

- A. General:

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1. Field Testing shall consist of Functional Testing performed by the CONTRACTOR, and Performance Testing performed by the Equipment Manufacturer with OWNER assistance.
 2. Minimum Functional Testing requirements are specified in Section 01750, Testing, Training and Startup.
 3. Additional testing required as specified in Section 15990 – Testing of Pressure Piping Systems.
 4. Disinfection required as specified in Section 15995 – Disinfection of Potable Water Systems.
 5. The CONTRACTOR shall schedule, coordinate, and perform all tests and disinfection procedures required to prove that the equipment has been properly installed and is in satisfactory operating condition.
 6. The Equipment Manufacturer will furnish a factory trained representative to provide technical guidance to assist the OWNER's CONTRACTOR during Testing as required.
 7. Additional Functional Testing requirements for the Owner-Supplied Equipment are listed in the Technical Specifications.
- B. The CONTRACTOR shall repair, replace or correct to the satisfaction of the ENGINEER all defective equipment items caused by the CONTRACTOR's improper placement and handling of OWNER-furnished equipment.
- C. After testing, the CONTRACTOR shall repair, replace, or correct faulty work.

3.4 SERVICES OF EQUIPMENT MANUFACTURER'S REPRESENTATIVES

- A. The Equipment Manufacturers (through the OWNER) will provide services of skilled representatives of equipment manufacturer's for inspecting the installation, adjustments, start-up and testing of OWNER-furnished equipment.
- B. The extent of services provided by manufacturer's representatives is specified in the Equipment Specifications.
- C. The services will be provided as requested by the ENGINEER.
- D. The CONTRACTOR and their employees shall fully cooperate with the manufacturer's representatives.
- E. The CONTRACTOR shall notify the ENGINEER in writing 15 calendar days before the equipment manufacturer's representative needs to be present at the site.

++ END OF SECTION ++

SECTION 01750

TESTING, TRAINING AND STARTUP

PART 1 - GENERAL

1.1 GENERAL

- A. Scope:
 - 1. This Section covers general equipment and system testing and startup requirements, services of the manufacturer's representatives and special coordinating services required of the CONTRACTOR that shall apply during construction and training of the OWNER's personnel for facilities operation.
 - 2. Specific testing and tracking procedures and requirements found in the Technical Specifications shall also apply.
- B. The CONTRACTOR shall inform all Subcontractors and manufacturers of the requirements herein and include the required services in their costs for the work specified in these Contract Documents. Where a minimum amount of time is stated in the Technical Specifications for manufacturers' services, any additional time required to perform the specified services shall be provided at no additional cost to the OWNER.
- C. Scheduling:
 - 1. Equipment testing and plant startup are requisite to satisfactory completion of the Contract and, therefore, shall be completed within the contract time.
 - 2. All equipment testing and plant startup activities shall be realistically allowed for and shown on the CONTRACTOR's Construction Schedule, in accordance with Section 01320, Progress Schedule.
 - 3. All equipment testing and plant startup activities shall be scheduled in conformance with the restrictions specified in Section 01130, Special Project Constraints.
- D. Equipment testing shall be satisfactorily completed prior to commencing plant startup associated with the particular equipment item or equipment package. The equipment shall not be considered ready for testing until the following conditions are satisfied:
 - 1. Manufacturer's certification of equipment installation has been accepted by the ENGINEER.
 - 2. Electrical and/or instrumentation Subcontractor certification of motor control logic has been accepted by the ENGINEER.
 - 3. Related Technical Submittals, O&M Manual and Final Shop Drawings have been accepted by the ENGINEER.
 - 4. Operator training services have been furnished by the CONTRACTOR (operational testing only).
 - 5. Testing procedures have been submitted in writing and accepted by the ENGINEER in accordance with Section 01330, Submittal Procedures. All testing procedures and results shall be submitted in writing.
- E. The requirements of plant startup specified herein shall also apply to the startup of individual treatment plant processes and facilities.
- F. Startup Plan:

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1. Not less than 3 months prior to initial equipment or system startup, the CONTRACTOR shall submit to the ENGINEER for review, a detailed Facilities Startup Plan for the associated items of equipment and/or systems.
2. The Startup Plan shall include:
 - a. A detailed sub-network of the CONTRACTOR's Construction Progress Schedule including the following activities:
 - 1) Manufacturer's Services;
 - 2) Installation Certifications;
 - 3) Operator Training;
 - 4) O&M Manual;
 - 5) Functional Testing;
 - 6) Performance Testing;
 - 7) Operational Testing;
 - 8) All other activities necessary to affect a coordinated and successful Testing, Training and Startup.
 - b. Written testing plan with proposed data logs for each item of equipment to be tested.
 - c. A discussion of any coordination required with the Owners staff and/or any system or equipment outage requirements.
 - d. The Plan shall be updated and/or revised as necessary prior to subsequent Construction Progress Meetings.
 - e. Testing shall not be scheduled earlier than 30 days after approval of the Plan.

1.2 SERVICES DURING CONSTRUCTION

A. General:

1. Manufacturer's Representative:

- a. The CONTRACTOR shall provide the services of competent and experienced technical representatives of the manufacturers of all equipment and systems furnished under the contract, for as many days as may be necessary for assembly, installation, testing assistance and operator training.
- b. Manufacturer's field representatives shall observe, instruct, guide, and direct CONTRACTOR's erection or installation procedures, or perform an installation check, as required.
- c. In each case, the CONTRACTOR shall arrange to have the manufacturer's representative revisit the job site as often as necessary until operator training is complete and testing and startup problems have been resolved to the satisfaction of the ENGINEER.
- d. This requirement applies to manufacturers of all equipment furnished (excluding manually operated valves smaller than 24 inches in size, and any other items of equipment specifically exempted by the ENGINEER in writing), whether or not specifically set forth in the Technical Specifications.
- e. The CONTRACTOR shall maintain a service record on each item of equipment and shall deliver these service records to the ENGINEER prior to acceptance of operational testing.

B. Fulfillment of Specified Minimum Services:

1. The CONTRACTOR shall obtain prior written approval from the ENGINEER for providing manufacturers' services.
2. All requests to the ENGINEER for prior approval shall (1) be in writing, (2) be submitted not less than 10 calendar days prior to the providing of the subject

- services, (3) state the service to be provided, and (4) state the reason(s) why the timing of the service is appropriate.
3. Request made to the ENGINEER less than 10 calendar days prior to the manufacturers' services may not receive consideration and response prior to the times the services are provided.
 4. Visits of manufacturers and their representatives to the jobsite or training classroom without prior approval as provided herein may not act to fulfill the specified minimum man-day requirements.
- C. Certificate of Proper Installation:
1. Equipment requiring factory tests shall not be delivered to the jobsite until the CONTRACTOR submits acceptable certified test results to the ENGINEER.
 2. Equipment shall not be considered ready for functional testing until after the following certifications have been submitted and accepted by the ENGINEER.
 - a. Manufacturer Representatives:
 - 1) The CONTRACTOR shall require that each manufacturer's representative furnish to the ENGINEER a written and signed report addressed to the OWNER certifying that the equipment has been properly installed, adjusted, lubricated, is in accurate alignment, is free from any undue stress imposed by connecting piping or anchor bolts, has been operated satisfactorily under full-load conditions and is ready for full-time operation.
 - 2) For pumps, compressors, blowers, engines, motors, and other rotating or reciprocating equipment, the report shall certify that the equipment operates within the manufacturer's allowable limits for vibration.
 - 3) The report shall also certify that all controls, protective devices, instrumentation, and control panels furnished as part of the manufacturer's equipment package are properly installed and calibrated; and that the control logic for equipment startup, shutdown, sequencing, interlocks, and emergency shutdown has been tested and is properly operating.
 - 4) The CONTRACTOR shall also sign said certification.
 - 5) The CONTRACTOR shall submit "Manufacturer's Certification of Proper Installation" on the OWNER form.
 - b. Electrical and Instrumentation Subcontractor:
 - 1) The CONTRACTOR shall require that the electrical and/or instrumentation Subcontractor shall furnish a written and signed report to the ENGINEER certifying that the motor control logic for the equipment item that resides in motor control centers, control panels, control boards, microprocessors, distributed processing units, computers, and the like furnished by the electrical and/or instrumentation Subcontractor has been properly tested and calibrated.
 - 2) The report shall certify that the control logic for equipment startup, shutdown, sequencing, interlocks, and emergency shutdown has been tested and is properly operating.
 - 3) The CONTRACTOR shall also sign said certification.

1.3 STARTUP AND TESTING

- A. General:
1. The CONTRACTOR shall provide the effective coordination of all parties necessary for the successful project startup.

2. The ENGINEER shall not be responsible to instruct the CONTRACTOR in the startup of the project, however, the ENGINEER will be available prior to and during startup to provide operational and technical support to the CONTRACTOR.
 3. The CONTRACTOR shall furnish all labor, consumables (power, water, chemicals, air, etc.) tools, equipment, instruments, and services required and incidental to completing all functional, performance and operational testing of installed equipment.
 4. The CONTRACTOR shall submit the proposed test procedures to the ENGINEER for review at least 30 days prior to testing.
 5. The CONTRACTOR shall give the ENGINEER written notice confirming the date of testing at least five working days before the time the equipment is scheduled to be tested.
 6. All testing shall be witnessed by the ENGINEER to be considered valid.
 7. Test Reports:
 - a. CONTRACTOR shall submit written detailed results of all functional, performance and operational testing.
 - b. Upon successful completion of Operational testing all equipment installation, testing and maintenance records shall be submitted to the ENGINEER.
 - c. Said records shall be bound separately for each piece of equipment or system and shall be collected by type of record.
 8. For factory tests, written test results shall be submitted to the ENGINEER at least 10 days prior to shipment.
- B. Functional testing:
1. All items of mechanical and electrical equipment shall be functionally tested by the CONTRACTOR after installation for proper operation.
 2. A minimum of ten (10) days prior to the start of functional testing, the CONTRACTOR shall submit interconnection diagrams for the equipment and for the alarms, controls and instruments associated with the equipment. This requirement shall not relieve the CONTRACTOR of meeting any requirements in the technical specifications for earlier submittal of the interconnection diagrams.
 3. Minimum Test Requirements
 - a. The functional test of each piece of mechanical equipment shall continue for not less than eight (8) continuous hours without interruption.
 - b. The functional test shall include checking for proper rotation, alignment, speed, flows, pressure, vibration, sound level, etc. Initial equipment and system adjustment and calibrations shall be performed in the presence of and with the assistance of the manufacturer's representative.
 - c. The functional test shall include a demonstration of the proper performance of all alarms, local and remote controls, instrumentation, equipment functions, and all other electrical, mechanical and piping systems.
 - d. All parts shall operate satisfactorily in all respects, under continuous full load, and in accordance with the specified requirements, for the full duration of the eight-hour test period.
 - e. If any part of a unit shows evidence of unsatisfactory or improper operation during the eight-hour test period, correction or repairs shall be made and the full eight-hour test operation, as specified herein, shall be repeated after all parts operate satisfactorily.
- C. Performance testing:
1. Where performance testing is required by the Technical Specifications, the testing shall be supervised by the manufacturer's representative. These services shall continue until such times as the applicable equipment or system has been

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successfully tested for performance and has been accepted by the ENGINEER for operational testing.

2. Performance testing shall take place after functional testing is successfully completed in accordance with Article 1.3 B.
3. Performance testing shall demonstrate that the equipment meets all performance requirements specified.

D. Startup/operational testing:

1. Upon successful completion of operator training and the functional, performance and leakage testing, the CONTRACTOR shall startup the plant facilities and test the equipment operation and performance by conducting a seven (7) day, continuous operational test of the completed facilities as an operational process unit to demonstrate to the ENGINEER's satisfaction that all equipment and systems required by these specifications will operate in the manner in which they are intended to perform.
2. The OWNER will provide CONTRACTOR-trained operating personnel for the duration of the operational test. Said operation shall be conducted and under the supervision and direction of the CONTRACTOR and/or manufacturer's representative.
3. Operational Defects:
 - a. All defects in materials or workmanship which appear during the operational test shall be immediately corrected by the CONTRACTOR.
 - b. In the event of a malfunction or deficiency that results in shutdown or partial operation of a system or process unit or results in performance that is less than that specified, the startup duration shall be repeated for that corresponding system or process unit and any other affected equipment so its proper operation and performance as required by the Contract Documents is demonstrated for a minimum of seven (7) continuous and trouble free days.
4. If the operational test is interrupted through no fault of the CONTRACTOR the test may resume at the earliest mutually agreeable time.
5. No unit process or part thereof shall be placed in service until it has successfully completed operational testing.
6. During plant startup, the CONTRACTOR shall provide the appropriate construction trades and the services of authorized Manufacturer's representatives for operational testing and as necessary, to correct faulty equipment operation.
7. After completion of all startup/operational testing, the CONTRACTOR shall repaint, hose, scrub, clean up and otherwise return the work to a "like new" condition, prior to OWNER acceptance.

1.4 TRAINING OF OWNER PERSONNEL

A. General:

1. Operation and maintenance training of OWNER's personnel shall be provided for mechanical, electrical, instrumentation and control equipment as listed in this Section or elsewhere in the Specifications.
2. For the purposes of this requirement, operations training is considered to be separate from maintenance training. Instructions are to be tailored to the needs of each group.
3. These training services shall be conducted by the manufacturer's representative and shall ensure measurable and observable means that OWNER personnel are qualified to perform equipment task requirements, including essential knowledge, skills and abilities.

4. Training shall be conducted by competent representatives who are certified by the manufacturer to be thoroughly familiar with the subject matter as well as instructional methods.
 5. Training materials shall be submitted to the OWNER (see Paragraph 1.4 C below) for review. Acceptance of training materials is required prior to start of training.
 6. All training shall be completed prior to beginning operational testing.
 7. The OWNER shall have the right to videotape any or all training sessions, or may designate separate sessions or portions thereof for the sole purpose of videotaping.
- B. Training coordinator:
1. The CONTRACTOR shall designate and provide one or more persons to be responsible for coordinating and expediting training duties.
 2. The person or persons so designated shall be present at all training coordination meetings with the OWNER.
- C. Training schedule:
1. The CONTRACTOR's coordinator shall coordinate the training periods with OWNER's personnel and manufacturer's representatives, and shall submit a training schedule and the training materials for each piece of equipment or system for which training is to be provided.
 2. The 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 then current Plan of Operation.
 3. Equipment and/or systems shall be deemed suitable for use in training upon satisfactory completion of functional testing.
 4. All training with regards to a unit process or part thereof shall be completed prior to the start of operational testing.
 5. As a minimum, training shall be provided on the following equipment and systems:
 - a. Zone A Pump Station - Vertical Turbine Pumps
 - b. New Electrical and Controls (SCADA)
 6. The CONTRACTOR shall provide distinct and separate training sessions for both operations and maintenance personnel, meeting the following criteria:
 - a. Maintenance Training:
 - 1) Maintenance training shall be provided for all items in 1.4.C.5 above.
 - 2) The CONTRACTOR shall provide two (2) separate training sessions on a day agreed to by the ENGINEER.
 - 3) Training shall emphasize theory of operations, troubleshooting, and preventative maintenance and repair procedures.
 - 4) The discussion shall encompass issues relating to instrumentation, electrical, and mechanical systems.
 - b. Operations training:
 - 1) Operations training shall be provided for each piece of equipment listed in Paragraph 1.4.C.5 above.
 - 2) The CONTRACTOR shall provide two (2) separate training sessions for each three (3) operating shifts.
 - 3) Sessions are to be provided for each shift within the following time periods.
 - a) Day Shift 8:00 a.m. - 2:00 p.m.
 - b) Swing Shift 4:00 p.m. - 10:00 p.m.
 - c) Grave Shift 12:00 a.m. - 6:00 a.m.
 - c. Training session schedules shall be approved by the ENGINEER.

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- d. Training shall emphasize theory of operations, startup instructions, emergency and normal shutdown instructions, lockout procedures, troubleshooting, preventative maintenance, and alarm and control logic.
7. The CONTRACTOR shall confirm each training period a minimum of three working days prior to the schedule time.
8. If a manufacturer's representative fails to conduct a scheduled training class, the CONTRACTOR hereby agrees to compensate the OWNER for labor costs, including overhead, for all OWNER personnel in attendance for the entire scheduled training period.
9. If the CONTRACTOR or the manufacturer's representative fails to provide training that qualifies the OWNER personnel to perform equipment task requirements, the CONTRACTOR hereby agrees to provide remedial training to ensure OWNER personnel proficiency at no additional cost to the OWNER.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 RECORD KEEPING

- A. The CONTRACTOR shall maintain as a minimum, the following records:
 1. Equipment manufacturer's shop drawings.
 2. Daily logs indicating all equipment testing and startup activities.
 3. Log and time sheets of all manufacturer's representatives performing services on the jobsite.
 4. Updated equipment testing and startup schedules.
 5. Records of system cleaning.
 6. Hydrostatic and pressure test records.
 7. Equipment alignment and vibration measurements and corrective actions.
 8. Equipment lubrication records.
 9. Insulation resistance measurements.
 10. Electrical phase, voltage and amperage measurements.
 11. Electrical breaker inspection, test, and adjustment records.
 12. Logs of abnormal circuits and lifted wires.
 13. Testing and validation of all central and alarm functions.
 14. Data sheets of all testing and calibration of instrumentation devices and control loops including documentation of set points.
 15. Equipment and system release logs (from construction to startup).
 16. Daily work reports.

3.2 GENERAL PROCEDURES

- A. The general work procedures listed below outline the work to be performed by the CONTRACTOR. Additional procedures applicable to specific equipment items are specified elsewhere.
- B. Technical assistance and support:
 1. Obtain the assistance of the appropriate construction trades and the manufacturer or vendor, as required for technical assistance during equipment installation, testing,

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- and startup by the CONTRACTOR and for training of the OWNER's Operation and Maintenance personnel.
2. Furnish names and telephone numbers of manufacturer's and vendor's current technical service representatives for use by the ENGINEER.
- C. Instructions:
1. Maintain an adequate manufacturer's instruction file so that the information will be readily available during equipment testing and startup.
 2. Prior to equipment testing, finalize, and transmit to the ENGINEER the applicable technical manuals as required under Section 01330, Submittal Procedures of the Contract Specifications.
- D. Removal of rust preventives:
1. Prior to equipment testing, remove all rust preventives and oils used to protect the equipment during the construction period whenever these protective materials will be detrimental to operation or equipment maintenance.
- E. Lubricants:
1. At least 60 days prior to startup, provide a list of the manufacturer's recommended lubricants for use in the plant. All equipment lubrication shall be listed with the lubricant types and quantities recommended and approved by the equipment manufacturers.
 2. Provide the necessary lubricants for startup and the initial 60 days of operation.
 3. Flush systems and install the initial charge of all lubricants. Dispose of flushing oil in accordance with applicable regulations.
 4. The CONTRACTOR shall lubricate the equipment in accordance with the manufacturer's recommendations until the equipment is accepted by the OWNER.
 5. Maintain a lubrication record for each item of equipment. The CONTRACTOR shall submit the lubrication records to the ENGINEER prior to equipment testing.
- F. Packing and seals:
1. Install, adjust, and replace packing, mechanical seals, and accessories, as necessary, during the equipment testing and startup period.
 2. Adjust seal water and flushing water flow rates in accordance with the equipment manufacturer's recommendations.
- G. Removal of temporary bracing:
1. Prior to equipment testing, remove all temporary supports, bracing, or other foreign objects that were installed in vessels, transformers, rotating machinery, or other equipment to prevent damage during shipping, storage, and erection, and repair any damage sustained.
- H. Rotation, alignment, and vibration:
1. Prior to equipment testing, check rotating machinery for correct direction of rotation and for freedom of moving parts before connecting the driver.
 2. Prior to equipment testing, perform the cold alignment and hot alignment to the manufacturer's tolerances.
 3. Prior to equipment testing, test equipment vibration and correct any vibration in excess of the manufacturer's recommendation.
- I. Tie-ins at the contract limits:

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1. Provide proper notification, preparation, and coordination for safe tie-ins and minimal interference with the plant operation.
 2. Obtain approval and make the necessary tie-ins at the unit limits as required by the Contract Documents and as approved by the ENGINEER.
 3. Prior to startup, remove the temporary blind flanges, plugs, bulkheads, seals, etc.
- J. Leak and pressure tests:
1. Provide the ENGINEER with 3-day advance notification in writing of the schedule for non-operating field leak tests or field pressure tests on piping and field fabricated equipment, unless otherwise directed by the ENGINEER.
 2. Provide the water, air and any special media required for the test purposes.
 3. Prior to startup, conduct all leak and pressure tests in accordance with applicable codes, regulations, and the Contract Documents, and as approved by the ENGINEER. The CONTRACTOR is advised that the tests shall be witnessed by the ENGINEER, to be considered valid.
 4. Maintain a record of the leak and pressure test data and work completed.
 5. Dispose of the test media in a manner that is acceptable to and approved by the OWNER and applicable regulatory agencies.
 6. Isolate in-line equipment as necessary for protection against test pressure.
- K. Pressure/vacuum safety relief devices:
1. Prior to equipment testing, test and adjust all safety devices as recommended by the equipment manufacturer.
 2. Prior to plant startup, provide the ENGINEER with a list of all field or factory equipment settings.
- L. Flushing and chemical/mechanical cleaning:
1. Prior to equipment operation, conduct all flushing, blowing, and chemical/mechanical cleaning operations without using the permanently installed equipment.
 2. Provide any special media needed for flushing and/or cleaning purposes.
 3. Dispose of all media in a manner that is acceptable to and approved by the OWNER and the applicable regulatory agencies.
 4. All systems shall be free of trash and construction debris before initiating startup.
 5. Maintain a record of the work completed.
- M. Screens, strainers, and blind flanges:
1. Provide and install temporary strainers, screens, and blind flanges as necessary to protect the equipment and to test the equipment and pipelines.
 2. Prior to startup, remove all of the temporary blinds and temporary appurtenances.
 3. Clean the screens and strainers as required during startup.
 4. At the end of startup, clean all of the permanently installed screens and strainers.
- N. Purging/inerting:
1. Prior to startup, purge and/or passivate the facilities as specified.
 2. Install purge/inerting connections in accordance with the manufacturer's recommendations.
 3. Provide purge or inerting materials and conduct the necessary operations as recommended by the equipment manufacturer.
- O. Drying out:

1. Prior to startup, dry out the facilities as specified or recommended by the equipment manufacturer to prevent contamination of catalysts, operating materials, and/or product.
2. Dry out systems, protective coatings, refractories, and linings as specified or recommended by the equipment manufacturers.

3.3 SPECIFIC PROCEDURES

- A. In addition to the work responsibilities described in Subsection 3.2, the procedures outlined below further define the work responsibilities of the CONTRACTOR for specific systems and items of equipment.
- B. Mechanical equipment:
 1. Level baseplates and soleplates and grout under all load bearing surfaces.
 2. Install suitable supports and flexible connections to alleviate any piping stresses that may be imposed on pumps, compressors, and drivers.
 3. In accordance with the manufacturer's recommendations, chemically clean lube oil, seal oil, and cooling systems. Dispose of waste and cleaning media in a manner that is acceptable to and approved by the OWNER and applicable regulatory agencies.
 4. In accordance with the manufacturer's recommendations, charge the lube oil, seal oil, and cooling systems with flushing media and circulate for cleaning purposes. Dispose of any flushing media in a manner that is acceptable to and approved by the OWNER and applicable regulatory agencies.
 5. Charge the lube oil systems, seal oil systems, and cooling systems with the amount and type of operating oil or coolant recommended by the manufacturer.
 6. Operate the equipment and check for excessive vibration, abnormal operating noises, overheating and lubricant leakage, etc., and test any safety shutdown/alarm devices for proper operation, and make any operating tests required by the ENGINEER. The adjustments required for proper operation shall be made prior to operational testing.
 7. Utilize manufacturer's representative for technical assistance during installation and startup.
 8. Prior to startup, all sidewalks, gratings, handrails, safety chains, safety shields, etc., shall be installed.
 9. Prior to startup, demonstrate to the ENGINEER's satisfaction that all chemical solution pipelines are connected to the intended tank(s), feeder(s), pump(s), and application points, and that the pipes, appurtenances contained therein and diffusers will operate at the intended flow rates.
 10. Prior to startup, the applicable safety equipment, emergency shower and eyewash units, fire extinguishers, fire suppression equipment, self-contained breathing apparatus, toxic and/or combustible gas detectors (including the respective personnel warning system), protective clothing, emergency repair kits, etc., shall be installed in an acceptable manner-subject to the ENGINEER's approval, and be fully ready for operation.
 11. All safety hazards, e.g., exposed drive shafts or rotating equipment members, exposed electrical circuitry, open electrical junction boxes and panels, improperly supported piping and conduits, missing safety devices, etc., shall be corrected prior to supplier training of the OWNER's personnel.
 12. The CONTRACTOR shall perform a comprehensive safety inspection and correct any safety deficiencies found before implementing plant startup.
 13. Roadways that are required for ambulance service, fire fighting access, delivery of treatment chemicals and supplies, and disposal of the treatment byproducts shall be completed prior to startup.

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14. Prior to startup, install all warning and safety signs, labels, and devices.

C. Tanks:

1. Test all tanks and internals, as required to demonstrate conformance to the Contract Documents. Dispose of test media in a manner that is acceptable to and approved by the OWNER and the applicable regulatory agencies.
2. Prior to startup, conduct chemical cleaning or flushing operations as specified. Dispose of wastes and cleaning media in a manner that is acceptable to and approved by the OWNER and the applicable regulatory agencies.
3. Prior to startup, install all chemical identification, warning, and safety signs and labels.

D. Electrical power and lighting systems:

1. Provide the ENGINEER with 3-day advance notification in writing of the test schedule. The CONTRACTOR is advised that the tests shall be witnessed by the ENGINEER.
2. Perform insulation resistance tests on all wiring 120 volt and larger. Do not meggar instruments or solid-state devices.
3. Perform insulation resistance tests on all motor and transformer windings from phase to phase and phase to ground.
4. Perform grounding system tests to determine the continuity of connections and the value of resistance to ground.
5. Fill electrical gear with oil and/or other media as recommended by the equipment manufacturer.
6. Prior to substantial completion and startup, test and set switchgear and circuit breaker relays for proper coordination and operation.
7. The CONTRACTOR shall obtain the services of a qualified "independent testing service", member of the National Electric Testing Association, to perform a thermographic survey on all switchgear buses, insulators and power connections when energized and under at least 20 percent load. Significant hot spots shall be further checked by infrared pyrometer for exact temperature rise. The CONTRACTOR shall troubleshoot and correct the thermographic hot spots. Correction shall be verified by repeating the thermographic survey at no additional cost to the OWNER.
8. The CONTRACTOR shall obtain the services of a qualified "independent testing service", member of the National Electric Testing Association, to inspect and test the protective relays and the 800-ampere and larger drawout breakers for proper installation, adjustment, and operation in accordance with the manufacturer recommendations.
9. The CONTRACTOR shall obtain the services of a qualified "independent testing service", member of the National Electrical Testing Association, to perform DC high potential tests on all cables that will operate at more than 2,000 volts to ground.
10. Obtain local electrical inspector's approval where required.
11. Energize all substations, with approval of the Utility Company and the ENGINEER after completion of all electrical testing.
12. Prior to startup, perform tests and adjustments on all switchgear and motor control equipment to demonstrate proper operation and conformance to the Contract Documents and manufacturer's recommended settings.
13. Prior to startup, test installation of emergency power and lighting systems for proper operation, including light intensity.
14. Prior to startup, provide the ENGINEER with a record of all test data and the work completed.
15. Vacuum clean all electrical equipment prior to startup and acceptance.

E. Piping systems:

1. Provide the ENGINEER with 3-day advance notification in writing of test schedule.
2. Hydrostatically or pneumatically test all piping as required by the codes and contract documents.
3. After successful testing of the piping, slowly drain the system and then flush the system. Orifice plates shall be installed after testing. If installed with the piping, they will be removed and replaced with spacers or pipe spools of equal length prior to the pressure test.
4. Dewater the system, remove blind flanges, and perform tightness tests, as required by the ENGINEER.
5. Insulate or paint piping, flanges, threaded joints, or field welds after the specified testing of each item has been completed unless instructed otherwise by the ENGINEER.
6. Leave exposed all welded joints (longitudinal, girth, and nozzle) in underground piping that have not been shop tested until the specified testing has been completed. After final testing of these joints, cover the system.
7. Prior to substantial completion and startup, check pipe hangers, supports, guides, and pipe specialties for the removal of all shipping and erection stops and for the correctness of the cold and hot settings for the design service, make adjustments as necessary to obtain proper installation. Provide the ENGINEER with instructions for the hot settings.
8. As necessary during equipment testing and at the end of substantial completion and startup, clean or replace the screens and filter elements as appropriate for the filter type and service.
9. Prior to startup, verify, to the extent required by the ENGINEER, that specified valve packing has been provided on valves installed in the plant.
10. Prior to startup, install all of the valve and piping system identification labels.
11. Prior to startup, check and record the position of all process system valves.
12. Prior to startup, correct support, vibration, and thermal expansion problems detected during the preliminary equipment testing.
13. Prior to the startup, retorque all hot and cold service bolting as required to ensure a permanent and proper installation.
14. Prior to startup, demonstrate to the ENGINEER's satisfaction that each piping system (e.g., chemical, sample, utility, irrigation process, etc.) functions as designed and required by the Contract Documents.

+ + END OF SECTION + +

SECTION 01800

OPERATIONAL COMPLETION AND PROJECT CLOSEOUT

PART 1 - GENERAL

1.1 GENERAL

- A. The Work will be considered operationally complete when all technical and administrative submittals, testing, training and startup are completed satisfactorily in accordance with the Contract Documents.
- B. Operational completion shall apply to the project in its entirety.

1.2 CERTIFICATION OF OPERATIONAL COMPLETION

- A. Prior to requesting the ENGINEER's inspection for certification of each phase as operationally complete, the CONTRACTOR shall certify in writing that each phase of the Work is operationally complete and shall submit a list of known items still to be completed or corrected (punchlist) prior to Contract Completion.
- B. The following items shall be completed:
 - 1. OWNER has been advised of any pending insurance changeover requirements.
 - 2. Specific warranties, maintenance agreements, final certifications and similar documents have been submitted.
 - 3. All tools, spare parts, extra stocks of materials, and similar physical items have been delivered to OWNER.
 - 4. Instruction of OWNER's operation/maintenance personnel, and start up testing has been completed.
 - 5. Submittal and acceptance of all O&M manuals.
 - 6. Changeover of locks to OWNER's cores/keys.
- C. Punchlist:
 - 1. When the CONTRACTOR considers that the Work, or a portion or phase thereof which the OWNER agrees to accept separately, is operationally complete, the CONTRACTOR shall certify in writing that the work is operationally complete and shall prepare and submit to the ENGINEER a comprehensive list of items to be completed or corrected prior to Contract Completion (punchlist).
 - 2. The ENGINEER may add additional work items to the punchlist.
 - 3. Failure to include an item on the punchlist does not alter the responsibility of the CONTRACTOR to complete all Work in accordance with the Contract Documents.
 - 4. Upon receipt of the CONTRACTOR's punchlist, the ENGINEER will make an inspection to determine whether the Work or designated portion thereof is operationally complete.
 - 5. If the ENGINEER's inspection discloses any item, whether or not included on the CONTRACTOR's list, that is not in accordance with the requirements of the Contract Documents, the CONTRACTOR shall, upon notification by the ENGINEER and before an issuance of the Certificate of Operational Completion is provided, complete or correct such item.
 - 6. The CONTRACTOR shall then submit a request for another inspection by the ENGINEER.

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7. When the Work or designated portion thereof is accepted by the ENGINEER to be operationally complete, the ENGINEER will prepare a Certificate of Operational Completion.
8. The date of Operational Completion shall be the date of the ENGINEER's inspection and acceptance.

1.3 DESCRIPTION OF PROJECT CLOSEOUT

- A. Closeout is hereby defined to include general requirements near the end of the Contract Time, in preparation for Final Acceptance, Final Payment, normal termination of Contract, occupancy by OWNER and similar actions evidencing completion of the Work.
- B. Specific requirements for individual units of Work are specified in Sections of Divisions 2 through 16.

1.4 FINAL CLEANUP

- A. At completion, leave project clean and ready for use.
 1. Legally dispose of waste materials, debris and rubbish off the site.
 2. Remove grease, dust, dirt, stains, labels, fingerprints and other foreign materials from exposed and enclosed surfaces.
 3. Repair, patch and touch up all affected curbs, gutters, and sidewalks to match adjacent surfaces.
 4. Broom clean paved surfaces, rake clean other surfaces of grounds. Vacuum clean all interior surfaces, rake clean other surfaces of grounds.

1.5 RECORD DRAWINGS

- A. The CONTRACTOR shall prepare and submit Contract Record Drawings for the OWNER.
 1. The CONTRACTOR shall make a record of changes during construction on prints of the Drawings provided by the OWNER for this purpose (Contract Record Drawings) as described in Section 01330, Submittal Procedures.
 2. The reproducible drawings on which changed conditions are recorded shall be returned to the ENGINEER prior to project completion.

1.6 GUARANTEES

- A. The General Conditions cover the CONTRACTOR's responsibility to remedy defects due to faulty workmanship and materials which appear within one year from the date of Final Acceptance.
- B. Special guarantees are required by various Sections of the Specifications. Assemble written guarantees, label and submit to the ENGINEER.
 1. Equipment guarantees shall be written in the manufacturer's standard form and shall be countersigned by the Subcontractor or supplier and the CONTRACTOR.
 2. All other guarantees shall be written on the Subcontractor's or supplier's letterhead and shall be countersigned by the CONTRACTOR.

1.7 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Spare parts and maintenance materials are required by various Sections of the Specifications.

1. Parts and materials shall be packaged so as to preclude damage in normal handling and storage.
2. Packages shall be labeled with full description of contents and project name and clearly identified as to which item of equipment they belong to. CONTRACTOR shall maintain a spare parts inventory list which shall be provided to the OWNER prior to Final Acceptance.
3. Submit packaged parts and materials to ENGINEER.
4. Submit the value of all spare parts.

1.8 FINAL INSPECTION

- A. Prior to requesting ENGINEER's final inspection for certification of Final Acceptance and Final Payment, complete the following and list known exceptions (if any):
 1. Submit Final Payment request with final releases and supporting documentation not previously submitted and accepted.
 2. Submit copy of final punchlist of itemized work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, endorsed and dated by ENGINEER.
 3. Submit Consent of Surety.
 4. Revise and submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Certify in writing that the work has been completed in accordance with the Contract Documents, and request ENGINEER's final inspection.
- C. Reinspection:
 1. Within seven (7) days after receipt of the CONTRACTOR's notice that the work has been completed, including punchlist items resulting from earlier inspections, and excepting incomplete items delayed because of acceptable circumstance, the ENGINEER will reinspect the work.
 2. Upon completion of reinspection, ENGINEER will either prepare a certificate of Final Acceptance or advise the CONTRACTOR of work not complete or obligations not fulfilled as required for Final Acceptance.
 3. If necessary, inspection procedure will be repeated.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

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SECTION 01810

CLEANING

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This Section covers the work necessary for cleaning during construction and final cleaning on completion of the Work.

1.2 GENERAL

- A. At all times maintain areas covered by the Contract and public properties free from accumulations of waste, debris, and rubbish caused by construction operations.
- B. Pollution Control:
 - 1. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
 - 2. Do not burn or bury rubbish and waste materials on project site.
 - 3. Volatile wastes shall be properly stored in covered metal containers and removed daily.
 - 4. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
 - 5. Do not dispose of wastes into streams or waterways.
- C. Construction materials such as concrete forms and scaffolding shall be neatly stacked by the CONTRACTOR when not in use. The CONTRACTOR shall promptly remove splattered concrete, asphalt, oil, paint, corrosive liquids, and cleaning solutions from surfaces to prevent marring or other damage.
- D. Use only cleaning materials recommended by manufacturer of surface to be cleaned.
- E. Use cleaning materials only on surfaces recommended by cleaning material manufacturers.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CLEANING DURING CONSTRUCTION

- A. During execution of Work, clean site and public properties and dispose of waste materials, debris, and rubbish to assure that buildings, grounds, and public properties are maintained free from accumulations of waste materials and rubbish.
- B. Wet down dry materials and rubbish to lay dust and prevent blowing dust.

- C. Provide approved containers for collection and disposal of waste materials, debris, and rubbish. Empty containers within one day after they are full.
- D. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from exposed and semi-exposed surfaces.
- E. Repair, patch, and touch up marred surfaces to specified finish to match adjacent surfaces.
- F. Vacuum clean all interior spaces, including inside cabinets. Broom clean paved surfaces, rake clean other surfaces of grounds.
- G. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.
- H. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.
- I. Vacuum clean interior building areas when ready to receive finish painting and continue vacuum cleaning on an as-needed basis until building is ready for substantial completion or occupancy.

3.2 FINAL CLEANING

- A. Refer to the requirements of the General Conditions, Section 6.11 in addition to the requirements of this Section.
- B. See Section 01800, Operational Completion and Project Closeout, for additional requirements.
- C. At the completion of Work on all Contracts and immediately prior to final inspection, cleaning of the entire Project will be accomplished according to the following provisions:
 - 1. The CONTRACTOR shall thoroughly clean, sweep, wash, and polish all work and equipment, including finishes. The cleaning shall leave the structures and site in a complete and finished condition to the satisfaction of the ENGINEER.
 - 2. Should the CONTRACTOR not remove rubbish or debris or not clean the building and site as specified above, the OWNER reserves the right to have the cleaning done at the expense of the CONTRACTOR.
 - 3. Employ professional cleaners for final cleaning.
 - 4. In preparation for substantial completion of occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces.
 - 5. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior finished surfaces; polish surfaces so designated to shine finish.
 - 6. Repair, patch, and touch up marred surfaces to specified finish, to match adjacent surfaces.
 - 7. Broom clean paved surfaces; rake clean other surfaces of grounds.
 - 8. Replace air-handling filters if units were operated during construction.
 - 9. Clean ducts, blowers, and coils, if air-handling units were operated without filters during construction.
 - 10. Clean luminaires in accordance with manufacturer's recommendations. Clean all light fixtures.

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11. Remove from the OWNER's property all temporary structures and all materials, equipment, and appurtenances not required as a part of, or appurtenant to, the completed work. See Section 01500 - Temporary Construction Facilities and Utilities.

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+ + END OF SECTION + +

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SECTION 02200
SITE PREPARATION

PART 1 - GENERAL

1.1 DEFINITIONS

- A. Interfering or Objectionable Material: Trash, rubbish, and junk; vegetation and other organic matter, whether alive, dead, or decaying; topsoil.
- B. Clearing: Removal of interfering or objectionable material lying on or protruding above ground surface.
- C. Grubbing: Removal of vegetation and other organic matter including stumps, buried logs, and roots greater than 0.5 inch caliper to a depth of 6 inches below subgrade.
- D. Stripping: Removal of topsoil remaining after applicable scalping is completed.
- E. Project Limits: Areas, as shown or specified, within which Work is to be performed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

- A. Clear, grub, and strip areas actually needed for waste disposal, borrow, or site improvements within limits shown or specified.
- B. Do not injure or deface vegetation that is not designated for removal.

3.2 LIMITS

- A. As follows, but not to extend beyond Project limits.
 - 1. Excavation 5 feet beyond top of cut slopes.
 - 2. Trench Excavation: 4 feet from trench centerline, regardless of actual trench width.
 - 3. Waste Disposal:
 - a. Clearing: 5 feet beyond perimeter.
 - b. Scalping and Stripping: Not required.
 - c. Grubbing: Around perimeter as necessary for neat finished appearance.
 - 4. Structures: 5 feet outside of new structures.
 - 5. Roadways: Clearing, grubbing and stripping 50 feet from centerline.
 - 6. Overhead Utilities:
 - a. Clearing and Grubbing: Entire width of easements and rights-of-way.
 - b. Scalping and Stripping: Wherever grading is required.
 - 7. Other Areas: As shown.
- B. Remove rubbish, trash, and junk from entire area within Project limits.

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3.3 CLEARING

- A. Clear areas within limits shown or specified.
- B. Fell trees so that they fall away from facilities and vegetation not designated for removal.
- C. Cut stumps not designated for grubbing flush with ground surface.
- D. Cut off shrubs, brush, weeds, and grasses to within 2 inches of ground surface.

3.4 GRUBBING

- A. Grub areas within limits shown or specified.

3.5 STRIPPING

- A. Do not remove topsoil until after scalping is completed.
- B. Strip areas within limits to minimum depths shown or specified. Do not remove subsoil with topsoil.

3.6 DISPOSAL

- A. Clearing and Grubbing Debris: Dispose of debris offsite.
- B. Strippings:
 - 1. Dispose of strippings that are unsuitable for topsoil or that exceed quantity required for topsoil offsite or approved by ENGINEER.
 - 2. Stockpile topsoil in sufficient quantity to meet Project needs. Dispose of excess strippings as specified for clearing and grubbing.

+ + END OF SECTION + +

SECTION 02220

DEMOLITION

PART 1 - GENERAL

1.1 DEFINITIONS

- A. "Demolish": CONTRACTOR shall remove from the site as property of CONTRACTOR. Demolition includes disconnecting, removal, loading, repairs, cleanup, transportation, unloading, disposal permits and fees, disposal, and all other items required to remove the material from the site.
- B. "Salvage": CONTRACTOR shall remove from area of Work and place in location designated by ENGINEER. Equipment is property of OWNER. Salvage includes disconnecting, removal, repairs, cleanup, loading, transportation, unloading, and all other items required to remove and relocate the material.
- C. "OWNER to Remove": OWNER will remove from area of Work prior to CONTRACTOR commencing demolition Work for this area.
- D. "Relocate": CONTRACTOR shall relocate material shown to new locations shown on Drawings or stated herein. Relocation includes disconnecting, removal, reconnecting, attaching, repairs, and all other items required to relocate material to new location.
- E. "Abandon": CONTRACTOR shall disconnect and leave in place as specified.
- F. "Materials": Any and all items and objects that are scheduled, specified, or shown to be demolished, salvaged, removed, relocated, or abandoned.

1.2 SUBMITTALS

- A. Action Submittals:
 - 1. Product Information: Grout, sealants, and bonding agents to be used for patching.
- B. Informational Submittals:
 - 1. Plan and schedule phased demolition, including limits of demolition, as part of and consistent with the progress schedule specified in Section 01320, PROGRESS SCHEDULE.
 - 2. Methods of demolition and equipment proposed to demolish materials.
 - 3. Copies of any authorizations and permits required to perform Work.
 - 4. Copies of Hazardous Materials Inspection Reports.
 - 5. Repair procedures for demolition of materials beyond limits shown on Drawings.

PART 2 - PRODUCTS

2.1 GENERAL

- A. CONTRACTOR shall provide all materials and equipment in suitable and adequate quantity as required to accomplish the Work shown, specified herein, and as required to complete the Project.

PART 3 - EXECUTION

3.1 GENERAL

- A. Drawings are based on available information. The Work may differ slightly from what is shown. CONTRACTOR shall be responsible for determining the work required by inspecting the site.

3.2 SAFETY REQUIREMENTS

- A. All Work shall be done in conformance with all applicable rules and regulations pertaining to safety.
- B. Hazardous Materials:
 - 1. See General Conditions.
 - 2. Existing facilities, or portions thereof, to be demolished may contain hazardous materials such as asbestos cement piping, residual chemicals in existing or abandoned piping, lead-based paint, mercury seals, or other unknown hazardous materials.

3.3 SEQUENCE

- A. Be responsible for the sequence of Work.
- B. Conform to constraints as specified in Section 01130, SPECIAL PROJECT CONSTRAINTS.

3.4 COORDINATION

- A. Coordination with ENGINEER:
 - 1. Only materials specified herein, shown on the Demolition Photographs or the Drawings, or approved by ENGINEER in the field shall be demolished, salvaged, removed, relocated, or abandoned.
 - 2. Verify materials scheduled to be demolished, salvaged, removed, relocated, or abandoned with ENGINEER prior to performing Work.
 - 3. Do not remove materials without prior approval of ENGINEER.
 - 4. Provide at least 3 working days' notice to ENGINEER prior to start of Work.
 - 5. Notify ENGINEER to turn off affected services or facilities before starting Work.
 - 6. Provide temporary services during interruptions to affected services or facilities as acceptable to ENGINEER.
 - 7. ENGINEER will indicate limits of Work if not clearly shown.
- B. Coordination with Utility Owners:
 - 1. Notify utility owners to turn off affected services or facilities before starting Work.

2. Provide not less than 72 hours notice to utility owners prior to shutdown, unless otherwise directed by utility owners.
3. Provide temporary services during interruptions to affected services or facilities as acceptable to utility owners.

3.5 LIMITS

- A. Drawings define minimum portions of materials to be demolished. Unless otherwise shown, rough cuts or breaks may be made to limits of demolition shown. If rough cuts or breaks are made exceeding limits shown, CONTRACTOR shall repair the cuts or breaks back to the dimensions shown on Drawings at CONTRACTOR's expense.
- B. If limits are not clear on the Drawings or Demolition Photographs, limits shall be as directed by ENGINEER.
- C. All areas not within the limits of demolition Work shown on the Drawings, or as specified herein, shall be left undisturbed, unless necessary for demolition of materials.

3.6 DEMOLITION

- A. General:
 1. Inspect condition of materials to be demolished prior to bidding to assess potential for salvage value.
 2. Remove all materials associated with existing equipment that is to be demolished.
 3. Materials within limits of demolition will become the property of CONTRACTOR.
 4. All materials from the demolition process shall be removed safely from the project site as soon as possible. They shall be disposed of in accordance with applicable federal, state, and city regulations. CONTRACTOR is responsible for determining these regulations and shall bear all costs associated with disposal of the materials.
- B. Pavement and Curbs:
 1. Provide saw cut at all concrete and pavement surfaces and curb removal limits and where neat connection lines are required.
 2. Surfaces exposed by demolition activities shall be repaired and finished to provide a uniform, smooth, level transition between adjacent surfaces.
- C. Concrete, CMU, and Reinforcing:
 1. In areas where concrete or CMU portions are to be removed from a structure, the edge of removal shall be cut with a concrete saw to leave a perpendicular edge or by core-drilling where a circular hole is required.
 2. Damaged concrete shall be removed to solid concrete. Damaged concrete shall include concrete that is soft, spalled, cracked, or otherwise damaged as determined by ENGINEER.
 3. Depth of removal shall be as determined by ENGINEER unless otherwise shown or specified.
 4. Reinforcing shall be cut and removed unless otherwise shown or instructed by ENGINEER.
 5. Spalled edges may be required to be resawn at the discretion of the ENGINEER.
 6. Protect adjacent structures and equipment from damage during Work.
 7. Exposed surfaces following demolition activities shall be repaired and finished to provide a uniform, smooth, and level transition between adjacent surfaces.

8. Remove and repair designated cracked and damaged concrete areas shown in accordance with this section and Section 03300, CAST-IN-PLACE CONCRETE.
- D. Concrete Embedded Items:
1. Except for core drills, demolish anchor bolts, reinforcing steel, conduit, and other materials that are concrete embedded to a minimum of 1 inch below final finished surface. For core drills, coat rebar exposed by core drilling with System No. 304 in accordance with Section 09900, PAINTING.
 2. Plug empty pipes and conduits with fireproof sealant to maintain fire ratings for floors or walls.
 3. Patching:
 - a. Demolish damaged concrete. Damaged concrete shall be removed to solid concrete. Damaged concrete shall include concrete that is soft, spalled, cracked, or otherwise damaged as determined by ENGINEER.
 - b. Coat with approved bonding agent.
 - c. Patch with nonshrink, nonmetallic grout.
- E. Piping:
1. Pressurized Services: Install restrained caps or plugs at the demolished ends, unless otherwise shown.
 2. Gravity Services: Install concrete plugs, 5-foot minimum length.
- F. Utilities:
1. Excavate utility lines serving structures to be demolished.
 2. Demolish electrical, sanitary, and storm drainage lines serving structures to be demolished.
 3. Support or relocate utility lines exposed by Work.
 4. For water and gas lines to be demolished or capped and terminated, provide a permanent leakproof closure. Closure type shall be as recommended by utility owner.
- G. Electrical:
1. Remove conduits and wiring from materials to be demolished back to nearest junction box.
 2. For existing circuits to remain operational, intercept existing conduit at the most convenient location, or as shown, and splice and extend conduit to new location. Install new conductors as required to accomplish intended results. New conductors shall be continuous without splices between junction boxes.
 3. For existing circuits no longer needed, demolish conductors from conduits.
 4. Demolish all surface-mounted conduit which is no longer needed.
 5. For conduit below grade or concealed within walls, cap and abandon in place.

3.7 SALVAGE

- A. Salvage materials for OWNER's own use where shown.
- B. Remove materials with extreme care so as not to damage.
- C. Promptly remove materials from Work area.
- D. Store materials in location designated by ENGINEER.
- E. Clean and protect materials from dust, dirt, natural elements, and store as directed.

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3.8 RELOCATION

- A. ENGINEER will determine condition of materials prior to removal.
- B. Remove all materials associated with items to be relocated.
- C. Existing materials shall not be damaged during removal.
- D. Properly store and maintain materials in same condition as when removed.
- E. Clean and protect materials from dust, dirt, natural elements, and store as directed.

3.9 ABANDONMENT

- A. Structures: Break holes into or core drill floor slabs, catch basins, and other below-grade concrete structures to be abandoned in place to allow water to freely migrate through.
- B. Piping and Conduits:
 - 1. General: Piping and conduits to be abandoned shall be capped with a watertight plug at demolished end in a manner that will prevent entrance of soil, groundwater, or moisture.
 - 2. Pressurized Services: Install restrained caps or plugs at the demolished ends, unless otherwise shown.
 - 3. Gravity Services: Install concrete plugs, 5-foot minimum length.

3.10 REPAIR AND REPLACEMENT

- A. Any damaged materials scheduled to be salvaged or relocated shall be repaired by the CONTRACTOR to the satisfaction of ENGINEER or replaced at the CONTRACTOR's expense.
- B. Any damage to areas not within the limits of demolition Work shown on the Demolition Photographs, Drawings, or as specified herein shall be repaired or replaced to original precontract conditions at the CONTRACTOR's sole expense.

3.11 DISPOSAL

- A. Dispose of materials offsite in licensed landfills and in accordance with all local, state, and federal regulations. CONTRACTOR is responsible for obtaining any and all necessary permits for disposal.

+ + END OF SECTION + +

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SECTION 02300

EARTHWORK

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section includes: All excavating, backfilling, filling, grading, subgrade preparation and disposing of earth materials as required. It also includes all temporary means needed to prevent discharge of sediment to watercourses from dewatering systems or erosion.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM C33, Standard Specification for Aggregate Material.
 - 2. ASTM D422, Method for Particle-Size Analysis of Soils.
 - 3. ASTM D423, Liquid Limit of Soils.
 - 4. ASTM D427, Shrinkage Factors of Soils.
 - 5. ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil.
 - 6. ASTM D1556, Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 - 7. ASTM D2922, Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 8. ASTM D2166, unconfined compressive strength of soils.
- B. Occupational Safety and Health Administration (OSHA)
 - 1. Title 29, Code of Federal Regulations, Part 1926

1.3 SYSTEM DESCRIPTION

- A. Permits and Regulations:
 - 1. Perform excavation Work in compliance with applicable requirements of governing authorities having jurisdiction.
 - 2. Obtain all necessary permits for Work in roads, rights-of-way, railroads, etc. Also, obtain permits as required by local, state and federal agencies for discharging water from excavations, for erosion control, and for prevention of air and water pollution.

1.4 SUBMITTALS

- A. Test Reports - Borrow, Backfill, and Grading: Testing laboratory shall submit copies of the following reports directly to ENGINEER:
 - 1. Tests on borrow material.
 - 2. Tests on footing subgrade.
 - 3. Field density tests.
 - 4. Optimum moisture - maximum density curve for each soil used for backfill.
 - 5. Reports of observations for conformance of borrow material to the Project Geotechnical Report.
 - 6. Quality Control Plan: Names and phone numbers of independent testing companies that will be used to perform soil and asphalt concrete testing, qualifications, and proposed procedures for performing tests and providing test results to ENGINEER.

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- B. Submit to the ENGINEER samples of all materials, including select backfill, general backfill, bedding, crushed stone, sand and topsoil. Submit samples of the proposed material at least seven days in advance of its anticipated use.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General:
 - 1. All material will be tested by the laboratory and approved by the ENGINEER.
 - 2. No material shall be placed without the approval of the ENGINEER.
- B. Marking Tape:
 - 1. Plastic:
 - a. Inert polyethylene, impervious to known alkalis, acids, chemical reagents, and solvents likely to be encountered in soil.
 - b. Thickness: Minimum 4 mils.
 - c. Width: 12 inches.
 - d. Identifying Lettering: Minimum 1-inch high, permanent black lettering imprinted continuously over entire length.
 - e. Manufacturers and Products:
 - 1) Reef Industries; Terra Tape.
 - 2) Allen; Markline.
 - 3) Or equal.
 - 2. Metallic:
 - a. Solid aluminum foil, visible on unprinted side, encased in a protective high visibility, inert polyethylene plastic jacket.
 - b. Foil Thickness: Minimum 5.5 mils.
 - c. Width: 12 inches.
 - d. Identifying Lettering: Minimum 1-inch high, permanent black lettering imprinted continuously over entire length.
 - e. Joining Clips: Tin or nickel-coated, furnished by tape manufacturer.
 - f. Manufacturers and Products:
 - 1) Reef Industries; Terra "D".
 - 2) Allen; Detectatape.
 - 3) Or equal.
 - 3. Marking tape shall be marked with the following statements:
 - a. For Existing Utilities Within Trench Limits: "CAUTION - BURIED PIPELINE/CONDUIT" or as specified by utility owner.
 - 4. Color:
 - a. Effluent Pipeline: Purple, as specified in ANSI Z53.1 Safety Color Code.
 - b. Sanitary Sewer Pipeline: Green, as specified in ANSI Z53.1 Safety Color Code.
 - c. Others Disturbed: Color, as specified for specific utility in ANSI Z53.1 Safety Color Code.
- C. Pipe Locating Wire:
 - 1. Pipe locating wire shall be bare AWG No. 12, soft drawn, single-strand copper wire.
 - 2. Provide at least 6-mil PVC electrical tape insulation around wire where adjacent to metal pipe, valves, and in all valve boxes.
- D. Fill Material:

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1. Classification:
 - a. Fill adjacent to structures to a distance measured horizontally from the structure that is equal to the depth from the finished grade is classified as Select Fill.
 - b. Outside these limits, the fill is classified as Common Fill, unless otherwise specified.
 2. Common Fill:
 - a. Common Fill materials shall consist of soils obtained from on-site excavations or off-site sources that are uniformly mixed, contain no organic material, and have been passed through a 3" screen.
 - b. The maximum expansion of off-site materials shall be 1.5% as performed on a sample remolded to approximately 9% of the maximum dry density as determined in accordance with ASTM D 698 at 2% below optimum moisture content under a 100 psf surcharge pressure.
 - c. If on-site material is unsuitable as determined by the ENGINEER, imported fill shall be used.
 3. Select Fill:
 - a. Select fill or backfill is material selected by the ENGINEER from the excavation.
 - b. Select material shall be free of organic or other unsuitable materials and shall not contain rocks, or unbroken masses of soil larger than 4" in greatest dimension.
- E. Aggregate Base:
1. Class 2, $\frac{3}{4}$ " maximum conforming to Section 26 of the Caltrans Standard Specifications.
- F. Granular Bedding:
1. Well-graded sand and gravel materials.
 2. Unfrozen, friable, and no clay balls, roots, or other organic material.
 3. Clean or gravelly sand with less than 5 percent passing No. 200 sieve, as determined in accordance with ASTM D1140, or gravel or crushed rock within maximum particle size and other requirements as follows unless otherwise specified.
 4. $\frac{3}{4}$ -inch maximum particle size, except $\frac{1}{4}$ inch for stainless steel pipe, copper pipe, tubing, and plastic pipe under 3-inch diameter.
 5. Conduit and Direct-Buried Cable:
 - a. Sand, clean or clean to silty, less than 12 percent passing No. 200 sieve.
 - b. Individual Particles: Free of sharp edges.
 - c. Maximum Size Particle: Pass a No. 4 sieve.
 - d. If more than 5 percent passes No. 200 sieve, the fraction that passes No. 40 sieve shall be non-plastic as determined in accordance with ASTM D4318.
- G. Sand:
1. Natural or manufactured granular material, containing no organic material.
 2. Sand will be non-plastic, when tested in accordance with ASTM D 4318, 100% passing a $\frac{1}{2}$ " screen and no more than 20% passing a No. 200 screen.
- H. Crushed Stone :
1. Crushed stone will be crushed rock or gravel conforming to the requirements of ASTM C33, Size #57.
- I. Gravel Surfacing
1. Gravel Surfacing will be crushed rock, angular, and well-graded.
 2. Maximum size of $\frac{3}{4}$ ", at least 50% passing the No 4. screen, between 10 and 30% passing the No. 10 screen and no more than 15% passing the No. 40 screen.

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3. Color to be selected by OWNER.
- J. Controlled Low Strength Material (CLSM/Slurry):
 1. Select and proportion ingredients to obtain compressive strength between 50 and 150 psi at 7 days in accordance with ASTM D4832. Sufficient cement shall be added to meet the strength and material requirements given below and as required to provide sufficient strength for compacting overlying trench backfill. Provide certified mix design and test results in accordance with submittal requirements.
 2. Materials:
 - a. Cement: ASTM C150, Type I or II, two sacks minimum per cubic yard.
 - b. Aggregate: ASTM C33, maximum Size 7. The amount of material passing a No. 200 sieve shall not exceed 12 percent. The above No. 200 sieve material shall be well graded so as to avoid segregation. The minus #200 sieve fraction shall be nonplastic.
 - c. Fly Ash (if used): ASTM C618, Class C or F.
 - d. Water: Clean, potable, containing less than 500 ppm of chlorides.
 3. Mix Design:
 - a. The CONTRACTOR and its suppliers shall determine the materials and proportions used to meet the requirements of these Specifications. Make daily checks of the aggregate gradation and adjust the mix design as required. Modify the CLSM mix as necessary to meet the flowability, pumpability, and set time requirements for each individual pour.
 - b. At least 30 days before placing CLSM, submit to the ENGINEER a mix design for each CLSM to be used. The mix design shall include trial lab and field data, with pairs of 6-inch by 12-inch cylinder breaks performed at 7, 14, and 28 days. Molds shall be plastic or waxed cardboard. The mix design shall be performed by an independent laboratory under the direction of an engineer licensed in California.
 - c. No CLSM shall be placed until the ENGINEER has approved the mix design. The ENGINEER's approval of the mix design shall be understood to indicate conditional acceptance. Final acceptance will be based on tests conducted on field samples and conformance with these Specifications.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Inspection:
 1. Provide ENGINEER with sufficient notice and with means to examine the areas and conditions under which excavating, filling, and grading are to be performed.
 2. ENGINEER will notify CONTRACTOR if conditions are found that may be detrimental to the proper and timely completion of the Work.
 3. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.
- B. Potholing:
 1. Excavate and backfill, in advance of the construction, test pits to determine conditions or location of the existing utilities and structures.
 2. Define the location of each existing facility involved within the area of his excavation for Work under this Contract.
 3. Exercise care during such location work to avoid damaging and/or disrupting the affected facility.

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4. CONTRACTOR is responsible for repairing, at his expense, damage to any structure, piping, or utility caused by his Work.
- C. Temporary Fencing:
1. Furnish and install a temporary fence surrounding excavations and work area, including the stockpile and storage areas.
 2. Provide fence openings only at vehicular, equipment and worker access points.

3.2 EROSION CONTROL

- A. General: Implement the construction procedures outlined herein to assure minimum damage to the environment during construction. Take all additional measures required to conform to the requirements of applicable codes and regulations.
1. Whenever possible, locate and construct access and temporary roads to avoid environmental damage. Make provisions to regulate drainage, avoid erosion and minimize damage to vegetation.
 2. Where areas must be cleared for storage of materials or temporary structures, provisions will be made for regulating drainage and controlling erosion, subject to the ENGINEER'S approval.
 3. Remove only those shrubs and grasses that must be removed for construction. Protect the remainder to preserve their erosion-control value.
- B. Control Measures: Apply measures to control erosion and to minimize the siltation of the existing waterways, and natural ponding areas. Such measures include, but are not limited to, the use of berms, baled straw silt barriers, gravel or crushed stone, mulch, slope drains and other methods.
1. Install erosion and sediment control practices where shown and according to applicable standards, codes and specifications. The practices will be maintained in effective working condition during construction and until the drainage area has been permanently stabilized.
 2. Temporary measures will be coordinated with the construction of permanent drainage facilities and other Work to the extent practicable to assure economical, effective, and continuous erosion and siltation control.
 3. CONTRACTOR will provide special care in areas with steep slopes. Disturbance of vegetation will be kept to a minimum to maintain stability.
 4. After stabilization, remove all straw bale dikes, debris, etc., from the site.
- C. Dust Control:
1. Prevent blowing and movement of dust from exposed soil surfaces and access roads to reduce on- and off-site damage and health hazards.
 2. Control may be achieved by irrigation in which the site is sprinkled with water until the surface is moist.
 3. Repeat the process as needed.
- D. Failure to Comply: In the event CONTRACTOR repeatedly fails to satisfactorily control erosion and siltation, the OWNER reserves the right to employ outside assistance or to use its own forces to provide the corrective measures indicated. The cost of such work, plus engineering costs, will be deducted from monies due CONTRACTOR.

3.3 DEWATERING

- A. General:

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1. Continuously control all water during the course of construction, including surface water and ground water, to prevent any damage to any excavation or to the construction activities occurring within those excavations.
 2. Maintain all dewatering systems full time (24-hours/day) during the entire time the excavation is open. Do not shut down dewatering systems at night, on weekends or on holidays, or any other time the excavation is open.
 3. Each excavation will be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein is inspected by the ENGINEER and backfill operations have been completed.
 4. Provide adequate alarm, monitoring and back-up systems for all dewatering systems to maintain control of all water during all times any excavation is open.
- B. Surface Water:
1. Provide and maintain adequate drainage and dewatering system to prevent surface water from entering excavations and to remove and dispose of all rainwater entering excavations, trenches, or other parts of the Work.
 2. Keep the different working areas on the site free of surface water at all times. Special care will be taken to eliminate depressions that could serve as mosquito pools.
 3. The diversion and removal of surface water will be performed in a manner that will prevent the accumulation of water behind temporary structures or at any other locations within the construction area where it may be detrimental.
- C. Ground Water:
1. Provide, operate and maintain dewatering system to permit excavation and subsequent construction activities in a dry, safe environment.
 2. System shall be of sufficient size and capacity to maintain groundwater level a minimum of 2 feet below the lowest point of excavation.
 3. Contractor shall make an assessment of the potential for dewatering induced settlement of surrounding soils and structures. Contractor shall provide all necessary equipment and facilities, including re-injection wells, cutoff walls, infiltration trenches, etc, to prevent damage to adjacent structures.
- D. Disposal of water:
1. Disposal of discharge water shall conform to any and all applicable permit requirements.

3.4 EXCAVATION SUPPORT SYSTEMS

- A. Trench Support
1. Provide, install and maintain trench shields for all trench excavations for which trench shields are required (at a minimum, as required by OSHA).
 2. Follow all OSHA guidelines and other applicable laws and ordinances.
 3. Elevation of Bottom:
 - a. Excavation of earth material below the bottom of a shield will not exceed the limits established by ordinances, codes, laws and regulations.
 - b. When using a shield for pipe installation, the bottom of the shield will not extend below the mid-diameter of installed pipe at any time.
 - c. When using a shield for the installation of structures, the bottom of the shield shall not extend below the top of the bedding for the structures.
 4. Moving Shield: When a shield is removed or moved ahead, extreme care will be taken to prevent the movement of pipe or structures or the disturbance of the

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bedding for pipe or structures. Pipe or structures that are disturbed are to be removed and reinstalled as specified.

B. Below Grade Structure Excavation Support

1. Provide, install and maintain excavation support systems for all structural excavations where excavation support is required (at a minimum, as required by OSHA).
2. Follow all OSHA guidelines and other applicable laws and ordinances.
3. Prepare excavation support plan addressing the following topics:
 - a. Details of shoring, bracing, sloping or other provisions for worker protection from the hazards of caving ground
 - b. Design assumptions and calculations
 - c. Methods and sequencing of installing excavation support
 - d. Proposed locations of stockpiled excavated materials
 - e. Minimum lateral distance from the crest of slopes for vehicles, equipment and materials
 - f. Location of vertical and horizontal monitoring points on structures and recommended frequency of monitoring for excavation support system stability and performance
4. Design of excavation support systems and excavation support plan shall be prepared by a civil or structural engineer registered in the state in which the system is installed.
 - a. Excavation support system shall consist of h-pile and lagging, sheet piles, or other reliable method of excavation support.
 - b. The use of below-ground tiebacks is allowed, however, Contractor is responsible for locating and avoiding potential conflicts with existing utilities in the area in which the tie-backs are installed. All tiebacks shall be further than 3 feet from any conflicting utility. Tiebacks shall not use existing structures for support.

C. Removal of Excavation Support

1. Completely remove all excavation support unless ENGINEER specifically allows requested excavation support to remain in place after backfill.
2. Remove all excavation support in a manner that will maintain support as excavation is backfilled and will not leave voids in the backfill.

3.5 EXCAVATION

A. General:

1. Material removed: Excavations include earth, sand, clay, gravel, hardpan, boulders, rock, pavements, rubbish and all other materials within the excavation limits.
2. Excavations for structures and pipelines will be open excavations. Provide excavation protection system(s) required by ordinances, codes, law and regulations to prevent injury to workmen and to prevent damage to new and existing structures or pipelines. Unless shown or specified otherwise, protection system(s) will be utilized under the following conditions.
 - a. Excavation Less Than 5' deep: Excavations in stable rock or in soil conditions where there is no potential for a cave-in may be made with vertical sides. Under all other conditions, excavations will be sloped and benched, shielded, or shored and braced.
 - b. Excavations More Than 5' deep: Excavations in stable rock where there is no potential for a cave-in may be made with vertical sides. Under all other

conditions, excavations will be sloped and benched, shielded or shored and braced.

- c. Excavation protection system(s) will be installed and maintained in accordance with the excavation plan submitted.

B. Structural Excavation:

1. The elevation of the bottom of footings shown is approximate only. ENGINEER may order such changes in dimensions, and elevations as may be required to secure a satisfactory footing.
2. Hand-trim all structure excavations to permit the placing of full widths and lengths of footings on horizontal beds. Rounded and undercut edges will not be permitted.
3. Excavations shall allow for aggregate base, forms, working space, installation of shoring or bracing or the safe sloping of banks.

C. Pipe Trench Excavation:

1. No more than 100' of trench may be opened in advance of pipe laying.
2. Minimize trench width to the greatest extent practical, but conform to the following:
3. Sufficient to provide room for installing, jointing and inspecting piping, but in no case wider at top of pipe than pipe barrel outside diameter plus 3'.
4. Enlargements at pipe joints may be made, if required, and approved by ENGINEER.
5. Sufficient for shoring and bracing, or shielding and dewatering.
6. Sufficient to allow thorough compaction of backfill adjacent to bottom half of pipe.
7. Depth of trench will be as shown. If required and approved by ENGINEER, depths may be revised.

D. Subgrades:

1. Subgrades for roadways, structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; free from mud, muck, and other soft or unsuitable materials; and remain firm and intact under all construction operations.
2. Subgrades that are otherwise solid, but which become soft or mucky on top due to construction operations, shall be reinforced with select fill.
3. The finished elevation of stabilized subgrades shall not be above subgrade elevations shown.

E. Material Storage: Stockpile satisfactory excavated materials in approved areas, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.

1. Locate and retain soil materials away from edge of excavations.
2. Dispose of excess soil material and waste materials as specified hereinafter.

F. Unauthorized Excavation:

1. All excavation outside the lines and grades shown, and which is not approved by ENGINEER, together with the removal and disposal of the associated material is at the CONTRACTOR'S expense.
2. Unauthorized excavations shall be filled and compacted with select fill by the CONTRACTOR at his expense.

3.6 PLACEMENT OF FILL AND BACKFILL

A. General:

1. Backfill excavations as promptly as Work permits, but not until completion of the following:
 - a. Acceptance by the ENGINEER of construction below finish grade.

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- b. Inspection, testing, approval, and recording of locations of underground piping and ductwork.
 - c. Removal of concrete formwork.
 - d. Removal of shoring and bracing, and backfilling of voids with satisfactory materials.
 - e. Removal of trash and debris.
 - 2. Remove and replace with approved fill material, as specified, fill containing organic materials or other unacceptable material.
 - 3. Compact all fill and backfill as specified in Subsection 3.7.
- B. Structural Backfill:
- 1. Select fill shall be placed as structural backfill where shown on the Drawings or indicated herein.
 - 2. Constraints:
 - a. Backfill water-holding basins or structures only after satisfactory leakage tests have been conducted as specified in Sections Concrete and Precast Concrete.
 - b. No backfill or fill material shall be placed when free water is standing on the surface of the area.
 - c. No compaction of fill will be permitted with free water on any portion of the fill to be compacted.
 - d. No fill shall be placed or compacted in a frozen condition or on top of frozen material.
 - e. Any fill containing organic materials or other unacceptable material previously described shall be removed and replaced with approved fill material prior to compaction.
 - 3. Levels of backfill against concrete walls are not to differ by more than 2' on either side of walls, unless walls are adequately braced or all floor framing is in place up to and including grade level slabs.
 - 4. Wherever a pipe passes through a structure backfill, the structure backfill shall be placed and compacted to an elevation 12" above the top of the pipe before the trench is excavated.
- C. Backfill in Pipe Trenches:
- 1. Pipeline trenches may be backfilled prior to pressure testing, but no structure shall be constructed over any pipeline until it has been tested.
 - 2. Unless otherwise shown, place all pipe on a minimum 6" thick layer of Granular Bedding. The bedding shall extend 12" above the top of the pipe.
 - 3. Install bedding as follows:
 - a. Spread bedding and grade to provide a uniform and continuous support beneath the pipe at all points between bell holes or pipe joints.
 - b. After each pipe section is placed, deposit and compact sufficient bedding material under and around each side of the pipe to hold the pipe in proper position and to maintain alignment during subsequent pipe jointing and bedding operations.
 - c. Bedding material shall be deposited and compacted uniformly and simultaneously on each side of the pipe to prevent lateral displacement. Then place and compact the bedding material to an elevation 12" above the top of pipe.
 - 4. Above the level of bedding, place Select or Common Fill, as specified elsewhere in these specifications.
 - 5. Controlled Low Strength Material (CLSM):
 - a. When CLSM pipe zone material is indicated, the pipe may be supported above the trench floor on pea gravel bags or sandbag supports. The CONTRACTOR shall demonstrate to the ENGINEER, 7 days prior to full pipeline backfill installation,

placement of CLSM as described below. This demonstration shall occur on the first 300 feet of trench, The CLSM pipe zone material shall be installed as indicated.

- 1) Bedding and Embedment: Place and compact CLSM pipe zone material using the following techniques:
 - a) Following placement and anchoring of the pipe, remove all loose soil from trench walls and floor. Remove any unstable soil at the top of the trench which might fall into the trench during placement of the CLSM.
 - b) Deliver the CLSM to the trench in ready mix trucks or traveling pug mill and utilize pumps or chutes to place the CLSM in the trench. Direct CLSM to one side of the pipe, taking care not to displace the pipe at any time. Continue placing CLSM on one side of the pipe until CLSM has gone under the pipe and up the other side to a depth of 6 inches above the pipe bottom. Use at least two handheld vibrators to continuously liquefy and move CLSM into all voids. Adjust water in mixture to maintain fluid consistency but maintain strength requirements. Continue placing CLSM on both sides of the pipe continuously using two vibrators for every 30 feet of pipe run.
 - c) Maintain stability of pipe and conduit throughout CLSM placement and curing. CLSM will likely require placement in lifts to prevent pipe flotation. No movement of the pipe caused by flotation will be allowed. If any movement occurs, the CLSM material shall be removed and/or repaired in full conformance with these Contract Documents at no additional cost to the OWNER. Remove all sloughed material or other debris from top of previously placed CLSM.
 - d) CLSM shall be allowed to cure a minimum of 4 hours prior to placing each lift as well as trench zone material. A smaller cure period will be allowed if it can be demonstrated to the ENGINEER that it will support the individual lift or trench zone material. The CLSM shall be sufficiently strong to support trench backfill material and the compaction effort required to achieve the specified compaction.

D. Marking Tape:

1. Continuously install marking tape along centerline of all buried piping, on top of last lift of pipe zone material unless otherwise shown. Coordinate with piping installation drawings. Install in accordance with manufacturer's recommendations.
 - a. Metallic Marking Tape: Install with nonmetallic piping and waterlines. Join ends with clips provided by the manufacturer.
 - b. Plastic Marking Tape: Install with metallic piping.

E. Pipe-Locating Wire:

1. Pipe-locating wire shall be provided for the entire length of all nonmetallic pipelines and shall be continuous around restrained joint sections.
2. Install pipe locating wire by strapping to the top of the pipe with PVC tape, polyethylene-backed tape, or tie locks. Test pipe locating wire with pipe locator equipment prior to final acceptance.
3. Stub the pipe-locating wire up inside each valve box or flush-mounted Type C corrosion monitoring stations. Sufficient excess length shall be provided at terminal connections to allow continuation of the pipe-locating wire to the terminal connection.
4. Wire splices shall be made with compression fittings or soldering; wrapped with Tac-Tape, Aqua-Seal, or equal, and wrapped with electrical tape. Prevent bare copper

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wire from contacting metallic appurtenances including, but not limited to, pipe, buried valves, or fittings.

- F. Resume backfilling operations using the techniques described above to complete the pipe zone backfill. ENGINEER will approve the pipe zone backfill prior to initiating the trench zone backfill.
- G. Embankments:
1. To the maximum extent available, use excess earth obtained from structure and trench excavations for construction of embankments. Obtain additional material from borrow pits, if such pits are shown, otherwise obtain additional material from offsite sources as necessary.
 2. Strip, scarify, level and roll the subgrade so that surface materials of the subgrade will be compact and well bonded with the first layer of the embankment.
 3. Wherever a pipe is to pass through a fill or embankment, place and compact the fill or embankment material to an elevation 12" above the top of the pipe before the trench is excavated.
- H. Crushed Stone:
1. Place where shown on the Drawings, to the limits shown.
 2. Place in hand-tamped lifts, not to exceed 6".
- I. Replacement of Unacceptable Excavated Materials: In cases where over-excavation for the replacement of unacceptable soil materials is required, backfill the excavation to the required subgrade with select backfill material and thoroughly compacted.

3.7 COMPACTION

- A. General:
1. Compaction by inundation with water will not be permitted.
 2. Provide equipment capable of discing, aerating, and mixing the soil to ensure reasonable uniformity of moisture content throughout the material and to reduce the moisture content by air drying, if necessary.
 3. Perform compaction with equipment suitable for the type of fill material being placed. Select equipment that is capable of providing the minimum density required by these Specifications. Use hand-operated compacting equipment within a distance of 3 feet from the wall of any completed below grade structure. Between 3 feet and 12 feet adjacent to below grade structures, compaction may be completed with lightweight compaction equipment weighing less than 15,000 pounds. Beyond 12 feet adjacent to below grade structures, there are no equipment weight restrictions. Provide equipment that is capable of compacting in restricted areas next to structures and around piping.
- B. Compaction Density Requirements: The degree of compaction required for several types of fill is listed below. Moistened or aerated material as necessary to provide the moisture content specified, or if not specified, that will facilitate obtaining the specified compaction.

MATERIAL	Required Minimum Density (ASTM D 1557)	Maximum Uncompacted Lift*
Common Fill/Prepared Subgrade:	90%	8"

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Select Fill/Trench Backfill above pipe:		
More than 2 feet below final grade	90%	8"
Less than 2 feet below final grade	95%	8"
Aggregate Base:	95%	8"
Granular Bedding	90%	6"
Sand	90%	6"
Gravel Surfacing	95%	6"

*Where large areas of backfill allow for use of large, heavy equipment, ENGINEER may, at their option, allow uncompacted lifts up to 12".

- C. Moisture Content: All fill and backfill shall be prepared and thoroughly mixed to achieve optimum moisture content, $\pm 3\%$, with the following exception: On site clayey soils optimum to $+3\%$.
- D. Testing: Testing will be as specified under Paragraph 3.10, "Field Quality Control".

3.8 GRADING

- A. General:
 - 1. Uniformly grade areas within limits of grading under this Section, including adjacent transition areas.
 - 2. Smooth subgrade surfaces within specified tolerances, and compact with uniform levels or slopes between points where elevations are shown or between such points and existing grades.
- B. Adjacent to Structures: Grade areas adjacent to structures to drain away from structures (including masonry fences) and to prevent ponding.
- C. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 1" above or below the required subgrade elevation.
- D. Pavements: Shape surface of areas under pavement to line, and grade and cross-section with finish surface not more than 1/2" above or below the required subgrade elevation.
- E. Under Building Slabs: Grade smooth and even, free of voids, compacted as specified and to required elevation. Provide final grades within a tolerance of 1/2" when tested with a 10' straightedge.
- F. Special Areas: In turfed areas or areas covered with gravel, stone, wood chips, or other special cover, grade to within not more than 1-inch above or below the required subgrade elevations.
- G. Compaction: After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

Area	Required Minimum Density (ASTM D 1557)
Beneath Treatment Structures and Buildings	95%
Beneath Pavement	90%

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Landscaped and other areas	85%
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3.9 PAVEMENT BASE COURSE

- A. Shoulders:
 1. Place shoulders along edges of base course to prevent lateral movement.
 2. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each base course layer.
 3. Compact and roll at least a 12" width of shoulder simultaneously with compacting and rolling of each layer of base course.
- B. Placing:
 1. Place base course material on prepared subgrade in layers of uniform thickness conforming to indicated cross-section and thickness.
 2. Maintain optimum moisture content for compacting base material during placement operations.

3.10 FIELD QUALITY CONTROL:

- A. General: Testing by a testing laboratory of materials, testing for moisture content during placement and compaction of fill materials, and of compaction requirements for compliance with technical requirements of the Specifications.
- B. The CONTRACTOR shall retain one or more independent testing agencies to perform all quality control testing required for all materials except portland cement concrete. The required testing is for soil, aggregates, imported gravel, aggregate base, asphalt concrete, and CLSM. Each independent testing agency shall perform the testing under the supervision of an engineer registered in California. Technicians performing the testing shall be certified to operate the equipment and have at least 1 full year of experience in the type of tests being performed.
- C. A Quality Control Plan shall be submitted by the CONTRACTOR to the ENGINEER at least 30 days before field testing is required. It shall include the names, addresses, and phone number of the companies, the major personnel that will be involved, and resumes of the individuals that will be supervising and performing the tests. Copies of certificates held by the companies and the testing personnel shall be included.
- D. CONTRACTOR's independent testing agency shall perform all field and laboratory testing as described in these Specifications. Test shall include specific gravity, sand equivalent, durability, abrasion resistance, soundness, gradation, compaction curves, lab and field moisture contents, compressive strength, and field density. Other tests shall be performed by the CONTRACTOR's independent testing agency as may be required to meet the Specifications. Mix design testing for portland cement concrete, CLSM, and asphalt concrete shall also be performed by the CONTRACTOR. Field testing for portland cement concrete will be performed by the ENGINEER.
- E. CONTRACTOR shall schedule all lab testing so that materials arriving at the site have been approved by the ENGINEER for use on the Project.

- F. All lab tests shall be performed on Samples obtained from the source of actual material that will be used on the Project. No test results more than 90 days old shall be submitted for review.
- G. The location of field density tests shall be determined by the ENGINEER.
- H. Frequency of tests: Frequency will be not less than as follows:
 - 1. For trenches:
 - a. In open fields: 2 locations every 1,000 linear feet, for each layer
 - b. Along dirt, gravel, or paved roads or off traveled right-of-way: 2 locations every 500 linear feet, for each layer
 - c. Crossing roads: 2 locations along each crossing, for each layer
 - 2. For structural backfill: 1 every 50 cubic yards.
 - 3. In embankment or fill: 1 every 200 cubic yards.
 - 4. Base material: 1 every 50 cubic yards.
 - 5. Footing Subgrade: 1 every 50 linear feet, for each layer.
 - 6. Paved Areas and Building Slab Subgrade: 1 every 500 square feet, but in no case less than 3 tests, for each layer.
- I. The ENGINEER may modify the frequency or spacing of tests to provide for testing at specific structures or locations where the ENGINEER deems additional testing is required. The CONTRACTOR shall perform such additional testing up to 10 percent above the frequency and total number of tests specified at no additional cost to the OWNER.
- J. Verbal and hand-written test results shall be provided to the ENGINEER and CONTRACTOR immediately following the field testing. Written test data sheets shall be provided to the ENGINEER not more than 12 hours following completion of the field test. Typed lab test results shall be provided to the ENGINEER not more than 7 calendar days following completion of the tests; however, the results must be reviewed and approved by the ENGINEER prior to placing the material in the trenches or incorporating it in the Work.
- A. Any location where a failing test occurs shall be recompacted and retested until a passing test is obtained. Specified testing values are minimums and no tests shall be accepted below the specified minimums. No material shall be placed over the failing test area until the failing material is recompacted and a passing test is obtained, and the area is approved by the ENGINEER. The limits of the failing test shall be assumed to be halfway between the failing location and the nearest passing location. Additional tests may be taken to determine the limits of unsatisfactory compaction.
- B. At the first of each month, the CONTRACTOR shall provide to the ENGINEER a typed summary of all tests performed for the previous month including test location by station, depth below finished grade, material tested, wet density, moisture content, dry density, maximum density curve used, and percent relative compaction. Lab test results shall also be included in the monthly report with clear description of material tested, intended use on the Project, and a statement of compliance or noncompliance with the Project Specifications.
- C. Any material which does not meet the Specifications shall be removed from the site and replaced with material in compliance.

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- D. Material which has been softened or modified prior to placing the overlying lift shall be removed down to material which is in compliance.

3.11 DISPOSAL OF EXCAVATED MATERIALS

- A. Material removed from the excavations that does not conform to the requirements for fill or is in excess of that required for backfill shall be hauled away from the Work site and disposed of by CONTRACTOR in compliance with ordinances, codes, laws and regulations at no additional cost to the OWNER.
- B. A site is not available to dispose of excess material.

+ + END OF SECTION + +

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SECTION 02770

ASPHALT CONCRETE PAVING

PART 1 - GENERAL

1.1 SUBMITTALS

A. Information Submittals:

1. Asphalt Concrete Mix Formula:
 - a. Submit minimum of 15 days prior to start of production.
 - b. Submittal to include the following information:
 - 1) Gradation and portion for each aggregate constituent used in mixture to produce a single gradation of aggregate within specified limits.
 - 2) Bulk specific gravity for each aggregate constituent.
 - 3) Measured maximum specific gravity of mix at optimum asphalt content determined in accordance with ASTM D2041.
 - 4) Percent of asphalt lost due to absorption by aggregate.
 - 5) Percentage of asphalt cement, to nearest 0.1 percent, to be added to mixture.
 - 6) Optimum mixing temperature.
 - 7) Optimum compaction temperature.
 - 8) Temperature-viscosity curve of asphalt cement to be used.
2. Test Report for Asphalt Cement:
 - a. Submit minimum 10 days prior to start of production.
 - b. Show appropriate test method(s) for each material and the test results.
3. Statement of qualification for independent testing laboratory.
4. Test Results:
 - a. Mix design.
 - b. Asphalt concrete core.
 - c. Gradation and asphalt content of un-compacted mix.

1.2 QUALITY ASSURANCE

A. Qualifications:

1. Independent Testing Laboratory: In accordance with ASTM E329.
2. Asphalt concrete mix formula shall be prepared by approved certified independent laboratory under the supervision of a certified asphalt technician.

1.3 ENVIRONMENTAL REQUIREMENTS

- A. Temperature:** Do not apply asphalt materials or place asphalt mixes when ground temperature is lower than 10 degrees C (50 degrees F) or air temperature is lower than 4 degrees C (40 degrees F). Measure ground and air temperature in shaded areas away from heat sources or wet surfaces.
- B. Moisture:** Do not apply asphalt materials or place asphalt mixes when application surface is wet.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Asphalt Material: Conform to the following specification:
 - 1. Asphalt Material shall be a hot mix asphalt concrete, consisting of a mixture of mineral aggregate and paving asphalt conforming to Section 92 of the Caltrans Standard Specifications, PG 64-16.
- B. Seal Coat: Conform to the following specification:
 - 1. Seal coat material shall be conforming to Section 37 of the Caltrans Standard Specifications.

PART 3 - EXECUTION

3.1 GENERAL

- A. Traffic Control:
 - 1. In accordance with all applicable specification sections and laws.
 - 2. Minimize inconvenience to traffic, but keep vehicles off freshly treated or paved surfaces to avoid pickup and tracking of asphalt.
- B. Driveways: Repave driveways from which pavement was removed. Leave driveways in as good or better condition than before start of construction.

3.2 LINE AND GRADE

- A. Provide and maintain intermediate control of line and grade, independent of underlying base, to meet finish surface grades and minimum thickness.
- B. Shoulders: Construct to line, grade, and cross-section shown.

3.3 PREPARATION

- A. Prepare subgrade as specified.
- B. Thoroughly coat edges of contact surfaces with emulsified asphalt or asphalt cement prior to laying new pavement. Prevent staining of adjacent surfaces.

3.4 PAVEMENT APPLICATION

- A. General: Place asphalt concrete mixture on approved, prepared base in conformance with this section.
- B. Pavement Mix:
 - 1. Prior to Paving:
 - a. Sweep primed surface free of dirt, dust, or other foreign matter.
 - b. Patch holes in primed surface with asphalt concrete pavement mix.
 - 2. Place asphalt concrete pavement mix in one single lift.
 - 3. Total Compacted Thickness: 3 inches.
 - 4. Apply such that meet lines are straight and edges are vertical.

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5. Collect and dispose of segregated aggregate from raking process. Do not scatter material over finished surface.
 6. After placement of pavement, seal meet line by painting a minimum of 150 millimeters (6 inches) on each side of joint with cut-back or emulsified asphalt. Cover immediately with sand.
- C. Compaction: Roll until roller marks are eliminated and density of 92 percent of measured maximum density determined in accordance with ASTM D2041.
- D. Tolerances:
1. General: Conduct measurements for conformity with crown and grade immediately after initial compression. Correct variations immediately by removal or addition of materials and by continuous rolling.
 2. Completed Surface or Wearing Layer Smoothness:
 - a. Uniform texture, smooth, and uniform to crown and grade.
 - b. Maximum Deviation: 1/8 inch from lower edge of a 3.6-meter (12-foot) straightedge, measured continuously parallel and at right angle to centerline.
 - c. If surface of completed pavement deviates by more than twice specified tolerances, remove and replace wearing surface.
 3. Transverse Slope Maximum Deviation: 1/4 inch.
- E. Seal Coat:
1. General: Apply seal coat of paving grade or emulsified asphalt to finished surface at longitudinal and transverse joints, joints at abutting pavements, areas where asphalt concrete was placed by hand, patched surfaces, and other areas as directed by ENGINEER.
 2. Preparation:
 - a. Surfaces that are to be sealed shall be maintained free of holes, dry, and clean of dust and loose material.
 - b. Seal in dry weather and when temperature is above 2 degrees C (35 degrees F).
 3. Application:
 - a. Fill cracks over 1.5 millimeters (1/16 inch) in width with asphalt-sand slurry or approved crack sealer prior to sealing.
 - b. When sealing patched surfaces and joints with existing pavements, extend minimum 150 millimeters (6 inches) beyond edges of patches.

+ + END OF SECTION + +

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SECTION 03100
CONCRETE FORMWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Formwork as required to construct cast-in-place concrete, including placing of all items such as sleeves, anchor bolts, inserts and all other items to be embedded in concrete for which placement is not specifically provided under other Sections.
- B. REFERENCES
 - 1. American Concrete Institute (ACI)
 - a. ACI 301, Specifications for Structural Concrete for Buildings.
 - b. ACI 347, Guide for Concrete Formwork.

1.2 SYSTEM DESCRIPTION

- A. Coordination:
 - 1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the formwork.
 - 2. Coordinate formwork specifications herein with the requirements for finished surfaces specified in Section 03300, Cast-In-Place Concrete.

1.3 SUBMITTALS

- A. Submit for information purposes the following: Copies of manufacturer's data and installation instructions for all proprietary materials, including form coatings, manufactured form systems, ties and accessories.

1.4 QUALITY ASSURANCE

- A. Allowable Tolerances: Construct formwork to provide completed concrete surfaces complying with tolerances specified in ACI 347, Chapter 3.3, except as otherwise specified.
- B. Furnish and install all items for permanent or temporary facilities in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Unless otherwise shown or specified, construct formwork for exposed concrete surfaces with plywood overlaid with MDO or HDO specifically designed for concrete forms, metal, metal-framed plywood-faced or other acceptable panel materials, to provide continuous, straight, smooth as-cast surfaces. Furnish in largest practical sizes to minimize number of joints. Provide form material

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with sufficient thickness to remain watertight and withstand pressure of newly placed concrete without bow or deflection.

- B. Forms for Unexposed Finish Concrete: Form concrete surfaces that will be unexposed in the finished structure with plywood, lumber, metal, or other acceptable material. Provide lumber that is dressed on at least 2 edges and 1 side.

C. Form Ties:

1. Form ties on exposed surfaces shall be located in a uniform pattern or as indicated on the Drawings. Form ties shall be constructed so that the tie remains embedded in the wall, except for a removable portion at each end. Form ties shall have conical or spherical type inserts, inserts shall be fixed so that they remain in contact with forming material, and shall be constructed so that no metal is within 1 inch of the concrete surface when the forms, inserts, and tie ends are removed. Wire ties will not be permitted. Ties shall withstand all pressures and limit deflection of forms to acceptable limits.
2. Flat bar ties for panel forms shall have plastic or rubber inserts having a minimum depth of 1 inch and sufficient dimensions to permit proper patching of the tie hole.
3. Ties for water-holding structures or dry structures with access such as basements, pipe galleries, etc., that are below finish grade, shall have either an integral steel water stop 0.103 inch thick and 0.625 inch in diameter that is tightly and continuously welded to the tie, or a neoprene water stop 3/16-inch thick and 15/16 inch in diameter whose center hole is 1/2 the diameter of the snap tie, or a molded plastic water stop of comparable size. Flat snap ties complying with above requirements and other sections of this Specification may be used. The water stop shall be considerably larger in area than the tie cross sectional area, and shall be oriented perpendicular to the tie and symmetrical about the center of the tie. The ties shall be constructed to provide a positive means of preventing rotation or disturbance of the center portion of the tie during removal of the ends.

D. Alternative Form Ties – Through-Bolts:

1. Alternate form ties consisting of tapered through-bolts at least 1 inch in diameter at smallest end, or through-bolts that utilize a removable tapered sleeve of the same minimum size may be used at the CONTRACTOR's option. Clean and roughen, fill, and seal form tie hole as shown on the Drawings; or where not shown on the Drawings, the CONTRACTOR shall provide a shop drawing submittal of his proposed method of sealing the through-bolt hole by sandblasting or mechanically cleaning and roughening the entire interior surface of the hole, epoxy coating the roughened surface and driving a vinyl plug and then dry packing the entire hole on each side of the plug with nonshrink grout, meeting these Specifications. Dry packing shall be done while the epoxy is tacky or remove the epoxy by mechanical means and reapply new epoxy. The CONTRACTOR shall be responsible for watertightness and any repair needed. Any leaks or dampness on the exterior of through-bolt patches during or after water testing shall require repair or replacement of the patch.
2. The elastic plug to be inserted into the form tie hole as shown on the Drawings shall be a Dayton Sure Plug, or approved equal, sized to allow insertion using the insertion tool to elongate the plug, place it at the correct location, and allow the plug to return to its original length and diameter upon removal to form a watertight seal. The plugs shall be as manufactured and supplied by Dayton Superior, Dayton OH, phone: 888/977-9500.

- E. Forms Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.

2.2 DESIGN OF FORMWORK

- A. The CONTRACTOR shall design all formwork prior to fabrication. The design shall account for all the tolerances, form ties, finishes, architectural features, rebar supports, construction joint locations, and other features and other nonstructural formwork requirements specified. Forms shall contain pouring and observation windows to allow placement of concrete through windows or shall be staged to allow visual observation at all times of the fresh concrete to ensure correct placement and vibration. Provide a formwork and placement design that will limit free fall of concrete in forms 8-inch or less in width to 5 feet; and for forms wider than 8 inches, limit this fall to 8 feet, except as hereinafter specified. Review methods with ENGINEER prior to start of work. Use placement devices, such as chutes, pouring spouts, pumps, as required.
- B. Wall forms shall be designed such that wall sections can be poured full height without creating horizontal cold joints and without causing snapping of form ties which shall be of sufficient strength and number to prevent spreading of the forms during the placement of concrete and which shall permit ready removal of the forms without spalling or damaging the concrete.
- C. Reuse of forms will be permitted only if a "like new" condition, unless otherwise approved in writing, is maintained. The ENGINEER shall be notified 1 full working day prior to concrete placement so that the forms can be inspected. The CONTRACTOR shall correct any defective work, found in the ENGINEER's inspection, prior to delivery of concrete to the project. Formwork surfaces that were in good condition and accepted for use, but were damaged during removal and handling shall not be reused on additional pours. The CONTRACTOR is expected to take care in the handling of forms and to obtain approval of form surfaces prior to each reuse.
- D. All forms, shoring, and other structural formwork required shall be structurally designed by the CONTRACTOR and the design shall comply with all applicable safety regulations, current OSHA regulations, and other codes. Where federal or state agencies require a licensed engineer to prepare and/or seal all formwork, falsework or shoring designs, the CONTRACTOR shall hire this engineer and pay all costs. The designs shall be made available to any governing agency upon request. Comply with applicable portions of ACI 347, ACI 318 current edition, and these Specifications. All design, supervision, and construction for safety of property and personnel shall be the CONTRACTOR's full responsibility.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the substrate and the conditions under which Work is to be performed with installer and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

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3.2 FORM CONSTRUCTION

- A. Construct forms complying with ACI 347; to the exact sizes, shapes, lines and dimensions shown; as required to obtain accurate alignment, location and grades; to tolerances specified; and to obtain level and plumb work in finish structures. Provide for openings, offsets, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required. Use selected materials to obtain required finishes. Finish shall be as determined by approved mock-up or sample panel, if specified.
- B. Fabricate forms for easy removal without damaging concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where the slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.
- C. Provide temporary form windows where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Brace temporary closures and set tightly to forms to prevent loss of concrete mortar. Locate form windows on forms in locations as inconspicuous as possible, consistent with requirements of the Work. Form intersecting planes of openings to provide true, clean-cut corners, with edge grain of plywood not exposed as form for concrete.
- D. Forms for Exposed To View Concrete:
 - 1. Do not use metal cover plates for patching holes or defects in forms.
 - 2. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections.
 - 3. Use extra studs, walers and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material that will produce bow.
 - 4. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.
 - 5. Form molding shapes, recesses, rustication joints and projections with smooth-finish materials, and install in forms with sealed joints to prevent displacement.
- E. Corner Treatment:
 - 1. Form exposed corners of beams, walls, foundations, bases and columns to produce smooth, solid, unbroken lines, except as otherwise shown. Except as specified below for reentrant or internal corners, exposed corners shall be chamfered.
 - 2. Form chamfers with 3/4"x 3/4" strips, unless otherwise shown, accurately formed and surfaced to produce uniformly straight lines and tight edge joints. Use rigid PVC chamfers for all architecturally formed concrete. Extend terminal edges to require limit and miter chamfer strips at changes in direction.
 - 3. Reentrant or internal corners and unexposed corners need not be formed chamfered.
- F. Openings and Built-In Work:
 - 1. Provide openings in concrete formwork shown or required by other Sections or other contracts.
 - 2. Accurately place and securely support items to be built into forms.
- G. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove all foreign materials, such as chips, wood, sawdust, tie wire scraps,

dirt, or other debris just before concrete is to be placed. Retighten forms immediately after concrete placement as required to eliminate mortar leaks.

3.3 FORM COATINGS

- A. Coat form contact surfaces with a non-staining form-coating compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come into contact with surfaces that will be bonded to fresh concrete. Apply in compliance with manufacturer's instructions.
- B. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.4 INSTALLATION OF EMBEDDED ITEMS

- A. Set and build into the formwork, anchorage devices and other embedded items, shown, specified or required by other Sections and other contracts. Use necessary setting drawings, diagrams, instructions and directions.
- B. Edge Forms and Screeds Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support screeds.

3.5 FIELD QUALITY CONTROL

- A. Before concrete placement, check the formwork, including tolerances, lines, ties, tie cones, and form coatings. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.
- B. During concrete placement check formwork and related supports to ensure that forms are not displaced and that completed Work is within specified tolerances.
- C. If forms are unsatisfactory in any way, either before or during placing of concrete, postpone or stop placement of concrete until the defects have been corrected, and reviewed by ENGINEER.

3.6 REMOVAL OF FORMS

- A. Conform to the requirements of ACI 301, Chapter 2 and ACI 347, Chapter 3.7 except as specified below.
 - 1. Removal of Forms and Supports: Continue curing in accordance with Section 03300, Cast-In-Place Concrete, Paragraph 3.7. Forms are to remain in-place for the time specified below following the end of concrete placement. The durations shown represent a cumulative number of days, or hours, not necessarily consecutive, during which the temperature of the air surrounding the concrete is above 50°F.

<u>Temperature:</u>	<u>Above 50°F</u>	<u>Below 50°F or when retarders are used</u>
Sides of Beams and Slabs	6 hours	12 hours

3.7 RE-USE OF FORMS

- A. Clean and repair surfaces of forms to be re-used in the Work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces. Form surfaces shall be subject to ENGINEER'S approval.

+ + END OF SECTION + +

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SECTION 03200
CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Fabrication and placement of reinforcement including bars, ties and supports, and welded wire fabric for concrete, encasements and fireproofing.

1.2 SUBMITTALS

- A. Shop Drawings:
1. Manufacturer's specifications and installation instructions for all materials and reinforcement accessories.
 2. Drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315, Parts A and B. For walls, show elevations to a minimum scale of 1/4-inch to 1 foot. For slabs, show top and bottom reinforcing on separate plan views. Show bar schedules, stirrup spacing, diagrams of bent bars, arrangements and assemblies, as required for the fabrication and placement of concrete reinforcement, unless otherwise noted. Keep splices to a minimum. Avoid splices in regions of maximum tension stresses whenever possible.
- B. Certificates: Submit one (1) copy of steel producer's certificates of mill analysis, tensile and bend tests for reinforcing steel.

1.3 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
1. American Concrete Institute (ACI):
 - a. ACI 315, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.
 - b. ACI 318, Building Code Requirements for Reinforced Concrete.
 - c. ACI 117, Specification for Tolerances for Concrete Construction and Materials and Commentary.
 2. Concrete Reinforcing Steel Institute:
 - a. Manual of Standard Practice, includes ASTM standards referred to herein.
- B. Allowable Placing Tolerances: Comply with ACI 117, Specification for Tolerances for Concrete Construction and Materials and Commentary.

1.4 DELIVERY, HANDLING AND STORAGE

- A. Deliver concrete reinforcement materials to the site bundled, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.

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- B. Store concrete reinforcement material at the site to prevent damage and accumulation of dirt or excessive rust. Store on heavy wood blocking so that no part of it will come in contact with the ground.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Reinforcing Bars: ASTM A615, Grade 60 for all non-welded bars. ASTM A706, Grade 60 for welded bars.
- B. Mechanical Couplers: Reinforcement bars may be spliced with a mechanical connection. Provide a full mechanical connection which shall develop in tension or compression, as required, at least 125% of specified yield strength (f_y) of the bar in accordance with ACI 318 Section 12.14.3.2. The locations of the connections are subject to the approval of the ENGINEER.
 - 1. Dayton Superior Bar Lock S/CA Series.
 - 2. Or approved equal
- C. Threaded Splicing Systems: Dowel Bar Splicer System shall comply with ICC Report #4028. The completed splice shall exceed 160% of the specified yield strength (f_y) of the bar.
 - 1. Dayton Superior DB/DI parallel threaded couplers.
 - 2. Or approved equal
- D. Supports for Reinforcement: Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place.
 - 1. Use wire bar type supports complying with CRSI recommendations, except as specified below. Do not use wood, brick, or other unacceptable materials.
 - 2. For slabs on grade, use 5000 psi concrete blocks.
 - 3. At all formed surfaces, provide supports complying with CRSI "Manual of Standard Practice" as follows: Plastic protected or stainless steel legs.

2.2 FABRICATION

- A. General: Fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with CRSI, "Manual of Standard Practice". In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken the material.
- B. Unacceptable Materials: Reinforcement with any of the following defects will not be permitted in the Work:
 - 1. Bar lengths, bends, and other dimensions exceeding specified fabrication tolerances.
 - 2. Bends or kinks not shown on approved Shop Drawings.
 - 3. Bars with reduced cross-section due to excessive rusting or other cause.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine substrate and conditions under which concrete reinforcement is to be placed with installer, and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Comply with the applicable recommendations of specified codes and standards, and CRSI, Manual of Standard Practice, for details and methods of reinforcement placement and supports.
- B. Clean reinforcement to remove loose rust and mill scale, oil, earth, ice, and other materials that reduce or destroy bond with concrete.
- C. Position, support, and secure reinforcement against displacement during formwork construction or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.
 - 1. Place reinforcement to obtain the minimum concrete cover as shown. Arrange, space, and securely tie bars and bar supports together with 16-gage wire to hold reinforcement accurately in position during concrete placement operations. Slab and wall bars shall be tied at every intersection around the periphery of the slab or wall and not less than every 48 inches in the field at walls and 60 inches in the field at slabs.
 - 2. Bar supports shall be placed no further than 4 feet apart in each direction. Supports must be completely concealed in the concrete and shall not discolor or otherwise mar the surface of the concrete.
 - 3. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.
 - 4. Do not secure reinforcing steel to forms with wire, nails or other ferrous metal. Do not permit metal supports subject to corrosion to touch or be within the required clearance to formed or exposed concrete surfaces.
- D. Provide sufficient numbers of supports of strength required to carry reinforcement. Do not place reinforcing bars more than 2-inches beyond the last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment or similar construction loads.
- E. Splices: Provide reinforcement lap splices by placing bars in contact, and tying tightly with wire. Comply with requirements shown for minimum lap of spliced bars.
- F. Mechanical Couplers in Lieu of Lap Splicing:
 - 1. Provide mechanical butt splices in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Flame dry bars before butt splicing. Provide adequate jigs and clamps or other devices to support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line.

- G. Reinforcement Around Openings: Place an equivalent area of steel around the pipe or opening and extend on each side sufficiently to develop bond in each bar. See the Details on Drawings for bar extension length each side of opening.
- H. Field Bending: Field bending of reinforcing steel bars is not permitted when rebending will later be required to straighten bars. Rebending of bars at the same place where strain hardening has taken place due to the original bend will damage the bar. Consult with the ENGINEER prior to any pour if the CONTRACTOR foresees a need to work out a solution to prevent field bending.

3.3 INSPECTION OF REINFORCEMENT

- A. Do not place concrete until the reinforcing steel is inspected and permission for placing concrete is granted by ENGINEER. All concrete placed in violation of this provision will be rejected.

+ + END OF SECTION + +

SECTION 03251
CONCRETE JOINTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes installation of concrete joints including, construction joints, expansion joints and fillers, and contraction (control) joints.

1.2 REFERENCES

- A. American Concrete Institute (ACI)
 - 1. ACI 301, Specifications for Structural Concrete for Buildings.
- B. American Society for Testing and Materials (ASTM)
 - 1. ASTM A36, Standard Specification for Structural Steel.
 - 2. ASTM D1752, Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

1.3 SUBMITTALS

- A. Product Data: Submit for approval, Manufacturer's specifications and installation instructions for all materials required.

1.4 QUALITY ASSURANCE

- A. Install all manufactured items in accordance with manufacturer's instructions.
- B. Store materials off the ground and protected from moisture, dirt and other contaminants. Protect installed and uninstalled materials from UV exposure in accordance with manufacturer's instruction.

PART 2 - PRODUCTS

2.1 PREFORMED EXPANSION JOINT FILLER

- A. Bituminous type conforming to ASTM D994 or D1751, unless otherwise shown or specified.

2.2 CONCRETE CONSTRUCTION JOINT ROUGHENER

- A. Provide a water-soluble non-flammable, surface-retardant roughener.
- B. Product and Manufacturer: Provide one of the following:
 - 1. Rugasol-S, as manufactured by Sika Corporation for horizontal joints.
 - 2. MBT EAC-S, as manufactured by Master Builders for horizontal joints.
 - 3. MBT Tuf-Cote (Deep Etch), as manufactured by Master Builders for vertical joints.
 - 4. Or approved equal.

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2.3 EPOXY BONDING AGENT

- A. Provide an epoxy-resin bonding agent, two component type.
- B. Product and Manufacturer: Provide one of the following:
 - 1. Sikadur 32 Hi-Mod LPL, as manufactured by Sika Corporation.
 - 2. Eucopoxy LPL, as manufactured by the Euclid Chemical Company.
 - 3. Epoxite Binder (Code # 2390), as manufactured by A.C. Horn, Incorporated.
 - 4. Or approved equal.

2.4 BOND BREAKER

- A. Tape for Joints: Adhesive-backed glazed butyl or polyethylene tape, same width as joint that will adhere to premolded joint material or concrete surface.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine substrate and conditions under which Work is to be performed with installer and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 CONSTRUCTION JOINTS

- A. Comply with ACI 301, Chapter 2.2, and as specified below.
- B. Locate and install construction joints as shown. Locate additional construction joints as required to satisfactorily complete all Work.
- C. Horizontal Joints:
 - 1. Roughen concrete at the interface of construction joints by sandblasting to expose the aggregate (1/4-inch minimum amplitude) and remove accumulated concrete on rebar immediately subsequent to form stripping. Immediately before placing fresh concrete, thoroughly clean the existing contact surface using a stiff brush or other tools and a stream of water under pressure. The surface shall be clean and wet, but free from pools of water at the moment the fresh concrete is placed.
 - 2. Remove laitance, waste mortar or other substance that may prevent complete adhesion.
- D. Vertical Joints:
 - 1. Remove accumulated concrete on rebar.
 - 2. Roughen concrete at the interface of the construction joints to expose the aggregate (1/4-inch minimum amplitude) through one of the following:
 - a. Apply roughener to the form in a thin, even film by brush, spray or roller in accordance with the manufacturer's instructions. After roughener is dry, concrete may be placed. When concrete has been placed and the form removed, wash loosened material off with high-pressure water spray to obtain roughened surface subject to approval by ENGINEER.
 - b. Sandblast after concrete has fully cured.
 - c. Waterblast after concrete has partially cured.

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3.3 BONDING WITH EPOXY ADHESIVE

- A. Use adhesive for the following:
 - 1. Bonding of fresh concrete to concrete cured at least 45 days or to existing concrete.
- B. Handle and store epoxy adhesive in compliance with the manufacturer's printed instructions, including safety precautions.
- C. Mix the epoxy adhesive in complete accordance with the instructions of the manufacturer.
- D. Before placing fresh concrete, thoroughly roughen and clean hardened concrete surfaces and coat with epoxy adhesive not less than 1/16" thick. Place fresh concrete while the epoxy material is still tacky, without removing the in-place grout coat, and as directed by the epoxy manufacturer.

+ + END OF SECTION + +

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SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: Place, finish, cure, strip, and repair concrete.

1.2 REFERENCES

- A. American Concrete Institute (ACI)
1. ACI 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
 2. ACI 214, Recommended Practice for Evaluation of Strength Test Results of Concrete.
 3. ACI 301, Specifications for Structural Concrete for Buildings, (includes ASTM Standards referred to herein).
 4. ACI 304, Guide for Measuring, Mixing, Transporting and Placing Concrete.
 5. ACI 305, Hot Weather Concreting.
 6. ACI 306, Cold Weather Concreting.
 7. ACI 309, Guide for Consolidation of Concrete.
 8. ACI 311, Guide for Concrete Inspection.
 9. ACI 318, Building Code Requirements for Reinforced Concrete.
 10. ACI 347, Guide to Formwork for Concrete
 11. ACI 350, Environmental Engineering Concrete Structures.

1.3 SYSTEM DESCRIPTION

- A. Class A Concrete shall be steel reinforced and includes:
1. Foundations.
 2. Slabs.
 3. Equipment bases.
 4. Pipe supports.
- B. Class B Concrete shall be placed without forms or with simple forms, with little or no reinforcing, and includes:
1. Concrete fill.
 2. Curbs and gutters.
 3. Sidewalks.
 4. Thrust blocks.
 5. Encasements.

1.4 SUBMITTALS

- A. Samples: Submit samples of materials as specified and as otherwise may be requested by ENGINEER, including names, sources and descriptions.
- B. Product Data: Submit for approval the following:
1. Manufacturer's specifications with application and installation instructions for proprietary materials and items, including admixtures and bonding agents.

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2. List of concrete materials and concrete mix designs proposed for use. Include the results of all tests performed to qualify the materials and to establish the mix designs.
- C. Laboratory Test Reports: Submit copies of laboratory test reports for materials and mix design tests
- D. Delivery Tickets: Furnish to ENGINEER copies of all weighmaster certificate delivery tickets for each load of concrete delivered to the site. Provide items of information as specified in ASTM C94, Section 16. Delivery tickets shall be signed by a Certified Weighmaster.

1.5 QUALITY ASSURANCE

- A. Tests for Concrete Materials: Submit written reports to ENGINEER, for each material sampled and tested, prior to the start of Work. Provide the Project identification name and number, date of report, name of CONTRACTOR, name of concrete testing service, source of concrete aggregates, material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results. Indicate whether or not material is acceptable for intended use.
- B. If the concrete mix designs specified herein have not been used previously by the ready-mix supplier, mix proportions and concrete strength curves for regular cylinder tests shall be established by an approved ready-mix supplier or an independent testing laboratory based on the relationship of 7, 14 and 28 day strengths versus slump values of 2, 4 and 6 inches, all conforming to these Specifications. A laboratory, independent of the ready-mix supplier, shall be required to prepare and test all concrete cylinders. The costs for preparation of mix designs, not previously used by the ready-mix supplier, and testing of concrete and materials shall be borne by CONTRACTOR.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cement:
 1. Portland cement, ASTM C150, Type II; or blended hydraulic cement, ASTM C595, Type 1P (MS).
 2. Do not use cement which has deteriorated because of improper storage or handling.
- B. Aggregates: ASTM C33 and as herein specified.
 1. Do not use aggregates containing soluble salts, substances such as iron sulfides, pyrite, marcasite, ochre, or other materials that can cause stains on exposed concrete surfaces.
 2. Fine Aggregate: Provide clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances.
 3. Coarse Aggregate: Provide clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:
 - a. Crushed stone, processed from natural rock or stone.
 - b. Coarse Aggregate Size: Size to be ASTM C33, Nos. 57 or 67, except that No. 467 may be used for footings, foundation mats and walls 16" or greater in thickness.

- C. Water: Clean, free from injurious amounts of oils, acids, alkalis, organic materials or other substances that may be deleterious to concrete or steel.

2.2 CONCRETE ADMIXTURES

- A. Provide admixtures produced by established reputable manufacturers, and use in compliance with the manufacturer's printed instruction. Do not use admixtures that have not been incorporated and tested in the accepted mixes, unless otherwise authorized in writing by ENGINEER.
- B. Air-Entraining Admixtures: ASTM C260.
 - 1. Product and Manufacturer: Provide one of the following:
 - a. SIKA AER, as manufactured by Sika Corporation.
 - b. MasterAir AE 200, as manufactured by BASF.
 - c. Daravair, as manufactured by W.R. Grace & Conn.
 - d. Or approved equal.
- C. High-Range Water-Reducing Admixture ("Superplasticizer"): ASTM C494, Type F/G.
 - 1. Superplasticizer shall be used in all Class A Concrete. Do not use high range water-reducing admixture containing more chloride ions than are contained in municipal drinking water. Add only at the job site to concrete in compliance with the manufacturer's printed instruction.
 - 2. Product and Manufacturer: Provide one of the following:
 - a. Sikament 320, as manufactured by Sika Corporation.
 - b. MasterGlenium, as manufactured by BASF.
 - c. Daracem-100, as manufactured by W.R. Grace & Conn.
 - d. Or approved equal.
- D. Water-Reducing Admixture: ASTM C 494, Type A.
 - 1. A water-reducing, aqueous solution of a modification of the salt of polyhydroxylated organic acids. Do not use admixture containing any lignin, nitrates or chlorides added during manufacture.
 - 2. Product and Manufacturer: Provide one of the following:
 - a. Eucon WR-75, as manufactured by The Euclid Chemical Company.
 - b. MasterPozzoloth, as manufactured by BASF.
 - c. WRDA series, as manufactured by W.R. Grace & Conn.
 - d. Or approved equal.
- E. Pozzolanic Admixtures:
 - 1. Pozzolanic admixtures shall not be used in structures with concrete in contact with potable water, but may be used in other concrete.
 - 2. Provide Mineral admixtures, when used, meeting the requirements of ASTM C618 Class F.
 - 3. A substitution by weight, of the portland cement by pozzolan, so that the total tricalcium aluminate content of the resulting cement plus pozzolan is not greater than 8%, will be considered. However, the pozzolan shall not exceed 20% by weight of the cement plus pozzolan.
- F. Set-Control Admixtures: ASTM C494, as follows:
 - 1. Type B, Retarding.
 - 2. Type C, Accelerating.
 - 3. Type D, Water-reducing and Retarding.

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4. Type E, Water-reducing and Accelerating.
 5. Type F, Water-reducing, high range admixtures.
 6. Type G, Water-reducing, high range, and retarding admixtures.
- G. Calcium Chloride: Do not use calcium chloride in concrete, unless otherwise authorized in writing by ENGINEER. Do not use admixtures containing calcium chloride where concrete is placed against galvanized steel.

2.3 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes of concrete. Mixes subject to the following limitations:
1. Class A Concrete
 - a. Specified 28-day Compressive Strength: 4,000 psi minimum.
 - b. Air content: 5% \pm 1%. For concrete placed at least 2 feet below the adjacent grade, an air-entraining admixture is not required unless otherwise specified.
 - c. Slump, before addition of superplasticizer: 3½" \pm ½"
 - d. Slump, after addition of superplasticizer: 8" maximum

Coarse Aggregate Size	Cementitious Content-Pounds Per Cubic Yard	Water-Cement Ratio by Weight
¾"	625 min, 800 max	0.375
1"	600 min, 800 max	0.385
1 ½"	590 min, 800 max	0.400

- e. Use superplasticizer in all Class A Concrete. Use water reducers in combination with superplasticizers as required for mixing.
 2. Class B Concrete
 - a. Specified 28-day Compressive Strength: 2,500 psi.
 - b. Maximum Water-Cement Ratio by Weight: 0.49.
 - c. Slump: 3" Minimum, 5" Maximum.
- B. Use an independent testing facility acceptable to ENGINEER for preparing and reporting proposed mix designs.
- C. Admixtures:
1. Use air-entraining admixture in all concrete, except interior slabs subject to abrasion, unless otherwise shown or specified. Add air-entraining admixture at the manufacturer's prescribed rate to result in concrete at the point of placement having air content within the prescribed limits.
 2. Use amounts of admixtures as recommended by the manufacturer for climatic conditions prevailing at the time of placing. Adjust quantities and types of admixtures as required to maintain quality control.

2.4 EPOXY BONDING AGENT

- A. For use in all dry-packed holes, concrete repair and for unplanned cold-joints.
- B. Provide an epoxy-resin bonding agent, two component, polysulfide type.
- C. Product and Manufacturer: Provide one of the following:
1. Sikadur 32, Hi-Mod LPL, as manufactured by Sika Corporation.

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2. Eucopoxy LPL, as manufactured by the Euclid Chemical Company.
3. Or approved equal.

2.5 CONCRETE CURING MATERIALS

- A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 10 ounces per square yard and complying with AASHTO M182, Class 3.
- B. Moisture-Retaining Cover: One of the following, complying with ASTM C171.
 1. Waterproof paper.
 2. Polyethylene film.
 3. White burlap-polyethylene sheet.
- C. Curing Compound: ASTM C309 Type 1-D (water retention requirements):
 1. Product and Manufacturer: Provide one of the following:
 - a. Super Aqua Cure VOX, as manufactured by The Euclid Chemical Company.
 - b. Sealtight 1100, as manufactured by W.R. Meadows, Incorporated.
 - c. Or approved equal.

2.6 EMBEDDED ITEMS

- A. Provide and install items such as plates, angles, inserts, bolts and similar items not specified elsewhere under this Section. Carbon steel embedded items shall be hot dip galvanized after fabrication.

PART 3 - EXECUTION

3.1 CONCRETE MIXING

- A. Provide concrete produced by the ready-mixed process.
- B. Comply with the requirements of ASTM C 94, and as herein specified. Proposed changes in mixing procedures, other than herein specified, must be accepted by ENGINEER before implementation.
 1. Plant equipment and facilities: Conform to National Ready- Mix Concrete Association "Plant and Delivery Equipment Specification."
 2. Mix concrete in revolving type truck mixers that are in good condition and which produce thoroughly mixed concrete of the specified consistency and strength.
 3. Do not exceed the proper capacity of the mixer.
 4. Mix concrete for a minimum of two minutes after arrival at the job site, or as recommended by the mixer manufacturer.
 5. Mix concrete during transit only as recommended by the mixer manufacturer.
 6. Mix at proper speed until concrete is discharged.
 7. Maintain adequate facilities at the job site for continuous delivery of concrete at the required rates.
 8. Provide access to the mixing plant for ENGINEER at all times.

3.2 TRANSPORTING CONCRETE

- A. Transport and place concrete not more than 90 minutes after water has been added to the dry ingredients or before 250 revolutions of the drum or blades, whichever occurs first.
- B. If an admixture is used to retard the set time and the concrete temperature does not exceed 85 degrees F, the travel and placing time may be extended to 120 minutes or 300 revolutions of the drum or blades, whichever occurs first.
- C. Take care to avoid spilling and separation of the mixture during transportation.
- D. Do not place concrete in which the ingredients have been separated.
- E. Do not retemper partially set concrete.
- F. Use suitable and approved equipment for transporting concrete from mixer to forms.

3.3 CONCRETE PLACEMENT

- A. General: Place concrete continuously so that no concrete will be placed on concrete, which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as specified in Section 03251, Concrete Joints. Deposit concrete as nearly as practical in its final location to avoid segregation due to rehandling or flowing. Do not subject concrete to any procedure that will cause segregation.
 - 1. Screed concrete that is to receive other construction to the proper level to avoid excessive skimming or grouting.
 - 2. Do not use concrete which becomes non-plastic and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign materials. Do not use retempered concrete. Remove rejected concrete from the job site and dispose of it in an acceptable location.
 - 3. Do not place concrete until all forms, bracing, reinforcement, and embedded items are in final and secure position.
 - 4. Do not place in cold weather, unless adequate precautions are taken against frost action.
 - 5. Do not place footings, piers or pile caps on frozen soil.
 - 6. Unless otherwise approved, place concrete only when ENGINEER is present.
 - 7. Allow a minimum of 3 days of curing before placing new concrete against a slab or wall already in place.
- B. Concrete Conveying:
 - 1. Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practical by methods that will prevent segregation and loss of concrete mix materials.
 - 2. Provide mechanical equipment for conveying concrete to ensure a continuous flow of concrete at the delivery end. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, ice and other deleterious materials.
 - 3. Pumping concrete is permitted, however do not use aluminum pipe for conveying.

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C. Placing Concrete into Forms:

1. Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place concrete at such a rate that concrete that is being integrated with fresh concrete is still plastic.
2. Do not permit concrete to free fall within the form from a distance exceeding 8'-0", except as noted in Section 03100. Use "elephant trunks" or "wall pipes" to prevent free fall and excessive splashing on forms and reinforcement.
3. Remove temporary spreaders in forms when concrete placing has reached the elevation of such spreaders.
4. Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with the applicable recommended practices of ACI 309. Vibration of forms and reinforcing will not be permitted.
5. Vibrators shall have a frequency of at least 8,000 vpm, with amplitude required to consolidate the concrete in the section being placed. At least one stand-by vibrator in operable condition shall be at the placement site prior to initiating placement of the concrete.
6. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the layer of concrete and at least 6" into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.
7. The forms shall contain sufficient windows or be limited in height to allow visual observation of the concrete and the vibrator operators shall be required to see the concrete being consolidated to ensure good quality workmanship or the CONTRACTOR shall have a person who is actually observing the vibration of the concrete at all times and advising the vibrator operators of any changes needed to assure complete consolidation.
8. Do not place concrete in beam and slab forms until the concrete previously placed in columns and walls is no longer plastic.
9. Force concrete under pipes, sleeves, openings and inserts from one side until visible from the other side to prevent voids.

D. Placing Concrete Slabs and Footings:

1. Deposit and consolidate concrete in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.
2. Consolidate concrete during placing operations using mechanical vibrating equipment, so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Consolidate concrete placed in beams and girders of supported slabs, and against bulkheads of slabs on ground, as specified for formed concrete structures.
4. Bring surfaces to the correct level. Smooth the surface, leaving it free of humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the surfaces prior to beginning finishing operations.

E. Bonding for Next Concrete Pour: Per Section 03251, Concrete Joints.

F. Quality of Concrete Work:

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1. Make all concrete solid, compact and smooth, and free of laitance, cracks and cold joints.
2. All concrete for liquid retaining structures, and all concrete in contact with earth, water, or exposed directly to the elements shall be watertight.
3. Cut out and properly replace to the extent ordered by ENGINEER, or repair to the satisfaction of ENGINEER, surfaces which contain cracks or voids, are unduly rough, or are in any way defective. Thin patches or plastering will not be acceptable.
4. Repair all leaks through concrete, and cracks, holes or other defective concrete in areas of potential leakage and make watertight.
5. Repair, remove, and replace defective concrete as ordered by ENGINEER at no additional cost to OWNER.

G. Cold Weather Placing:

1. Protect all concrete Work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures, in compliance with the requirements of ACI 306 and as herein specified.
2. When the air temperature has fallen to or may be expected to fall below 40°F, provide adequate means to maintain the temperature, in the area where concrete is being placed, at between 50°F and 70°F for at least seven days after placing. Provide temporary housings or coverings including tarpaulins or plastic film. Maintain the heat and protection, if necessary, to ensure that the ambient temperature does not fall more than 30°F in the 24 hours following the seven-day period. Avoid rapid dry-out of concrete due to overheating, and avoid thermal shock due to sudden cooling or heating.
3. When air temperature has fallen to or is expected to fall below 40°F, uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 55°F and not more than 85°F at point of placement.
4. Do not use frozen materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Ascertain that forms, reinforcing steel, and adjacent concrete surfaces are entirely free of frost and ice before placing concrete.
5. When temperatures are expected to be below 32°F the night before the concrete is placed, then all reinforcing steel, forms and the ground shall be preheated, for a minimum of 12 hours, under a minimum temperature of 50°F.
6. Do not use salt and other materials containing antifreeze agents or chemical accelerators, or set-control admixtures, unless approved by ENGINEER, in mix designs.
7. Weather predictions made by the nearest NOAA station, and corrected for the local elevation and environmental conditions, may be used to determine whether cold weather protection shall be required. Thermometers will be used by ENGINEER and these readings shall determine whether cold weather protection shall be required and whether cold weather protection is adequate.

H. Hot Weather Placing:

1. When hot weather conditions exist as any combination of high air temperature, low relative humidity and wind velocity that would seriously impair the quality and strength of concrete, place concrete as recommended by ACI 305 and as herein specified.
2. Cool ingredients before mixing to maintain concrete temperature at time of placement below 85°F. No concrete shall be placed if its temperature exceeds 90°F. Mixing water may be chilled, or chopped ice may be used, or liquid nitrogen may be added. Ice, when introduced into the mixer shall be in such form that it will be

- completely melted and dispersed throughout the mix at the completion of the mixing time. The addition of ice shall not increase the specified water to cement ratio.
3. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
 4. Thoroughly wet forms before placing concrete. Forms shall be free of standing water when concrete is placed.
 5. Do not use set-control admixtures, unless approved by ENGINEER in mix designs.
 6. Fog spray shall be used during finishing operations whenever necessary to avoid surface plastic shrinkage cracking. Fog spray shall also be used after finishing and before the specified curing is commenced to avoid surface plastic shrinkage cracking.
 7. Obtain ENGINEER'S approval of other methods and materials proposed for use.
- I. Removal of Forms:
1. The CONTRACTOR shall be responsible for all damage resulting from improper and premature removal of forms. Satisfy all applicable OSHA requirements with regard to safety of personnel and property.
- J. Patching:
1. Patching of concrete shall provide an acceptable and structurally sound surface finish uniform in appearance or the CONTRACTOR shall upgrade the finish by other means at no additional cost.
 2. Tie Holes: All tie holes, except where sealant is indicated, shall be filled with dry pack nonshrink grout. White cement shall be added as needed so the color of grout after curing matches the color of adjacent concrete. Tie holes shall be thoroughly sandblasted or roughened. Flush the patch area with water and allow to dry. Coat the surface of the existing concrete with an approved bonding agent prior to filling with nonshrink grout. Complete the repair in the time duration specified by the bonding agent manufacturer. The grout shall be rammed into place in thin layers and leveled to the plane of the surrounding concrete. Cure in accordance with the manufacturer's recommendations.
 3. Defective Areas: Remove all defective concrete such as honeycombed areas and rock pockets out to sound concrete. Small shallow holes caused by air entrapment at the surface of the forms shall not be considered defects unless the amount is so great as to be considered not the standard of the industry and due primarily of poor workmanship. If chipping is required, the edges shall be perpendicular to the surface. Feather edges shall not be permitted. The defective area shall be filled with a nonshrink, nonmetallic, grout. Use an approved bonding agent on horizontal patches prior to placing nonmetallic, non shrink grout. Since some bonding agents may not be compatible for some vertical surface patching techniques, demonstrate all methods for repair of vertical surfaces using the actual materials, methods, and curing procedures required by the manufactures of the materials on the project site. The CONTRACTOR shall consult with representatives of the bonding agent manufacturer and the nonshrink grout manufacturer, and these representatives shall be onsite and assist in the demonstration.
 4. Blockouts at Pipes or Other Penetrations: Conform to details shown or submit proposed blockouts for review. Use nonshrink, nonmetallic grout.

3.4 FINISH OF FORMED SURFACES

A. Rough Form Finish:

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1. Standard rough form finish is with concrete surface having the texture imparted by the form material, with tie holes and defective areas repaired and patched with mortar of 1 part cement to 1½ parts sand & all fins and other projections exceeding 1/4" in height rubbed down or chipped off.
 2. Use rough form finish for the following:
 - a. Exterior vertical surfaces up to 1' below grade.
 - b. Other areas shown.
- B. Related Unformed Surfaces:
1. At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a texture matching the adjacent formed surfaces. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surfaces, unless otherwise shown.

3.5 MONOLITHIC SLAB FINISHES

- A. Float Finish:
1. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when the surface water has disappeared or when the concrete has stiffened sufficiently. Check and level the surface plane to a tolerance not exceeding 1/4" in 10' when tested with a 10' straightedge. Cut down high spots and fill all low spots. Uniformly slope surface to drains as shown. Immediately after leveling, refloat the surface to a uniform, smooth, granular texture.
 2. Use float finish for the following:
 - a. Interior horizontal surfaces of liquid containers, except those to receive grout topping.
- B. Trowel Finish:
1. After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.
 2. Consolidate the concrete surface by the final hand troweling operation. Finish shall be free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8" in 10' when tested with a 10' straight edge. Grind smooth surface defects that would telegraph through applied floor covering system.
 3. Use trowel finish for the following:
 - a. Interior exposed slabs, unless otherwise shown or specified.
 - b. Slabs to receive resilient floor finishes.
- C. Non-Slip Broom Finish:
1. Immediately after trowel finishing, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route. Use fiber-bristle broom, unless otherwise directed. Coordinate the required final finish with ENGINEER before application.
 2. Use Non-Slip Broom Finish for the following:
 - a. Exterior exposed horizontal surfaces subject to light foot traffic.
 - b. Interior and exterior concrete steps and ramps.
 - c. Horizontal surfaces which will receive a grout topping or a concrete equipment base slab.

3.6 CONCRETE CURING AND PROTECTION

A. General:

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperature, and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete.
2. Start initial curing after placing and finishing concrete as soon as free moisture and bleed water sheen has disappeared from the concrete surface. Keep concrete continuously moist during initial curing.
3. Begin final curing procedures immediately following initial curing and before the concrete has dried. The total curing duration shall not be less than ten (10) days. For concrete sections over 30" thick, continue curing for an additional seven (7) days, minimum. Avoid rapid drying at the end of the final curing period.

B. Use one of the following methods as approved by ENGINEER:

1. Slab and Curbs:

- a. Method 1: Protect surface by water ponding for the entire curing duration.
- b. Method 2: Cover concrete surfaces and exposed edges with the specified absorptive cover, thoroughly saturating the cover with water, and keeping the absorptive cover continuously wet with sprinklers or porous hoses during the curing duration. Lap adjacent absorptive cover sections 3-inches minimum.
- c. Method 3: Cover the concrete surfaces and exposed edges with the specified moisture-retaining cover during the curing duration. Seal edges and seams with waterproof tape, adhesive or sand berm. Water must be introduced between the moisture-retaining cover and the concrete surface whenever moist drops cannot be detected on the concrete side of the cover or the concrete surface is noticeably dry.
- d. Method 4: Continuously sprinkle or fog exposed surfaces for the curing duration.

C. Temperature of Concrete During Curing:

1. When the nighttime low temperature may drop to 40°F or below, maintain the concrete temperature between 50°F and 70°F continuously throughout the curing period, by heating, covering, insulation or housing as required.
2. When the daytime high temperature may rise to 90°F or above, maintain the concrete temperature at a minimum and reduce temperature variations by providing moist curing continuously for the concrete curing period.
3. During either of the conditions specified above, the minimum curing time shall be 10 days (240 hours), after which coverings, housings, and insulation shall remain on the work for an additional 3 days, to allow gradual temperature equalization with the atmosphere.

D. Protection from Mechanical Injury: During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration, and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations.

3.7 FIELD QUALITY CONTROL

- #### A. The CONTRACTOR will employ a testing laboratory to perform field quality control testing. ENGINEER will direct the number of tests and cylinders required. Furnish all necessary assistance required by ENGINEER.

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B. Quality Control Testing During Construction:

1. Perform sampling and testing for field quality control during the placement of concrete, as follows:
 - a. Sampling Fresh Concrete: ASTM C172.
 - b. Slump: ASTM C143; one test for each concrete load at point of discharge; and one for each set of compressive strength test specimens.
 - c. Air Content: ASTM C231; one for the first concrete load, and one for every two concrete loads thereafter, or when required by an indication of change. Adjust mix if test results are unsatisfactory and resubmit for ENGINEER'S approval.
 - d. Compressive Strength Tests: ASTM C39; one set of 4 standard compression cylinders for each 100 cubic yards or fraction thereof, of each mix design placed in any one day; 1 specimen tested at 7 days, and 2 specimens tested at 28 days, 1 held. Cast, store and cure specimens as specified in ASTM C31.
 - 1) Adjust mix if test results are unsatisfactory and resubmit for ENGINEER'S approval.
 - 2) Concrete that does not meet the strength requirements is subject to rejection and removal from the Work, or to other such corrective measures as directed by ENGINEER, at the expense of CONTRACTOR.
 - e. Concrete Temperature: Test each time a slump test is made.
2. Where questionable field conditions may exist during placing concrete or immediately thereafter, strength tests of specimens cured under field conditions will be required by ENGINEER to check the adequacy of curing and protecting of the concrete placed. Specimens shall be molded at the same time and from the same samples as the laboratory cured specimens.
 - a. Provide improved means and procedures for protecting concrete when the 28-day compressive strength of field- cured cylinders is less than 85% of companion laboratory-cured cylinders.
 - b. When laboratory-cured cylinder strengths are appreciably higher than the minimum required compressive strength, field-cured cylinder strengths need not exceed the minimum required compressive strength by more than 500 psi even though the 85 percent criterion is not met.
3. The testing laboratory shall submit certified copies of test results directly to ENGINEER and CONTRACTOR after tests are made.

C. Evaluation of Quality Control Tests:

1. Do not use concrete delivered to the final point of placement that has slump or temperature outside the specified values, nor that which is older than specified in section 3.2.
2. Compressive strength tests for laboratory-cured cylinders will be considered satisfactory if the averages of all sets of three consecutive compressive strength tests results equal or exceed the 28 day design compressive strength of the type or class of concrete; and, no individual strength test falls below the required compressive strength by more than 500 psi.
3. If the compressive strength tests fail to meet the minimum requirements specified, the concrete represented by such tests will be considered deficient in strength and subject to replacement, reconstruction or to other action approved by ENGINEER.

D. Testing Concrete Structure for Strength:

1. When there is evidence that the strength of the in-place concrete does not meet specification requirements, provide the services of a concrete testing service to take cores drilled from hardened concrete for compressive strength determination at no

additional expense to OWNER. Provide tests complying with ASTM C42 and the following:

- a. Take at least three (3) representative cores from each member or suspect area at locations directed by ENGINEER.
 - b. Strength of concrete for each series of cores will be considered satisfactory if their average compressive strength is at least 85% and no single core is less than 75% of the 28 day required compressive strength.
 - c. Report test results, in writing, to ENGINEER on the same day that tests are made. Include in test reports the Project identification name and number, date, name of CONTRACTOR, name of concrete testing service, location of test core in the structure, type or class of concrete represented by core sample, nominal maximum size aggregate, design compressive strength, compression breaking strength and type of break (corrected for length-diameter ratio), direction of applied load to core with respect to horizontal plane of the concrete as placed, and the moisture condition of the core at time of testing.
2. Fill core holes solid with non-shrink, high strength grout, and finish to match adjacent concrete surfaces.

E. Water Leakage Tests for All Water-Holding Structures:

1. All water-holding structures shall be subjected to leakage tests after the concrete has been cured and obtained its design strength, and before backfill, brick facing, or other work which will cover the concrete surfaces of the walls is begun. Water leakage tests shall be conducted by the CONTRACTOR as follows:
 - a. All water-holding structures shall be filled with water to the maximum liquid level shown on the Drawings prior to leak testing at a rate less than 4 ft/hr. After these structures have been kept full for 3-days, it will be assumed for the purpose of the test that the absorption of moisture by the concrete in the basin is complete. All valves and gates to the structure shall then be closed and the change in water surface measured over a 48-hour period. The vertical distance to the water surface shall be measured to within 1/16-inch from a fixed point on the containment structure above the water surface. Measurements shall be recorded at 24-hour intervals.
 - b. During the test period, all exposed portions of the structure shall be examined for dampness or leaks and all visible leaks or damp spots shall be marked; such leaks or damp spots shall be later patched or corrected in a manner acceptable to the ENGINEER prior to additional leakage testing. If the drop in water surface in the 48-hour period exceeds 0.05% of the normal volume of liquid contained in the water-holding structure, after accounting for evaporation, precipitation and temperature in open basins, or if damp spots or any seepage is present on the walls or other areas exposed to view where moisture can be picked up on a dry hand, the leakage shall be considered excessive and the leakage test will be considered to have failed. A floating, restrained, partially filled, calibrated, open container for evaporation and precipitation measurement should be positioned in open containment structures, and the water level in the container recorded. Determination of evaporation by a shallow pan-type measuring device is discouraged as the heating of the bottom of a shallow pan can cause accelerated evaporation of water when compared with that taking place from a deep containment structure.
 - 1) Wet areas on top of wall footings shall not be considered cause of a qualitative failure of the leakage test unless the water can be observed to be flowing.

- c. If the leakage is excessive, and if damp spots and observed seepage is present on exposed surfaces, the water-holding structure shall be drained, all leaks and damp spots previously marked shall be patched, and the necessary repairs made, and the basin shall be retested. The CONTRACTOR's method of repair shall be subject to the requirements of these specifications and submitted for review and approval by the ENGINEER.
- d. The water-holding structure shall then be refilled and again tested for leakage and this testing and repair process shall be repeated as many times as necessary until the leakage test passes. This process shall be continued until the drop in water surface in specified test period with the basin full is less than the quantity specified above and all damp spots and seepage disappears when the structures are full of water. All repairs of faulty workmanship and materials, and additional tests, shall be made by the CONTRACTOR in an acceptable manner, at no additional cost to the OWNER. Both the correction for excessive leakage and the removal of the damp or wet spots on exposed surfaces shall be required to pass the leakage test.
- e. The purpose of this test is to determine the integrity of the finished concrete and to show that the exposed wall surfaces are visually acceptable. Therefore, all other equipment, e.g., stop gates, sluice gates, etc. or temporary bulkheads, should be made watertight prior to the test.
- f. As an alternative to having watertight bulkheads, gates or valves, the CONTRACTOR shall accurately measure the leakage through gates, valves, and bulkheads with methods acceptable to the ENGINEER.
- g. An assumed leakage through gates and valves based on the manufacturer's recommendations is not acceptable.

3.8 MISCELLANEOUS CONCRETE ITEMS

- A. Filling-In: Fill-in holes and openings left in concrete structures for the passage of work by other contractors, unless otherwise shown or directed, after the work of other contractors is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide all other miscellaneous concrete filling shown or required to complete the Work.
- B. Curbs:
 - 1. Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
 - 2. Exterior curbs shall have rubbed finish for vertical surfaces and a broomed finish for top surfaces.
- C. Equipment Bases:
 - 1. Unless specifically shown otherwise, provide concrete bases for all pumps and other equipment. Construct bases to the dimensions shown, or as required to meet manufacturers' requirements and drawing elevations. Where no specific elevations are shown, bases shall be 6-inches thick and extend 3-inches outside the metal equipment base or supports. Bases to have smooth trowel finish, unless a special finish such as terrazzo, ceramic tile or heavy duty concrete topping is required. In those cases, provide appropriate concrete finish.
 - 2. Include all concrete equipment base work not specifically included under other Sections.

3. In general, place bases up to 1-inch below the metal base. Properly shim equipment to grade and fill 1-inch void with non-shrink grout as specified in Section 03600, Grout.
- D. Installation of embedded items
1. Install all embedded items prior to concrete placement, or, if necessary, as soon after concrete placement as possible, before concrete is set.
 2. Use temporary support and bracing to keep embedded items in place while concrete cures.
 3. Protect all embedded items from damage during concrete installation.

3.9 CONCRETE REPAIRS

- A. Repair of Formed surfaces:
1. Repair exposed-to-view formed concrete surfaces that contain defects which adversely affect the appearance of the finish. Surface defects that require repair include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, and holes left by the rods and bolts; fins and other projections on the surface; and stains and other discolorations that cannot be removed by cleaning.
 2. Repair concealed formed concrete surfaces that may contain defects that adversely affect the durability of the concrete. Surface defects that require repair include cracks in excess of 0.01-inch wide, cracks of any width and other surface deficiencies which penetrate to the reinforcement or completely through non-reinforced sections, honeycomb, rock pockets, holes left by tie rods and bolts, and spalls except minor breakage at corner.
 3. Repair structural cracks and cracks in water-holding structures.
- B. Method of Repair of Formed Surfaces:
1. Repair and patch defective areas with cement mortar immediately after removal of forms and as directed by ENGINEER.
 2. Cut out honeycomb, rock pockets, voids over 1/2" diameter, and holes left by tie rods and bolts, down to solid concrete but, in no case, to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Before placing the cement mortar, thoroughly clean, dampen with water, and brush-coat the area to be patched with the specified bonding agent.
 - a. For exposed-to-view surfaces, blend white portland cement and standard portland cement so that, when dry, the patching mortar color will match the color of the surrounding concrete. CONTRACTOR shall impart texture to repaired surfaces to match texture of existing adjacent surfaces. Provide test areas at inconspicuous locations to verify mixture, texture and color match before proceeding with the patching. Compact mortar in place and strike off slightly higher than the surrounding surface.
 3. Cracks which require repair shall be pressure grouted, epoxy injected, using one of the following in accordance with Section 03740. Apply in accordance with the manufacturer's directions and recommendations.
 - a. Sikadur 35, Hi-Mod L.V. and Sikadur 31, Hi-Mod Gel, as manufactured by Sika Corporation Company.
 - b. Euco Epoxy #452 Epoxy System, as manufactured by The Euclid Chemical Company.
 - c. Or approved equal.

4. Fill holes extending through concrete by means of a plunger- type gun or other suitable device from the least exposed face, using a flush stop held at the exposed face to ensure completely filling.
 5. Sandblast exposed-to-view surfaces that require removal of stains, grout accumulations, sealing compounds, and other substances marring the surfaces. Use sand finer than No. 30 and air pressure from 15 to 25 psi.
- C. Repair of Unformed Surfaces:
1. Test unformed surfaces, such as monolithic slabs, for smoothness and to verify surface plane to the tolerances specified for each surface and finish. Correct low and high areas as herein specified.
 2. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having the required slope. Correct high and low areas as herein specified.
 3. Repair finish of unformed surfaces that contain defects which adversely affect the durability of the concrete. Surface defects, as such, include crazing, cracks in excess of 0.01-inch wide or which penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.
 4. Repair structural cracks and cracks in water-holding structures.
- D. Methods of Repair of Unformed Surfaces:
1. Correct high areas in unformed surfaces by grinding, after the concrete has cured sufficiently so that repairs can be made without damage to adjacent areas.
 2. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out the low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Use one of the following. Apply in accordance with the manufacturer's directions and recommendations.
 - a. Euco Poly-Patch, as manufactured by The Euclid Chemical Company.
 - b. Sikatop 122, as manufactured by Sika Corporation.
 - c. Or approved equal.
 3. Repair defective areas, except random cracks and single holes not exceeding 2" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts, and expose reinforcing steel with at least 3/4" clearance all around. Dampen all concrete surfaces in contact with patching concrete and brush with the specified bonding agent. Place patching concrete before grout takes its initial set. Mix patching concrete of the same materials and proportions to provide concrete of the same type or class as the original adjacent concrete. Place, compact and finish as required to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.
 4. Repair isolated random cracks, as approved by ENGINEER, and single holes not over 2" diameter, by the dry-pack method. Groove the top of cracks, and cut out holes to sound concrete and clean of dust, dirt and loose particles. Dampen all cleaned concrete surfaces and brush with the specified bonding agent. Place dry-pack before the cement grout takes its initial set. Mix dry-pack, consisting of 1 part portland cement to 2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for not less than 72 hours.
 5. Cracks which extend through the full member section, or any cracks determined by ENGINEER to require pressure grouting repair, shall be pressure grouted, epoxy

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injected, using one of the following in accordance with Section 03740. Apply in accordance with the manufacturer's directions and recommendations.

- a. Sikadur 35, Hi-Mod L.V. and Sikadur 31, Hi-Mod Gel, as manufactured by Sika Corporation.
 - b. Euco Epoxy #452 Epoxy System, as manufactured by The Euclid Chemical Company.
 - c. Or approved equal.
6. Assure that surface is acceptable for flooring material to be installed in accordance with manufacturer's recommendations.

E. Other Methods of Repair:

1. Repair methods not specified above may be used if approved by ENGINEER.

+ + END OF SECTION + +

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SECTION 03400

PRECAST CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Section includes all plant-precast products, including, but not limited to, catch basins, manholes, vaults, and wheel stops.

1.2 SYSTEM DESCRIPTION

- A. Precast products shall be designed for the indicated service, the loadings specified in the Contract Documents, and all transportation, handling, and erection loads, in accordance with requirements and recommendations of the references.
 - 1. Precast products not subjected to traffic loads shall be designed to meet and exceed the requirements of ACI 318-14.
 - 2. Precast products subjected to traffic loads shall be designed to meet and exceed the requirements of the current AASHTO LRFD Bridge Design Specifications.
 - 3. Liquid containing precast products shall be designed for the additional requirements of ACI 350-06.
- B. If precast products are proposed as substitutes for cast-in-place designed structures, such precast products shall meet the above requirements and any other requirements for which the cast-in-place structures were designed by the ENGINEER. Such products shall be designed by an engineer licensed to practice in the State where the project is performed.
- C. Items located in or adjacent to traffic areas shall be designed to resist AASHTO HL93 loading, unless otherwise indicated.
- D. Lifting inserts shall have a minimum safety factor of 4.

1.3 QUALIFICATIONS

- A. Manufacturer:
 - 1. Manufacturer shall have at least 5 years experience in the design and manufacture of precast concrete products substantially similar to those required for this project.
- B. Installer:
 - 1. Precast Items shall be installed by the Manufacturer or by an installer regularly engaged for at least 5 years in erection of precast products similar to those required on this project.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit to the Engineer for review, shop drawings of the proposed details, and design calculations; all calculations and shop drawings shall be stamped and signed by a Civil or Structural Engineer registered in the State of California.

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2. Material specifications.
 3. All dead, live and other applicable loads used in the design.
 4. Applicable standards (from "References") met by the item(s).
 5. Setting plans locating and designating all items furnished by the manufacturer, with all major openings shown and located.
 6. Details to indicate quantities, location and type of reinforcing and prestressing steel.
 7. Sections and details showing connections, edge conditions, support conditions, and connections of the items.
 8. Description of all embeds, including stripping, lifting and erection inserts, with piece mark and location, including those cast into products or sent loose to the job site.
 9. Description and drawings of all frames and covers.
 10. Dimensions and special finishes.
- B. Mix Designs: Submit all precast mix designs for approval. Mix designs shall be prepared by an independent testing facility or qualified employee of the Precast Manufacturer.
- C. Design Modifications:
1. Submit design modifications necessary to meet performance requirements and field conditions.
 2. Variations in details or materials shall not adversely affect the appearance, durability or strength of products.
 3. Maintain general design concept without altering size of members, profiles and alignment unless otherwise approved by the Architect/Engineer.

1.5 QUALITY ASSURANCE

- A. In-Plant Quality Control
1. The Manufacturer shall have an established PCI quality control program in effect prior to bidding. If requested, a copy of this program shall be submitted to the ENGINEER.
 2. Testing of materials and inspection of production techniques shall be the responsibility of the Manufacturer's Quality Control Department.
 3. Keep quality control records available for two years after final acceptance.
 4. Keep certificates of compliance available for five (5) years after final acceptance.
- B. All other testing and inspection, if any, to be provided by OWNER.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Handle and transport products in a position consistent with their shape and design in order to avoid excessive stresses or damage.
- B. Lift or support products only at the points shown on the Shop Drawings.
- C. Installer shall be responsible for the repair of damage to items except that caused by others.
- D. After items are installed in their final positions, the CONTRACTOR shall be responsible for their protection. The CONTRACTOR shall be responsible for the repair of any damage to the items caused by someone other than the Manufacturer/Installer.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Portland Cement ASTM C150 Type I, II or III cement.
- B. Aggregates:
 - 1. Fine and coarse aggregate for mix shall conform to ASTM C33 or C330.
 - 2. Aggregates shall be clean, hard, strong, durable, inert, and free of staining and deleterious materials.
- C. Water Potable, free from deleterious material.
- D. Admixtures:
 - 1. Conforming to ASTM C260 and/or ASTM C494.
 - 2. Calcium chloride or admixtures containing chlorides shall not be used.
- E. Concrete Strength: Concrete strength shall be determined by design with a minimum 28 day design strength of 4,000 psi.

2.2 STEEL MATERIALS

- A. Products:
 - 1. Structural Shapes, Bars & Plates (1.6mm and thicker): ASTM A36
 - 2. Pipe: ASTM A53 Grades A or B
 - 3. Tube Steel: ASTM A500 Grades A or B
 - 4. Reinforcing Steel: ASTM A615 Grades 300 & 420 or ASTM A706
 - 5. Prestressing Strand: ASTM A416 Grade 270, low relaxation
 - 6. Deformed Steel Bar Mats: ASTM A184
 - 7. Deformed Bar Anchors: ASTM A496
 - 8. Deformed Welded Wire Fabric: ASTM A497
 - 9. Plain Welded Wire Fabric: ASTM A185
 - 10. Welded Headed Studs: AWS D1.1 Type B
 - 11. Standard Machine Bolts: ASTM A307 Grade A or SAE J429 Grade 2
 - 12. Standard Studs/Threaded Round Stock: ASTM A307 Grade C, ASTM A572 Grade 345
 - 13. Nuts for Standard Machine Bolts and Threaded Studs: ASTM A563 Grade A Hex Nuts
 - 14. High Strength Bolts: ASTM A325 Type 1, ASTM A449 Type 1, or SAE J429 Grade 5
 - 15. Nuts for High-Strength Bolts and Threaded Studs: ASTM A563 Grade DH Heavy Hex Nuts
 - 16. Coil Rods and Bolts: ASTM A108 - SAE 1016 to 1026, $F_u/F_y = 480/380$ MPa minimum
 - 17. Coil Nuts for Coil Rods and Bolts: Nuts passing a proof load stress of 80 ksi, based on the tensile stress area of the matching coil rods and bolts.
 - 18. Carbon Steel Castings: ASTM A27 Grade 415-205
- B. Protective Coatings:
 - 1. All connection hardware permanently exposed to weather after completion shall be protected. All connection hardware not exposed to weather after completion may be uncoated, except as otherwise explicitly required by the contract drawings. Fasteners can have either an electroplated zinc or cadmium coating.
 - 2. Alkyd Rust Inhibitive Primers (shop primers such as red iron oxide) :
 - a. Tnemec Series FD88 Azerox Primer
 - b. Ameron 5105

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- c. Weld-Thru Primer, Red, 2-0101 & Gray, 2-0102
- 3. Zinc Coatings:
 - a. Hot-Dip Galvanizing: ASTM A123, or ASTM A153
 - b. Electroplated Zinc for Steel Products and Steel Hardware: ASTM B633
 - c. Zinc Rich Paints: DOD-P-21035
- 4. Cadmium Coatings:
 - a. Electrodeposited Coatings of Cadmium: ASTM B766

2.3 MISCELLANEOUS PRODUCTS

- A. Grout:
 - 1. Cement Grout: Portland cement, sand and water sufficient for placement and hydration.
 - 2. Non-Shrink Grout: Premixed, packaged non-ferrous aggregate shrink resistant.
 - 3. Epoxy Resin Grout: Two-component mineral-filled resin: ASTM C881.
- B. Joint Sealing Compound: The joint sealing compound shall be a permanently flexible plastic material complying in every detail to Federal Specification SS S-00210 (GSA-FSS) dated July 26, 1965. "Quickseal", or approved equal.
- C. Frames and Covers: Catch basins, manholes, and vaults shall be provided with fabricated aluminum or steel frames and covers as specified or shown on the drawings and shall be built up so that the cover is flush with the surrounding surface unless otherwise specified.

2.4 FABRICATION

- A. Unless otherwise noted, precast concrete structure dimensions called out on the Drawings are interior dimensions.
- B. Manufacturing procedures shall be in general compliance with PCI MNL-116.
- C. Manufacturer shall provide for those openings 10 in. or larger, round or square as shown on the drawings. Other openings shall be located and field drilled or cut by the trade requiring them after the units have been erected. Openings and/or cutting of prestressing strand shall be approved by ENGINEER and manufacturer before drilling or cutting.
- D. Forms:
 - 1. Forms for precast products shall be rigid and constructed of materials that will result in finished products conforming to the profiles, dimensions and tolerances indicated by this Section, the Contract Documents and the reviewed Shop Drawings.
 - 2. Construct forms to withstand vibration method selected.
 - 3. Release agents shall be applied and used according to manufacturer's instructions.
- E. Concreting:
 - 1. Batching of Concrete shall be in accordance with approved Mix Design(s).
 - 2. Convey concrete by methods which will prevent separation, segregation or loss of material.
 - 3. Consolidate all concrete in the form to minimize honeycombing or entrapped air.

- F. Curing: Procedures sufficient to insure specified concrete strength of all products must be employed. Stripping of a panel shall not occur until concrete strength is sufficient to prevent cracking or damage of the panel.
- G. Manufacturing Tolerances:
1. Cross Sectional Dimensions:
 - a. Less than 24 inches: $\pm 1/4"$
 - b. 24 to 36 inches: $\pm 3/8"$
 - c. Over 36 inches: $\pm 1/2"$
 2. Length:
 - a. Less than 25 ft: $\pm 1/2"$
 - b. 25 to 50 ft: $\pm 3/4"$
 - c. Over 50 ft: $\pm 1"$
 3. Variation from square or designed skew (difference in length of two diagonal measurements): Max. $\pm 3/4"$
- H. Identification: Mark each precast item to correspond to identification mark on Shop Drawings for product location, and with casting date.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Access: Clear unloading areas and access roadways to point of component placement shall be provided and maintained by the CONTRACTOR. The CONTRACTOR shall provide all required traffic controls, barricades, warning lights and/or signs to insure a safe installation.
- B. Sitework: The CONTRACTOR shall excavate and prepare the subgrade, including 2 inches of clean sand, graded level and to the proper elevation.
- C. Installer Responsibility: Prior to installation of the precast products, notify the CONTRACTOR of any discrepancies discovered which affect the work under this contract.

3.2 INSTALLATION

- A. General: Precast products shall be lifted with suitable lifting devices at points provided by the Manufacturer to prevent excessive stresses or damage to the products. Brace and secure items before unhooking.
- B. Sitework:
1. Openings or "knockouts" shall be located as shown on the drawings and shall be sized sufficiently to permit passage of the largest dimension of pipe and/or coupling flange. Upon completion of installation, all voids or openings in the vault walls around pipes shall be filled with 4,000-psi concrete or mortar, using an approved epoxy for bonding concrete surfaces.
 2. All joints between precast sections shall be made watertight using preformed mastic material. The sealing compound shall be installed according to the manufacturer's recommendations to provide a watertight joint which remains impermeable throughout the design life of the structure. All joints shall be filled with dry-pack non-

shrink grout. If plastic liner system is used, after the joint has been made and is cured, install plastic liner weld strip at all joints and seams.

3. Frames and covers shall be built up so that the cover is flush with the surrounding surface unless otherwise specified. The CONTRACTOR is responsible for placing the cover at the proper elevation where paving is to be installed and shall make all necessary adjustments so that the cover meets these requirements.
4. After the structure and all appurtenances are in place and approved, and after any required disinfection or testing, backfill shall be placed to the original ground line or to the limits designated on the plans.

3.3 FIELD QUALITY CONTROL

A. Hydrostatic Testing:

1. All Manholes, Junction Boxes, or other water bearing structures shall be hydrostatically tested prior to acceptance.
2. Test Procedure:
 - a. Plug all inlets and outlets with temporary plugs
 - b. Fill water bearing structure with clean, potable water
 - c. Let stand for 24 hours, if desired, to allow for "soaking-in"
 - d. Fill to rim elevation
 - e. Let stand for a minimum of 2 hours
 - f. Check distance from rim to water surface
 - g. Calculate water loss. Leakage in each manhole may not exceed 0.1-gallon per hour per foot of water depth during the test.
3. Repair all structures which do not meet the above test requirements with a method approved by the ENGINEER and re-test until passing.

3.4 PATCHES AND REPAIRS:

- #### A. Patching of products, when required, shall be performed to industry standards for structural concrete. Repairs shall be sound, permanent and flush with adjacent surface.

3.5 WARRANTY:

- #### A. All labor and materials under the Precast Manufacturers contract shall be warranted by the Precast Manufacturer for a period of one (1) year after substantial completion.

+ + END OF SECTION + +

SECTION 03600

GROUT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes epoxy, non-metallic, non-shrink, and ordinary Portland cement-sand grouts.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM C33, Standard Specification for Concrete Aggregates.
 - 2. ASTM C150, Standard Specification for Portland Cement.
 - 3. ASTM C595, Standard Specification for Blended Hydraulic Cements.
 - 4. ASTM C1107, Standard Specification for Packaged Dry, Hydraulic-Cement Grout.

1.3 SYSTEM DESCRIPTION

- A. Furnish ordinary cement-sand grout for the following:
 - 1. Foundation grout.
 - 2. Construction joint grout.
 - 3. As shown in the Drawings.
- B. Furnish non-shrink, non-metallic grout for the following:
 - 1. Equipment bases, 25 hp or less.
 - 2. Base plates.
 - 3. Guardrail and railings.
 - 4. Through-bolt and form tie openings.
 - 5. As shown in the Drawings.
- C. Furnish epoxy grout for the following:
 - 1. Equipment bases, 26 hp or more and/or sole plates with vibration, thermal movement, etc.
 - 2. Blockouts for gate guides.
 - 3. Retrofit waterstop installation.
 - 4. As shown in the Drawings.

1.4 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's specifications and installation instructions for all proprietary materials.
 - 2. Proposed method for keeping existing concrete surfaces wet prior to placing grout.
 - 3. Forming method for fluid grout placements.
 - 4. Curing method for grout.
- B. Laboratory Test Reports and Certificates:
 - 1. For proprietary materials, submit copies of reports on quality control tests.

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2. Submit certification that materials meet specification requirements for nonproprietary materials.
3. For ordinary cement-sand grout, copies of grout mix design and laboratory strength test reports.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Deliver grout materials from manufacturers in unopened containers and bearing intact manufacturer's labels.
- B. Storage of Materials: Store grout materials in a dry shelter and protected from moisture.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. High-Strength Epoxy Grout.
 1. Use 100% solids, prepackaged, solvent-free, moisture insensitive, high-strength epoxy grout.
 2. Product and Manufacturer: Provide one of the following:
 - a. E³-HP, as manufactured by The Euclid Chemical Company.
 - b. Sikadur 42 Grout Pak, as manufactured by Sika Corporation.
 - c. Five Star HP Epoxy Grout by Five Star Products, Incorporated.
 - d. Or approved equal.
- B. Non-shrink, Non-metallic Grout:
 1. Prepackaged non-staining cementitious grout which shall meet the minimum requirements of ASTM C1107 and requiring only the addition of water at the jobsite.
 2. Product and Manufacturer: Provide one of the following:
 - a. NS, as manufactured by The Euclid Chemical Company.
 - b. Five Star Grout, as manufactured by Five Star Products, Incorporated.
 - c. Sika Grout 212, as manufactured by Sika Corporation.
 - d. Or approved equal.
- C. Ordinary Cement-Sand Grout: Prepare design mix for ordinary cement grout.
 1. Cement: Portland cement, ASTM C150, Type II; or blended hydraulic cement, ASTM C595, Type 1P.
 2. Aggregates: ASTM C33 and as herein specified.
 - a. Do not use aggregates containing soluble salts or other substances such as iron sulfides, pyrite, marcasite, ochre, or other materials that can cause stains on exposed concrete surfaces.
 - b. Fine Aggregate: Clean, sharp, natural sand, free from loam, clay, lumps or other deleterious substances.
 - 1) Dune sand, bank run sand and manufactured sand are not acceptable.
 - c. Coarse Aggregate: Coarse aggregate not permitted.
 3. Admixtures: Provide admixtures produced by established reputable manufacturers and use in compliance with the manufacturer's printed instruction. Do not use admixtures that have not been incorporated and tested in the accepted mixes, unless otherwise authorized in writing by ENGINEER. Refer to Section 03300 - Cast-In-Place Concrete, for additional admixture requirements.
 4. Proportioning and Design of Mixes: Mixes are subject to the following limitations:

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- a. Specified 28-day Compressive Strength: 4,000 psi.
 - b. Minimum amount of water necessary for the mixture to flow under its own weight.
 - c. Fine Aggregate meeting ASTM C33.
 - d. Air Content Percentage: $\pm 1.5\%$.
 - e. Minimum Cement Content in Pounds per Cubic Yard: 658.
 - f. Slump at point of placement: $5" \pm 1"$.
5. Proportion mix by either laboratory trial batch or field experience methods, using materials to be employed on the Project for grout required. Comply with ACI 211.1 and provide a complete report, from an independent testing laboratory, to ENGINEER, at least 30 days prior to start of Work. Do not begin grout production until ENGINEER has approved mix.
 6. Laboratory Trial Batches: When laboratory trial batches are used to select grout proportions, prepare test specimens and conduct strength tests as specified in ACI 301, Chapter 3 - Proportioning.
 7. Field Experience Method: When field experience methods are used to select grout proportions, establish proportions as specified in ACI 301, Chapter 4.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the substrate and conditions under which grout is to be placed with installer and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. General:
 1. Mix, place and cure grout as shown and in accordance with manufacturer's instructions. If manufacturer's instructions conflict with the Specifications, do not proceed until ENGINEER provides clarification.
 2. Manufacturers of proprietary products shall make available upon 72 hours notification the services of a qualified, full time employee to aid in assuring proper use of the product under job conditions. The cost of this service, if any, shall be borne by CONTRACTOR.
 3. When placing grout conform to temperature and weather limitations in Section 03300 - Cast-In-Place Concrete.
- B. Through-bolt and form-tie holes: Fill space with dry pack dense grout hammered in with steel tool and hammer. Coordinate dry pack dense grout application with bonding agent in Section 03251 - Concrete Joints.
- C. Columns, Beams and Equipment Bases: Prepare concrete surface by sandblasting, chipping, or by mechanical means to remove any soft material prior to setting base plates and machinery. After shimming columns, beams and equipment indicated to be grouted on the plans to proper grade, securely tighten anchor bolts. Properly form around the base plates allowing sufficient room around the edges for placing the grout. Adequate depth between the bottom of the base plate and the top of concrete base must be provided to assure that the void is completely filled with grout.

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- D. Guardrails and Railings: After posts and rails have been properly inserted into holes or sleeves, fill the annular space between posts and cast-in-place sleeves and/or below base plates with non-shrink grout. Bevel grout at juncture with post so that moisture flows away from posts.
- E. Construction Joints: Ordinary cement-sand grout may be used in place of mortar over the contact surface of the old concrete at the interface of horizontal construction joints as outlined in Section 03251 - Concrete Joints, and Section 03300 - Cast-In-Place Concrete, of these Specifications.
- F. Curing: Cure all grout in accordance with manufacturer's written instructions. Wet cure ordinary cement-sand grout and non-shrink non-metallic grout for a minimum of three (3) days unless directed otherwise by the ENGINEER.

+ + END OF SECTION + +

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SECTION 04200
CONCRETE MASONRY UNITS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes: All masonry work shown on the Drawings. It also includes providing openings in masonry, to accommodate the Work under other Sections, and building into the masonry all items such as sleeves, anchor bolts, inserts and all other embedded items for which placement is not specifically provided under other Sections.

1.2 REFERENCES

- A. American Concrete Institute (ACI)
1. ACI 315, "Manual of Standard Practice for Detailing Reinforced Concrete Structures."
- B. American Society for Testing and Materials (ASTM)
1. ASTM A36, Carbon Structural Steel, Standard Specification for.
 2. ASTM A82, Steel Wire, Plain, for Concrete Reinforcement, Standard Specification for.
 3. ASTM A153, Zinc Coating (Hot Dip) on Iron and Steel Hardware, Standard Specification for.
 4. ASTM A167, Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip, Standard Specification for.
 5. ASTM A240, Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels, Standard Specification for.
 6. ASTM A366, Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality, Standard Specification for.
 7. ASTM A569, Steel, Carbon (0.15 Maximum Percent), Hot-Rolled Sheet and Strip, Commercial Quality, Standard Specification for.
 8. ASTM A580, Stainless Steel Wire, Standard Specification for.
 9. ASTM A615, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement, Standard Specification for.
 10. ASTM A663, Steel Bars, Carbon, Merchant Quality, Mechanical Properties, Standard Specification for.
 11. ASTM C5, Quicklime for Structural Purposes.
 12. ASTM C67, Standard Methods of Sampling and Testing Brick.
 13. ASTM C90, Load-bearing Concrete Masonry Units, Standard Specification for.
 14. ASTM C91, Masonry Cement.
 15. ASTM C136, Sieve or Screen Analysis of Fine and Coarse Aggregates.
 16. ASTM C140, Sampling and Testing Concrete Masonry Units, Standard Test Methods of.
 17. ASTM C144, Aggregate for Masonry Mortar.
 18. ASTM C150, Portland Cement.
 19. ASTM C180, Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
 20. ASTM C207, Hydrated Lime for Masonry Purposes.
 21. ASTM C270, Mortar for Unit Masonry.
 22. ASTM C331, Lightweight Aggregates for Concrete Masonry Units, Standard Specification for.

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23. ASTM C404, Aggregates for Masonry Grouts.
24. ASTM C426, Linear Drying Shrinkage of Concrete Masonry Units, Standard Test Method for.
25. ASTM C476, Grout for Masonry.
26. ASTM C744, Prefaced Concrete and Calcium Silicate Masonry Units, Standard Specification for.
27. ASTM C1019, Standard Test Method of Sampling and Testing Grout.
28. ASTM D2240, Rubber Property - Durometer Hardness, Standard Test Method for.
29. ASTM E84, Surface Burning Characteristics of Building Materials, Standard Test Method for.
30. ASTM E119, Fire Tests of Building Construction and Materials, Standard Test Methods for.

C. Brick Institute of America

1. "Technical Notes on Brick and Tile Construction."
2. Technical Bulletin 1A, "Construction and Protection Recommendations for Cold Weather Masonry Construction."

D. National Concrete Masonry Association,

1. "Guide Specifications"
2. "Technical Bulletins."

E. Underwriters Laboratories (UL)

1. Design Numbers U901 through U914.

1.3 SYSTEM DESCRIPTION

A. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the masonry Work.
2. Masonry Work advanced without built-in flashings and other items shall be removed and rebuilt, at no additional cost to OWNER, even if discovered after masonry has been completed.
3. Coordinate the work of other Sections to avoid delay of the masonry Work.

1.4 SUBMITTALS

A. Shop Drawings:

1. Complete layout of all masonry walls showing modular planning and all special shapes to be used. Show all details for each condition encountered in the Work. Provide plans and elevations drawn at 1/4-inch scale and details drawn at 1½-inch scale. Show all items required to be built into masonry.
2. Masonry control joint locations and details.
3. Fabrication, bending, and placement of reinforcing bars. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcing for masonry Work.
4. Explanation of where each masonry accessory will be used in the Work, quantities purchased and intended spacings.

B. Samples:

1. One unit of each type of concrete masonry unit specified.

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2. One unit or one modular length of each accessory item specified.
 3. Each type of colored mortar, showing the range of color that can be expected in the Work.
- C. Product Data:
1. Complete selection of manufacturer's standard and custom colors.
 2. Mix designs for grout and mortar.
 3. Manufacturer's specifications and instructions for each manufactured product. Include data substantiating that materials comply with specified requirements.

1.5 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies:
1. Comply with the applicable requirements of International Building Code, including the requirements for Special Inspection.
 2. Wherever a fire-resistance classification is shown or scheduled for masonry Work (4-hour, 3-hour, and similar designations), comply with applicable requirements for materials and installation established by UL and other governing authorities.
- B. Source Quality Control:
1. Obtain all concrete masonry units from one manufacturer, cured by one process and of uniform texture and color or in an established uniform blend thereof. Cure units by autoclave treatment at minimum temperature of 350°F, and a minimum pressure of 125 psi.
 2. Do not change source or brands of materials during the course of the Work.
 3. No change shall be made in the proportions for mortar or grout, unless resubmitted and re-approved by the ENGINEER.
- C. Construction Tolerances:
1. Variation from Plumb: For lines and surfaces of columns, walls, and expansion joints, do not exceed 1/4-inch in 10-feet, or 3/8-inch in one story height or 20-feet maximum, nor 1/2-inch in 40-feet or more.
 2. Variation from Level: For lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 1/4-inch in any bay or 20-feet maximum, nor 1/2-inch in 40-feet or more.
 3. Variation of Linear Building Line: For position shown and related portion of columns, walls and partitions, do not exceed 3/8-inch in any bay or 20-feet maximum, nor 1/2-inch in 40' or more.
 4. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, do not exceed +1/2-inch-1/4-inch from dimensions shown.
- D. Preconstruction Conference: Prior to the installation of masonry Work, CONTRACTOR shall schedule a Preconstruction Conference at the project site.
1. Review foreseeable methods and procedures related to the masonry Work including, but not necessarily limited to, the following:
 - a. Project requirements, including Contract Documents.
 - b. Method of sequence of masonry construction.
 - c. Special masonry details.
 - d. Required submittals, both completed and yet to be completed.
 - e. Standards of workmanship.
 - f. Quality control requirements.

- g. Job organization and availability of materials, tradesmen, equipment and facilities needed to make progress and avoid delays.
- h. Modular planning requirements.
- i. Weather and forecasted weather conditions and procedures for coping with unfavorable conditions.
- j. Required inspection, testing and certifying procedures.
- k. Regulations concerning building code compliance.
- 2. Attendance is mandatory for the following:
 - a. CONTRACTOR'S job superintendent.
 - b. Masonry subcontractor's job superintendent.
 - c. Masonry subcontractor's foreman.
 - d. Authorized representative of concrete unit masonry supplier.
 - e. ENGINEER'S authorized representative.
- 3. Reconvene the meeting at the earliest opportunity if additional information must be developed in order to conclude the subjects under consideration and to resolve any outstanding issues.
- 4. CONTRACTOR shall record the discussions of the conference and the decisions and agreements (or disagreements) and furnish a copy of the record to each party attending.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:

- 1. Deliver concrete masonry units in original, unopened and undamaged packages and pallets, plainly marked with identification of materials and name of approved manufacturer. Delivery shall be by the manufacturer or manufacturer's agent.
- 2. Deliver reinforcing to the site, bundled, tagged and marked. Use metal tags indicating size, lengths and other markings shown on approved Shop Drawings.
- 3. Manufactured materials, such as cement and lime, shall be delivered and stored in their original containers plainly marked with identification of materials and manufacturer.

B. Storage of Materials:

- 1. Store materials off the ground, protected from dirt, construction traffic and contamination. Cover using tarpaulins or polyethylene sheets to prevent damage such as wetting, staining, and chipping.
- 2. Do not stack concrete masonry units higher than recommended by manufacturer.

C. Handling Materials:

- 1. Handle materials in a manner that minimizes chips, cracks, voids, discolorations or other defects that might be visible or cause staining in finished Work.

1.7 JOB CONDITIONS

- A. Site Facilities: Supplemental heat sources, as may be required, should CONTRACTOR wish to continue masonry Work in cold weather if not available at the project site. The provision of all supplemental heat energy sources and equipment is the responsibility of CONTRACTOR.

B. Environmental Requirements:

- 1. Do not place any masonry Work when air temperature is below 28°F, on rising temperatures or below 36°F, on falling temperatures, without temporary heated

enclosures or without heating materials or other precautions necessary to prevent freezing.

2. No frozen materials shall be used, nor shall frozen masonry Work be built upon.
3. Remove and replace all masonry Work damaged by frost or freezing.

C. Protection:

1. Protect all masonry against freezing for at least 48 hours after being placed.
 - a. Mean Daily Air Temperature 40°F to 32°F: Protect masonry from rain for 48 hours after installation.
 - b. Mean Daily Temperature 32°F to 20°F: Completely cover masonry with insulating blankets for 48 hours.
 - c. Mean Daily Air Temperature 20°F and Below: Maintain masonry above 32°F for 48 hours by enclosure and supplementary heat.
2. Protect partially completed masonry against rapid heat loss and from water entering it when Work is not in progress, by covering top of walls with strong, waterproof, nonstaining membrane. Extend membrane at least 2' down both sides of walls and secure in place using wall cover clamps spaced at intervals of 4' and at each end and joint of covering.
3. Do not apply distributed floor or roof loading for at least 3 days after completing masonry columns or walls.
4. Do not apply concentrated loads for at least 7 days after completing masonry columns or walls.

D. Cold Weather Masonry Work:

1. All mortar for use in masonry Work, when the mean daily temperature is below 40°F, shall be portland cement- lime-sand mortars using high early strength portland cement.
2. Air Temperature 40°F to 32°F: Heat sand or mixing water to 70°F-160°F.
3. Air Temperature 32°F to 20°F: Heat sand and mixing water to 70°F-160°F. Provide heat on both sides of wall under construction to heat constructed masonry to 40°F. Employ wind breakers when wind is in excess of 15 mph.
4. Air Temperature below 20°F: Heat sand and mixing water to 70°F-120°F. Provide enclosure and auxiliary heat to maintain air temperature above 32°F. Heat constructed masonry to 40°F. Temperature of masonry units when laid shall not be less than 20°F.

E. Hot Weather Masonry Work:

1. Preparation – Prior to conducting masonry work:
 - a. When the ambient air temperature exceeds 100°F, or exceeds 90°F with a wind velocity greater than 8 mph:
 - 1) Maintain sand piles in a damp, loose condition.
 - 2) Provide necessary conditions and equipment to produce mortar having a temperature below 120°F.
 - b. When the ambient air temperature exceeds 115°F, or exceeds 105°F with a wind velocity greater than 8 mph implement the requirements above and shade materials and mixing equipment from direct sunlight.
2. Construction – While masonry work is in progress:
 - a. When the ambient air temperature exceeds 100°F, or exceeds 90°F with a wind velocity greater than 8 mph:
 - 1) Maintain temperature of mortar and grout below 120°F.
 - 2) Flush mixer, mortar transport container, and mortar boards with cool water before they come into contact with mortar ingredients or mortar.

- 3) Maintain mortar consistency by retempering with cool water.
- 4) Use mortar within 2 hours of initial mixing.
- b. When the ambient temperature exceeds 115°F, or exceeds 105°F with a wind velocity greater than 8 mph implement the requirements listed above and use cool mixing water for mortar and grout. Ice is permitted in the mixing water prior to use. Ice is not permitted in the mixing water when added to the other mortar or grout materials.
3. Protection – When the mean daily temperature exceeds 100°F, or exceeds 90°F with a wind velocity greater than 8 mph, fog spray newly constructed masonry until damp, at least three times a day until the masonry is three days old.

PART 2 - PRODUCTS

2.1 GENERAL CONCRETE UNIT MASONRY

- A. General: Unless specifically modified by other requirements specified, provide concrete masonry units in compliance with the following classifications, weights, grades, colors, textures, scores, thermal resistance values and other features specified.
- B. Hollow Load-bearing Concrete Masonry Units: Provide the following:
 1. ASTM C90 medium weight.
 2. Minimum Compressive Strength: 1,900 pounds per square inch average of three units; 1,700 pounds per square inch minimum for an individual unit. The manufacturer shall certify that the masonry units meet all requirements of ASTM C90 including the moisture content and linear shrinkage requirements for intermediate conditions.
- C. Color and Texture: Provide the following:
 1. Manufacturer's complete selection of all standard and all custom colors. Submit preliminary color selection for review by ENGINEER.
 2. Color, surface texture and aggregate uniform within the normal range established by sample submission and as approved by ENGINEER.
- D. Special Shapes: Provide the following where required:
 1. Lintels, bond beams, reinforcing units, and flush-end reinforcing units, interior and exterior corner shapes, solid jambs, sash block, coves, premolded control joint blocks, headers, and other special conditions.
 2. Split-face, scored, and other facings, and special sizes, as shown on the Drawings.
- E. Waterproofing Admixture: Manufacture all types of concrete unit masonry, used in construction of exterior walls with an integral waterproofing admixture as follows:
 1. Material: Cross-linking acrylic polymer.
 2. Proportion: In strict accordance with manufacturer's instructions.
 3. Product and Manufacturer: Provide one of the following:
 - a. DRY-BLOCK Admixture by W. R. Grace & Company Construction Products Division.
 - b. Moxie Shield 1800 by Moxie International.
 - c. Or equal.

2.2 MORTAR

- A. General: Anti-freeze admixture or agents, including calcium chloride are not permitted.
- B. Mortar for All Unit Masonry: Type S. Comply with ASTM C270, Table 2, except limit materials to those specified herein.
 - 1. Portland cement-Lime: Provide the following proportions by volume:
 - a. Portland Cement: 1 part.
 - b. Hydrated Lime or Lime Putty: 1/4 to 1/2.
 - c. Aggregate (sand in damp, loose condition): 2¼ to 3 times the sum of cementitious materials.
 - d. Pigment: as required to match approved sample.
 - 2. Properties:
 - a. Average Compressive Strength, ASTM C270: 1,800 pounds per square inch.
 - b. Minimum Water Retention, ASTM C270: 75%.
 - c. Maximum Air Content, ASTM C270: 12% for Portland cement - lime mortars.

2.3 MASONRY GROUT

- A. Proportion coarse grout mixes subject to the following limitations:
 - 1. Specified 28-day Compressive Strength: 2,000 psi
 - 2. Minimum Cementitious Content: 550 lb/cu yd
 - a. Fly ash per ASTM C618 may be used replace cement but shall not exceed 20% by weight of cement plus fly ash.
 - 3. Maximum Water-Cement Ratio by Weight: 0.52
 - 4. Slump at point of placement: 8" to 11"
- B. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the Project for grout required. Comply with ACI 211.1.

2.4 MATERIALS

- A. Portland Cement:
 - 1. ASTM C150: Use Type II.
 - 2. Nonstaining and of natural color or as required to be compatible with the approved pigment.
- B. Hydrated Lime: ASTM C207, Type S, or lime putty ASTM C5.
- C. Aggregates: ASTM C33 and as herein specified.
 - 1. Do not use aggregates containing soluble salts or other substances such as iron sulfides, pyrite, marcasite, ochre, or other materials that can cause stains on exposed surfaces.
 - 2. Fine Aggregate: Clean, sharp, natural sand, free from loam, clay, lumps or other deleterious substances. For mortar, ASTM C144, except for mortar for joints less than 1/4-inch use aggregate graded with 100% passing the No. 16 sieve.
 - 3. Colored/ White Mortar Aggregates: Provide ground marble, granite or other sound stone, as required to match the approved sample.
 - 4. Coarse Aggregate: Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:
 - a. Crushed stone, processed from natural rock or stone.

- b. Washed gravel, natural or crushed. Use of slag and pit or bank run gravel is not permitted.
- c. Coarse Aggregate Size: ASTM C33, No. 8 or 89.

D. Admixtures:

- 1. Provide admixtures produced by established reputable manufacturers and use in compliance with the manufacturer's printed instruction. Do not use admixtures that have not been incorporated and tested in the accepted mixes. Refer to Section 03300, Cast-In-Place Concrete, for additional admixture requirements.
- 2. Waterproofing Admixture for Exterior Concrete Unit Masonry: Provide a cross-linking acrylic polymer integral waterproofing system, proportioned and mixed in strict accordance with manufacturer's instructions. Provide one of the following:
 - a. DRY-BLOCK Mortar Admix by W.R. Grace & Company Construction Products Division.
 - b. Moxie Shield 1800 by Moxie International.
 - c. Or equal.

E. Colored Mortar Pigments:

- 1. Commercial iron oxide, manganese dioxide, ultramarine blue, chromium oxide, or carbon black, compounded for use in mortar mixes.
- 2. Do not exceed pigment to cement ratios, by weight, of 1 to 35 for carbon black and 1 to 7 for other pigments.
- 3. Product and Manufacturer: Provide one of the following:
 - a. Truetone Mortar Colors by Frank D. Davis Co., subsidiary of Rockwood Industries, Inc.
 - b. Sonobrite by Sonneborn Building Products Division Rexnord Chemical Products, Inc.
 - c. Or equal.

F. Water: Clean and free from injurious amounts of oils, acids, alkalis, or organic matter.

2.5 REINFORCING

- A. Reinforcing Bars: ASTM A615, Grade 60 for all bars. Shop-fabricate reinforcing bars that are shown or required to be bent or hooked. Comply with ACI 315 for the fabrication of reinforcing steel for masonry Work.
- B. Wire products: Ties, and rebar positioners shall be fabricated from cold-drawn steel wire complying with ASTM A82 and hot-dipped galvanized after fabrication with 1.5 ounces per square foot of zinc coating complying with ASTM A153.
- C. Rebar Positioners: Nine gage reinforcing bar positioners which accommodate both horizontal and vertical reinforcing steel. Provide one of the following:
 - 1. #RB Series Rebar Positioners by Hohmann & Barnard, Inc.
 - 2. Or equal.

2.6 MISCELLANEOUS ACCESSORIES

- A. Compressible Filler: Provide watertight joint filler where masonry abuts structural framework members, and as shown. Provide the following:
 - 1. Polyurethane foam strip saturated with polybutylene waterproofing material which when installed at A compression ratio of 2:1 is impermeable to water.

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2. Resilient to -40°F with 100% movement recovery.
 3. Elongation of 140% with a tensile strength of not less than 53 psi.
 4. Product and Manufacturer: Provide one of the following:
 - a. Polyseal by Sandell Construction Solutions.
 - b. Or equal.
- B. Premolded Control Joint Strips: Provide complete selection of solid extruded rubber strips with a Shore A durometer hardness of 80 to 90 complying with ASTM D2240, designed to fit standard sash block and maintain lateral stability in masonry wall. Provide one of the following:
1. #RS Series - Rubber Control Joints by Hohmann & Barnard, Incorporated.
 2. Or equal.
- C. Sealants: Refer to Section 07900, Joint Sealants.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine areas and conditions under which masonry Work is to be installed, and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.
- B. Special Masonry Inspection:
1. The OWNER will employ a testing laboratory to perform Special Masonry Inspections in accordance with Chapter 17 of the current Building Code.
 2. Masonry inspection services will be provided during the following construction activities:
 - a. During laying of units:
 - 1) During the first day of the masonry construction, inspect proportions of site prepared mortar, construction of mortar joints, location of all reinforcing and connectors, size and location of structural elements, type, size and location of anchors, protection of masonry during cold weather.
 - 2) Inspection to be continuous the first full day of masonry construction which requires special inspection.
 - a) Thereafter, a minimum of 3 hours every third day of construction until the concrete masonry work is complete.
 - 3) Inspection while laying masonry units may be made concurrently with other inspection duties provided all inspection duties are adequately performed.
 - 4) When deficiencies are found, additional inspection shall be provided as required until deficiencies have been corrected.
 - 5) If masonry crews change, an additional full day of inspection is required during the first day the new crew is on-site.
 - b. Placement of reinforcing steel:
 - 1) Verification of all reinforcing including size, grade, lap lengths, and type.
 - 2) Inspection may be periodic as required to verify all reinforcing at Risk Category II and III structures. Inspection of all reinforcing shall be continuous at Risk Category IV structures.
 - 3) Inspector to be present during the concrete pour in which any dowels connecting concrete to masonry are cast to verify proper location of dowels.

- c. Prior to each grouting operation, verify that grout space is clean, reinforcing and connectors are properly placed, proportions of site-prepared grout are correct and mortar joints have been properly constructed.
 - 1) Inspection may be periodic as required to verify proper grout space at Risk Category II and III structures.
 - 2) Inspection shall be continuous prior to and during grout placement at Risk Category IV structures.
- d. Verify compliance with International Building Code and Specifications continuously during all grouting operations.
- e. Provide special inspection in accordance with ACI 530 Table 3.1.2 for Risk Category II and III structures and ACI 530 Table 3.1.3 for Risk Category IV structures including observation of masonry work for conformance to the Contract Documents:
 - 1) Provide inspection reports to the ENGINEER, Building Official and OWNER.
 - a) Notify Contractor of discrepancies for correction.
 - b) Notify ENGINEER, Building Official and OWNER, in writing, when discrepancies have been satisfactorily corrected.
 - 2) Submit final signed report stating that Work requiring special inspection was, to the best of the inspector's knowledge, in conformance to the Contract Documents and the applicable workmanship provisions of the International Building Code.

3.2 INSTALLATION, GENERAL

- A. Build chases and recesses as shown or required by others. Provide not less than 8-inch of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses.
- B. Leave openings for equipment, piping, ducts, and other items to be installed subsequent to starting of masonry Work. After installation of said items, complete masonry Work to match Work immediately adjacent to openings.
- C. Cut masonry units using motor driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining Work neatly. Use full size units without cutting wherever possible.

3.3 LAYING MASONRY WALLS

- A. General:
 - 1. Lay out walls in advance for accurate spacing of surface pattern bond with uniform joint widths and to properly locate openings, masonry control joints, returns and offsets. Avoid the use of less than half size units at corners, jambs and wherever possible at other locations.
 - 2. Lay up walls plumb and true to comply with specified tolerances, with courses level, accurately spaced and coordinated with other Work.
 - 3. Pattern Bond:
 - a. Lay all concrete masonry Work in running bond with vertical joints in each course centered on units in courses above and below unless otherwise shown.
 - b. Bond and interlock each course of each wythe at corners.
 - c. Do not use units with less than 8-inch horizontal face dimensions at corners or jambs.

B. Mortar Bedding and Jointing:

1. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout.
 - a. Lay walls with 3/8-inch joints.
2. Cut joints flush for masonry walls that are to be concealed or to be covered by other materials, except paint, unless otherwise shown.
3. Tool exposed joints when mortar is "thumbprint" hard, slightly concave, unless otherwise required to match existing joint treatment. Rake out mortar in preparation for application of caulking or sealants where required.
4. Concave-tool exterior joints below grade.
5. Do not use mortar that has begun to set or if more than 30 minutes have elapsed since initial mixing. Do not retemper mortar.
6. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

C. Stopping and Resuming Work: Rack back 1/2-unit masonry length in each course, and do not tooth. Clean exposed surfaces of set masonry, wet units lightly, if required, and remove loose masonry units and mortar prior to laying new masonry.

D. Built-in Work: As the Work progresses, build in items shown, specified or required by others. Fill cores in one block width solidly with masonry grout around built-in items.

E. Structural Reinforced Masonry:

1. Shape and dimension reinforcement as shown and are required by governing codes.
2. Position reinforcing accurately at the spacing shown. Support and secure vertical bars against displacement with rebar positioners.
3. For columns, piers and pilasters, provide a clear distance between vertical bars as shown, but not less than 1½-inch. Provide lateral ties.
4. For horizontal bars, provide fully-lapped "L" shaped corner bars at corners and intersections.
5. Provide lapped splices with reinforcing steel placed in contact with rebar positioners or tied. Provide 48 bar diameter lap length, unless otherwise shown.

F. Grouting Structural Reinforced Masonry:

1. Place grout within 1.5 hours from introducing water in the mixture and prior to initial set. Discard grout that does not meet the specified slump, has exceeded the 1.5 hour timeframe or has reached initial set.
2. Solid grout all walls, beams, piers and pilasters, unless noted otherwise.
3. Provide temporary dams where required or barriers to control horizontal flow of grout at ends of wall sections. Build dams full height of grout pour. If masonry units are used, do not bond into permanent masonry wythes. Remove temporary dams after completion of grout pour.
4. Grout pour height shall not exceed 5.33 feet for grouting cells of hollow units with dimensions equal to or greater than 2.5"x3".
5. Grout pour height shall not exceed 1 foot for grouting cells of hollow units with dimensions less than or equal to 1.5"x3".
6. Terminate pour 1½-inch below top of highest course in pour.
7. Provide metal wall ties, if required, to prevent blow outs.

3.4 ANCHORING MASONRY WORK:

- A. Anchor masonry to structural members where masonry abuts or faces, such members to comply with the following:
 - 1. Provide an open space, not less than 1/2-inch in width, between masonry and structural member, unless otherwise shown. Keep open space free of mortar or other rigid materials.
 - 2. Anchor masonry to structural members with metal ties embedded in masonry joints and attached to structure. Provide anchors with flexible tie sections, unless otherwise shown.
 - 3. Space anchors as shown, but not more than 8-inch on center vertically and 36-inch on center horizontally.
 - 4. Provide end blocks, where masonry abuts structural support, to facilitate installation of compressible filler, backer rod and sealant.
- B. Lintels and Bond Beams: Provide masonry lintels and bond beams where shown. Use specially formed "U" shaped lintel and bond beam units with reinforcing bars placed as shown, filled with grout. Temporarily support formed-in-place lintels and bond beams.

3.5 REPAIR, POINTING AND CLEANING

- A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point up all joints at corners, openings and adjacent Work to provide a neat, uniform appearance, properly prepared for application of sealant compounds.
- C. Cleaning Exposed, Unglazed Masonry Surfaces:
 - 1. Wipe off excess mortar as the Work progresses. Dry brush at the end of each day's Work.
 - 2. Final Cleaning: After mortar is thoroughly set and cured, clean sample wall area of approximately 20-square feet as described below. Obtain ENGINEER'S acceptance of sample cleaning before proceeding to clean remainder of masonry Work.
 - a. Dry clean to remove large particles of mortar using wood paddles and scrapers. Use chisel or wire brush if required.
 - b. Presoak wall by saturating with water and flush off loose mortar and dirt.
 - c. Acid type cleaners shall not be permitted.
 - d. Protect other Work from cleaning operations.
- D. Protection: Protect the masonry Work from deterioration, discoloration or damage during subsequent construction operations.

+ + END OF SECTION + +

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SECTION 05051

ANCHORS, INSERTS, AND DOWELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes all post-installed anchors and inserts required to anchor parts of the Work to supporting concrete or masonry construction, and plaster. This Section also includes adhesives for anchoring reinforcing dowels into existing concrete.

1.2 REFERENCES

- A. American Society for Testing and Materials
 - 1. ASTM A36, Standard Specification for Carbon Structural Steel.
 - 2. ASTM A320, Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service.
 - 3. ASTM D746, Standard Test Method for Brittleness of Temperature of Plastics and Elastomers by Impact
 - 4. ASTM D1505, Standard Test Method for Density of Plastics by the Density-Gradient Technique
 - 5. ASTM D1525, Standard Test Method for Vicat Softening Temperature of Plastics
- B. 2018 International Building Code (IBC)
- C. American Concrete Institute (ACI)
 - 1. ACI 355.2, Qualification of Post-Installed Mechanical Anchors in Concrete
 - 2. ACI 355.4, Qualification of Post-installed Adhesive Anchors in Concrete

1.3 SYSTEM DESCRIPTION

- A. Provide the size, type, and length of anchor shown on the drawings or, if not shown, as specified in the detailed sections of these specifications.
- B. When the size, length or load carrying capacity of an anchor bolt, expansion anchor, toggle bolt, or concrete insert is not shown or specified, provide the size, length and capacity required to carry the design load times a minimum safety factor of 4.
- C. For equipment anchors, if the design load is not specified by the manufacturer, provide anchors of diameter no less than the diameter of the hole minus 3/16 inch. When the design load is not specified by the manufacturer, provide structural calculations in accordance with Section 01610.

1.4 SUBMITTALS

- A. Product Data: Submit for approval copies of material certification, manufacturer's specifications, load tables, dimension diagrams and installation instructions for the devices.

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- B. Installer's Qualifications: When installing adhesive anchors subject to sustained tension loading or when specifically noted in the Drawings, submit for approval copies of the installer's qualifications certified by the ACI/CRSI Adhesive Anchor Installer Certification program.

1.5 QUALITY ASSURANCE

- A. Post-installed concrete anchors shall be ICC approved for seismic applications in cracked concrete and prequalified in accordance with ACI 355.2 or ACI 355.4.

PART 2 - PRODUCTS

2.1 ANCHOR BOLTS

- A. Nonsubmerged Use in areas of wet use, washdown areas, or areas outside heated buildings:
 - 1. Stainless steel Type 316, unless otherwise shown.
 - 2. Diameter, Length and Bend Dimensions: As required by equipment or machinery manufacturer. Unless otherwise required, provide 3/4-inch minimum diameter by 12-inches long and other geometry as shown.
 - 3. Furnish A320 nuts and washers of same material for each bolt, unless otherwise shown.
 - 4. Provide sleeves as required or as shown for location adjustment.
- B. Submerged Use:
 - 1. Submerged use is defined as any connection 1 foot 6 inches below the normal water surface elevation in a water holding basin.
 - 2. As specified for nonsubmerged use, for equipment, machinery or other connections except as follows:
 - a. Coating of anchor bolt threads is not required.
 - b. Where threads are covered with fusion bonded coating, provide nut of proper size to fit and provide connection of equal strength to embedded bolt.
- C. For anchoring fabricated metalwork, structural steel, or other components where connections will be protected or dry:
 - 1. Galvanized Steel, 36 ksi, minimum.
 - 2. Minimum Size: 3/4-inch diameter by 12-inch long, unless otherwise shown.
 - 3. At base plates with grout pads, furnish two nuts and two washers per bolt of same material as bolt, unless otherwise shown.

2.2 ANCHOR BOLT SLEEVE

- A. High Density Polyethylene Plastic:
 - 1. Single unit construction with deformed sidewalls such that the concrete and grout lock in place.
 - 2. The top of the sleeve shall be self-threading to provide adjustment of the threaded anchor bolt projection.
 - 3. Material requirements shall conform to the following:
 - a. Plastic: High density polyethylene.
 - b. Density: 0.956, ASTM D1505.
 - c. Vicant Softening Point: 256°F, ASTM D1525

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d. Brittleness Temperature: -180°F, ASTM D746

B. Fabricated Steel Sleeve:

1. Material: A36 steel.
2. Dimensions, welding, and sizes as shown.

2.3 STAINLESS STEEL FASTENERS LUBRICANT (ANTISEIZING)

- A. Provide for stainless steel nuts and machined bolts, anchor bolts, concrete anchors, and all other threaded fasteners.
- B. Lubricant shall contain substantial amounts of molybdenum disulfide, graphite, mica, talc, or copper as manufactured by:
1. Loc Tite Co., Permatex.
 2. Or equal

2.4 ADHESIVE (EPOXY) ANCHORS AND DOWELS

- A. Provide adhesive anchors where specifically shown and where adhesive anchors are allowed. Unless otherwise shown, adhesive anchors are allowed for anchoring:
1. Supports for pipe, conduit, and electrical boxes, devices, and panels, on floors and walls
 2. Handrails, guardrails, sunshades, stairs,
 3. Fixtures and equipment on floors and walls, and
 4. Single pipes and conduits <2 inch in diameter to ceilings and soffits.
- B. Adhesive shall be epoxy resin. Vinylester resin anchors are NOT allowed.
- C. Product and Manufacturer: Provide one of the following:
1. Installation to Concrete:
 - a. HIT-HY 200 as manufactured by Hilti, Inc.
 - b. SET-3G as manufactured by Simpson Strong-Tie, Inc.
 - c. Or approved equal meeting ACI 355.4.
 2. Installation to solid-grouted Masonry:
 - a. HIT-HY 270 as manufactured by Hilti, Inc.
 - b. SET-XP as manufactured by Simpson Strong-Tie, Inc.
 - c. Or approved equal.

2.5 EXPANSION ANCHORS

- A. Provide expansion anchors only where specifically shown and where expansion anchors are allowed. Unless otherwise shown, and except as noted below, expansion anchors are allowed for anchoring:
1. Supports for pipe, conduit, and electrical boxes, devices, and panels, to floors and walls.
 2. Handrails, guardrails, and sunshades.
 3. Fixtures and equipment which have no moving parts, to floors and walls.
- B. Expansion anchors are NOT allowed in any submerged or chemical containment areas.
- C. Leveling nuts shall not be used with expansion anchors. If leveling nuts are required, provide adhesive anchors, unless otherwise shown.

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- D. Wedge anchors: Provide one of the following:
 - 1. Installation to Concrete:
 - a. Hilti Kwik Bolt TZ by Hilti, Inc.
 - b. Strong-Bolt 2 by Simpson Strong-Tie, Inc.
 - c. Or approved equal meeting ACI 355.2.
 - 2. Installation to solid-grouted Masonry:
 - a. Hilti Kwik Bolt-3 by Hilti, Inc.
 - b. Wedge-All by Simpson Strong-Tie, Inc.
 - c. Or approved equal.
- E. Drop-in anchors, only where specific shown on the drawings: Provide one of the following:
 - 1. HDI by Hilti, Inc.
 - 2. Drop-In by Simpson Strong-Tie, Inc.
 - 3. Or equal.

2.6 SCREW ANCHORS

- A. Provide screw anchors only where specifically shown. Provide ICC approved screw anchors suited for seismic and cracked concrete applications.
- B. Installation to Concrete or Masonry:
 - 1. KH-EZ by Hilti, Inc.
 - 2. Titen HD by Simpson Strong-Tie, Inc.
 - 3. Or approved equal.

2.7 TOGGLE BOLTS

- A. Provide toggle bolts only where specifically shown, to fasten single pipes and conduits <1 inch and equipment weighing less than 50 lbs (4-bolts required) to hollow walls.
- B. Provide spring-wing toggle bolts, with two-piece wings, carbon steel bolts with zinc coating in accordance with Federal Specification FF-S-325.
- C. Product and Manufacturer: Provide toggle bolts of one of the following:
 - 1. The Rawlplug Company, Incorporated.
 - 2. Haydon Bolts, Incorporated.
 - 3. Or equal.

2.8 OTHERS

- A. Powder actuated fasteners and other types of anchors not specified herein shall not be used, unless approved by ENGINEER.

2.9 ACCESSORIES

- A. Provide Belleville washers, or approved equal, at anchorage connections used to transfer anchorage loads at sheet metal equipment housings.

PART 3 - EXECUTION

3.1 INSTALLATION OF ANCHORS

- A. Obtain anchor bolts in sufficient time so as not to delay concrete or masonry work.
- B. Adhesives shall be stored and installed at the service temperature ranges recommended by the manufacturer.
- C. Locate and accurately set the anchor bolts using templates or other devices as necessary.
- D. Protect threads and shank from damage during installation of equipment and structural steel.
- E. Post-installed anchors are NOT acceptable substitutes for cast-in-place anchor bolts.
- F. Assure that embedded items are protected from damage and are not filled in with concrete.
- G. Unless otherwise shown, the minimum diameter of anchor bolts for structural steel is $\frac{3}{4}$ inch, and for other applications, $\frac{3}{8}$ inch.
- H. Unless otherwise shown, provide the following minimum embedment, where "d" is the nominal anchor diameter:
 - 1. Cast-in-place anchors: 12d.
 - 2. Adhesive anchors: 12d.
 - 3. Expansion anchors: 8d.
- I. Unless otherwise shown, provide a minimum edge distance equal to six times the bolt diameter for adhesive anchors, eight times the bolt diameter for expansion anchors and a bolt spacing equal to twelve times the bolt diameter.
- J. Concrete shall have a minimum age of 21 days at the time of post-installed anchor installation.
 - 1. Concrete temperature at the time of adhesive anchor installation shall be at least 50°F.
- K. Existing reinforcing bars in the concrete structure may conflict with specific anchor locations. Unless noted on the Drawings that the bars can be cut, the contractor shall review the existing structural drawings and shall undertake to locate the position of the reinforcing bars at the locations of the concrete anchors by ferrosan, ground penetrating rebar (GPR), x-ray, chipping or other means.
- L. Drilling equipment used and installation of post-installed anchors shall be in accordance with the manufacturer's printed instructions.
- M. For the adhesive and expansion anchors, CONTRACTOR shall comply with the manufacturer's printed installation instructions on the drilled hole diameter and depth.
- N. CONTRACTOR shall properly clean out the hole utilizing a wire brush and compressed air in accordance with the manufacturer's printed installation instructions to remove all loose

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material from the hole, prior to installing adhesive or expansion anchors. Drilled and cleaned anchor holes shall be protected from contamination until the anchor is installed. A drilled anchor hole shall be re-cleaned assuming the hole was just drilled, if in the opinion of ENGINEER or Inspector that the hole has become contaminated after initial cleaning.

- O. Unless otherwise indicated by the manufacturer, adhesive shall be dispensed through a tube or cartridge extension, beginning at the maximum depth of the hole and withdrawn as adhesive is injected, followed by insertion and rotating the anchor to the specified depth. Where necessary, spaces around anchors at the surface shall be sealed at horizontal to vertically overhead locations to prevent loss of the adhesive during curing.
- P. Anchors to be installed in the adhesive shall be clean, oil-free, and free of loose rust, paint, or other coatings.
- Q. Installed anchors shall be securely fixed in-place to prevent displacement. Unless shown otherwise on the Drawings, anchors shall be installed perpendicular to the concrete surface.
- R. Reinforcing adhesive dowel bars or all-threaded adhesive bars shall not be bent after being adhesively embedded in hardened, sound concrete.
- S. In lieu of the use of stacked standard washers, if threads of an anchor bolt protrude beyond the attachment, the installers shall use a fabricated filler plate of equal or greater size of the washer. Hole on the filler plate shall be 1/16" (or 2 to 3 mm) greater than the bolt size. Coat as appropriate in accordance with the material and installation location requirements.

3.2 FIELD QUALITY CONTROL

- A. Anchors shall be installed by qualified personnel in accordance with the manufacturer's printed installation instructions. Installation of adhesive anchors shall be performed by personnel trained to install adhesive anchors.
- B. Installation of adhesive anchors horizontally or upwardly inclined to support sustained tension loads shall be performed by personnel certified by the ACI/CRSI Adhesive Anchor Installer Certification program.
- C. CONTRACTOR shall employ a special inspector to perform field inspection services in accordance with Chapter 17 of the IBC for all post-installed anchors.
 - 1. The special inspector must be periodically on the jobsite during post-installed anchor installation.
 - 2. Adhesive anchors installed to resist sustained tension loads shall be continuously inspected during installation by an inspector specially approved for that purpose by the building official.
- D. CONTRACTOR shall correct improper workmanship, remove and replace, or correct as instructed by the ENGINEER, all anchors or bars found unacceptable or deficient, at no additional cost to the OWNER.

- E. The independent testing and inspection agency shall complete a report on each area. The report should summarize the observations made by the inspector and be submitted to ENGINEER.
- F. Provide access for the testing agency to places where Work is being produced so that required inspection and testing can be accomplished.

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+ + END OF SECTION + +

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SECTION 05200

STEEL JOISTS

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Shop Drawings:
 - 1. Copies of manufacturer's specifications and installation instructions for each type of joist and its accessories. Include manufacturer's certification that joists comply with AISC-SJI "Specifications."
 - 2. Detailed drawings showing layout of joist units, headers, special connections, jointing and accessories. Include the mark, number, type, location and spacing of joists and bridging. Provide location drawings for installation of anchor bolts.
 - 3. Detailed drawings showing supports, field splices, bridging attachments and nonstandard joist profiles.
 - 4. Shop Drawings shall list all applicable loads.
- B. Structural Calculations:
 - 1. The steel joist manufacturer shall submit design calculations with a cover letter bearing the seal and signature of the joist manufacturer's registered design professional licensed in California.

1.2 QUALITY ASSURANCE

- A. Fabricator Qualifications: Fabricated by a firm regularly engaged in the manufacture of the types of steel joist specified. Manufacturer to have fabricated joists for at least 2 years.
- B. Qualification of Welding Work:
 - 1. Qualify welding processes and welding operators in accordance with the AWS D1.1, Section 5 Qualification.
 - 2. All welds will be subject to visual inspection. Where visually deficient welds are observed, the welds will be tested using non-destructive methods by a certified testing laboratory. If welds are found to be satisfactory, OWNER will pay for testing. Where welds are found unacceptable or deficient, the CONTRACTOR will pay for testing. The CONTRACTOR will correct improper workmanship, remove and replace, or correct as instructed, all welds found unacceptable or deficient. The CONTRACTOR will pay for all corrections and subsequent tests required to confirm the integrity of the weld.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle steel joists as recommended in AISC-SJI "Specifications." Handle and store joists in a manner to avoid deforming members and to avoid excessive stresses.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel: Comply with AISC-SJI "Specifications".
- B. Unfinished Threaded Fasteners: ASTM A307, Grade A, regular hexagon type, low carbon steel.
- C. High-Strength Threaded Fasteners: ASTM A325 or A490 heavy hexagon structural bolts with nuts and hardened washers.
- D. Surface Preparation and Shop Priming: All steel joists shall be primed in the shop. Surface preparation and shop priming are included herein, but are specified in Section 09900 - Painting.

2.2 FABRICATION

- A. General: Fabricate steel joists in accordance with AISC-SJI "Specification."
- B. Bottom Chord: Joists with bottom chords consisting of round bars will not be acceptable.
- C. Holes in Chord Members:
 - 1. Provide holes in chord members where shown for securing other Work to the steel joists.
- D. Extended Ends:
 - 1. Provide extended ends on joists where shown, complying with the manufacturer's standards and requirements of applicable AISC-SJI "Specifications" and load tables.
- E. Ceiling Extension:
 - 1. Provide ceiling extensions in areas having ceilings attached directly to joist bottom chord. Provide either an extended bottom chord element or a separate unit, to suit manufacturer's standards, of sufficient strength to support the ceiling construction. Extend ends to within 1/2" of the finished wall surface, unless otherwise shown.
- F. Bridging:
 - 1. Provide horizontal or diagonal type bridging for open web joists, complying with AISC-SJI "Specifications".
 - 2. Provide cross-bracing type bridging for longspan joists, complying with AISC-SJI "Specifications".
- G. End Anchorage: Provide end anchorages to secure joists to adjacent construction, complying with AISC-SJI "Specifications", unless otherwise shown.
- H. Header Units: Provide header units to support interrupted open web joists at openings in floor or roof system not framed with steel shapes.

PART 3 - EXECUTION

3.1 INSPECTION

- A. The CONTRACTOR and their installer shall examine the substrate and the conditions under which Work is to be performed and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 ERECTION

- A. Place and secure steel joists in accordance with AISC-SJI "Specifications," approved Shop Drawings, and as specified.
- B. Anchors: Furnish anchor bolts and other devices to be built into the concrete and masonry construction. Furnish templates for the accurate location of anchors in other Work. Furnish unfinished threaded fasteners for anchor bolts, unless otherwise indicated.
- C. Placing Joists:
 - 1. Do not start placement of steel joists until supporting Work is in place and secured. Place joists on supporting Work, adjust and align in accurate locations and spacing before permanently fastening.
 - 2. Provide temporary bridging, connections, and anchors to ensure lateral stability during construction.
- D. Bridging: Install bridging simultaneously with joist erection.
- E. Fastening Joists:
 - 1. Field weld joists to supporting steel framework in accordance with AISC-SJI "Specifications" for the type of joists used. Coordinate welding sequence and procedure with the placing of joists.
 - 2. Bolt joists to supporting steel framework in accordance with AISC-SJI "Specifications" for the type of joists used.
 - a. Provide unfinished threaded fasteners for bolted connections, unless otherwise indicated.
 - b. Provide unfinished threaded fasteners for bolted connections, except where high-strength bolts or welded connections are shown.
 - c. Provide high-strength threaded fasteners for bolted connections of steel joists to steel columns, and at other locations where shown, installed in accordance with AISC, Specifications for Structural Joints Using ASTM A 325 or A 490 Bolts.
- F. Touch-Up Painting: After joist installation, paint all field bolt heads and nuts, and welded areas, abraded or rusty surfaces on joists and steel supporting members. Wire brush surfaces and clean with solvent before painting. Use the same type of paint as used for shop painting.

+ + END OF SECTION + +

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SECTION 05300
METAL ROOF DECKING

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Shop Drawings:
 - 1. Complete erection drawings showing layout and dimensions, including type and gauge of decking sections, adaptations around openings and other special conditions, method of welding or anchoring sections to supporting structural steel, procedure for attaching end closure plates and butt joint cover plates, support of openings and miscellaneous flashing.
 - 2. Manufacturer's product literature and relevant approvals for decking, welding, mechanical fasteners, and sidelap connectors.

1.2 QUALITY ASSURANCE

- A. Field Measurements: Take field measurements prior to preparation of Shop Drawings and fabrication to ensure proper fitting of the Work.
- B. Fabrication and erection shall be in accordance with the current edition of the Steel Deck Institute "Code of Standard Practice". Steel decking shall be delivered, stored, handled and installed in such a manner that it will not be damaged or deformed.
- C. Qualification of Welding Work:
 - 1. Qualify welding processes and welding operators in accordance with AWS D1.1, Section 5 - Qualification.
 - 2. Decking welded in place is subject to inspection and testing. Expense of removing and replacing any portion of decking for testing purposes will be borne by the Owner if welds are found to be satisfactory; otherwise the CONTRACTOR shall pay all costs involved. Remove Work found to be defective and provide new acceptable Work.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Transport, store and erect metal decking and accessories in a manner that will prevent corrosion, deformation or other damage. Store decking clear of the ground with one end elevated to promote drainage. Protect metal deck from water and the elements with a water resistant material.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Deck sections and attachments shall be as shown on the Drawings. Decking having cross-sectional properties, which differ from the indicated, may be used provided that the structural properties of the proposed decking are equal to or greater than, the structural properties of the decking indicated.

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- B. Decking, where indicated, shall have sheet lengths that cover three or more spans wherever practicable.
- C. Galvanized Steel Sheet Decking: ASTM A653. The steel shall receive a protective metal coating of zinc conforming to ASTM A653, with a minimum of 0.6-ounce zinc per square foot, G-90. The decking shall be 20-gauge, unless otherwise shown on the Drawings.
 - 1. Product and Manufacturer: Provide one of the following:
 - a. Vulcraft.
 - b. Verco Manufacturing.
 - c. ASC Steel Deck.
 - d. Or approved equal.
- D. Accessories shall be formed of the same material as used for the steel deck.
- E. Miscellaneous Steel Shapes: ASTM A36.
- F. Mechanical Fasteners (power actuated):
 - 1. Product and Manufacturer: Provide one of the following:
 - a. Hilti, Inc.
 - b. Or approved equal.
- G. Sipelap Connectors:
 - 1. Product and Manufacturer: Provide one of the following:
 - a. Hilti, Inc.
 - b. Elco Textron.
 - c. Or approved equal.
- H. Galvanizing Repair Paint: Any galvanized surface which has the coating removed for any cause shall be touched up with a zinc-rich cold galvanizing compound so that the entire repair surface has a uniform coating of 1.0 ounces of zinc per square foot.

2.2 FABRICATION

- A. Manufacture deck units to lengths as indicated on the shop drawings. Panel end conditions are to be end-lapped 2-inches minimum. Sidelaps are to be nestable or interlocking when using screw-type fasteners.

PART 3 - EXECUTION

3.1 INSPECTION

- A. The CONTRACTOR shall examine conditions under which decking is to be installed and notify Engineer, in writing, of any unsatisfactory condition existing or whenever design of decking and connection may not be clearly indicated. Do not proceed with the Work until unsatisfactory conditions or deficiencies have been corrected in a manner acceptable to Engineer.

3.2 WORKMANSHIP

- A. Decking shall be installed in accordance with the manufacturer's requirements and approved erection layout drawing.

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- B. Steel decking shall be provided complete, including all cutting, shaping, fitting, drilling, welding, ridge plates, valley plates, reinforcing plates for all openings in the deck and miscellaneous pieces necessary for proper installation and weathertight construction.
- C. The steel deck units shall be placed on the supporting framework, aligned, and adjusted to final position before being permanently fastened.
- D. If the supporting beams are not properly aligned or sufficiently level to permit proper bearing of steel units, The CONTRACTOR shall take corrective action to ensure properly aligned Work.
- E. Special care shall be exercised not to damage or overload the decking during installation. The maximum uniform distributed load shall not exceed 20 psf. The decking shall not be used for storage or as a working platform until the sheets have been welded into position.
- F. The decking sheet shall be formed at the longitudinal sides in such a manner that they will overlap and interlock. All interlocking seams shall be welded as specified on the Drawings, with 1 ½-inch long side seam welds.
- G. End laps shall be a minimum of 2-inches and shall occur over bearings only.
- H. The steel decking shall provide a continuous uniform slope, with practically flush top surfaces, and shall be installed in straight and continuous rows, as far as practicable, with ribs at right angles to the supporting members.
- I. All sheets shall be 36-inch wide. Narrower closure strips shall be welded to adjacent full sheet with 1 ½-inch long seam welds at 12-inch on center.
- J. Flashing: Provide zinc coated continuous flashing for deck units at openings and at deck perimeters, if necessary.
- K. Connection Plates: Provide 14-gauge galvanized bent plate sections as shown or required over perimeter and interior framing to allow specified welding to parallel supports.
- L. After erection, all damaged surfaces shall be primed with a zinc dust type primer paint.
- M. After erection, all surfaces shall be cleaned and left free of all grime and dirt.

3.3 ATTACHMENT

- A. Steel deck units shall be fastened to steel framework as shown on the Drawings. Welds shall be free of sharp points or edges. All welds shall be cleaned immediately, by chipping or wire brushing, and shall be coated with a zinc dust type primer paint.
- B. Welding shall conform to the applicable requirements of the AISC "Light Gauge Steel Design" and all welding shall be done by qualified welders. Welder qualifications shall be in accordance with AWS Specification B3.0, "Standard Qualification Procedures."

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- C. Decking sheets fastened to framing with proprietary mechanical connections or screws shall be installed in accordance with the manufacturer's recommendations and ICC report.

+ + END OF SECTION + +

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SECTION 05500
MISCELLANEOUS METALS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work necessary to furnish and install, complete, fabricated metalwork and castings as shown or as required to secure various parts together and provide a complete installation.

1.2 SUBMITTALS

- A. Shop Drawings: Submit Shop Drawings for the fabrication and erection of the miscellaneous metal Work. Include plans, elevations and details of sections and connections. Clearly show all field connections. Show anchorage and accessory items.
- B. Product Data: Submit copies of manufacturer's specifications, load tables, dimensions, diagrams, anchor details, and installation instructions for manufactured products.
- C. Samples: Submit representative samples of manufactured products.

1.3 QUALITY ASSURANCE

- A. Field Measurements: Take field measurements prior to preparation of Shop Drawings and fabrication to ensure proper fitting of the Work.
- B. Shop Assembly: Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the project site. Disassemble units to the extent necessary for shipping limitations. Clearly mark units for reassembly and coordinated installation.
- C. Qualifications: Qualify welding operators in accordance with requirements of current AWS Standard Performance Qualification Procedures in the applicable structural welding code.
 - 1. Qualification Tests: Performed by a recognized testing laboratory.
- D. Certification: Certify welders of structural and reinforcing steel for all positions of welding in accordance with such procedure.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Like Items of Materials: Provide end products of one manufacturer in order to achieve standardization for appearance, operation, maintenance, replacement, and manufacturer's service.
- B. Lifting Lugs: Provide on equipment and equipment components weighing over 100 pounds.

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- C. Furnish miscellaneous items:
1. Miscellaneous metalwork and castings as shown, or as required to secure various parts together and provide a complete installation.
 2. Items specified herein are not intended to be all-inclusive. Provide metalwork and castings shown, specified, or which can reasonably be inferred as necessary to complete the project.

2.2 MATERIALS

- A. Carbon steel structural shapes:
1. Wide flange sections: ASTM A992 Grade 50.
 2. Steel pipe columns: ASTM A53 Grade B.
 3. Hollow Structural Sections (HSS): ASTM A500 Grade B.
 4. Plates, Angles, Channels, and S Shapes: ASTM A36.
- B. Stainless Steel:
1. Plates and Sheets: ASTM A240, Type 304L or 316
 2. Structural shapes: ASTM A276 or A479, Type 304L or 316.
 3. Fasteners and fittings: ASTM A320, Type 316
 - a. Where stainless steel bolts are in contact with dissimilar metals provide insulating sleeves and phenolic washers to electrically isolate the bolts and nuts.
- C. Aluminum, Structural Shapes and Plates: Alloy 6061-T6, meeting Aluminum Assoc. Specification for Aluminum Structures
- D. Cast Iron: A48, Class 30
- E. High-Strength Threaded Fasteners: Heavy hexagonal structural bolts, heavy hexagon nuts, and hardened washers, as follows:
1. Quenched and tempered medium carbon steel bolts, nuts and washers, complying with ASTM A325 or:
 2. Quenched and tempered alloy steel bolts, nuts and washers, complying with ASTM A490.
 3. Provide two ASTM F436 washers for all bolts.
 4. Provide beveled washers at connections of sloped/tapered sections.
 5. Unless noted otherwise, high-strength fasteners shall be used for all non-stainless steel fasteners.
- F. Cast-in-Place Anchor Rods:
1. ASTM F1554, Grade 36 with weldability supplement S1, galvanized, unless shown otherwise.
 2. Provide ASTM F436 washers at all nuts unless shown otherwise.
 3. Provide anchor bolt sleeves as required or as shown for location adjustment.
 4. Provide stainless steel anchors where shown on the Drawings or listed in another specific specification section.
- G. Galvanizing:
1. Zinc coated hardware: ASTM A153.
 2. Fabrications: ASTM A123.
- H. Surface preparation and Finish:

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1. Steel: Where not indicated to be galvanized, steel shall be primed in the shop. Comply with Section 09900, Painting.

2.3 ANCHOR BOLT SLEEVE

- A. High Density Polyethylene Plastic:
 1. Single unit construction with deformed sidewalls such that the concrete and grout lock in place.
 2. The top of the sleeve shall be self-threading to provide adjustment of the threaded anchor bolt projection.
 3. Material requirements shall conform to the following:
 - a. Plastic: High density polyethylene.
 - b. Density: 0.956, ASTM D1505.
 - c. Vicant Softening Point: 256°F, ASTM D1525
 - d. Brittleness Temperature: -180°F, ASTM D746
- B. Fabricated Steel Sleeve:
 1. Material: A36 steel.
 2. Dimensions, welding, and sizes as shown.

2.4 FABRICATIONS

- A. Miscellaneous Framings and Supports:
 1. Fabricate units to the sizes, shapes, and profiles shown, or if not shown, of the required dimensions to receive the adjacent gratings, plates, tanks, doors, or other work to be retained by the framing.
 2. Except as otherwise shown, fabricate from structural shapes, plates, and bars of compatible material, all-welded construction, using mitered corners, welded brackets and splice plates, and a minimum number of joints for field connection. Cut, drill, and tap units to receive hardware and other items to be anchored to the work.
 3. Equip units with integrally welded anchors for casting into concrete or integrating into masonry. Furnish inserts for casting in, if units must be installed after concrete or grout is placed. Anchor spacing shall be 24" on-center, unless otherwise shown.
 4. Galvanize where shown.
- B. Miscellaneous Fabricated Metals:
 1. The following additional items are listed as a guide. Some items on list may not be required, and list may not be all-inclusive. Submittal data for materials and products must be approved before they are incorporated in the work.
 - a. Lifting Eyes.
 - b. Pipe Supports.
 - c. Steel Bases and Anchors.
- C. Stainless Steel Fabrication: Following welding fabrication all stainless steel assemblies shall be cleaned, descaled and passivated in accordance with ASTM A380.
- D. Anchors, Fasteners, and Fittings: Provide zinc-coated carbon steel for steel fabrications, and stainless steel for aluminum and stainless steel fabrications, unless shown otherwise.
- E. Pipe Sleeves
 1. Provide as follows:

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- a. Hot-dip galvanized, Schedule 40 steel pipe sleeves where shown for piping passing through concrete or masonry.
- b. Holes drilled with rotary drill may be provided in lieu of sleeves in existing walls.
- c. Provide a center flange for water stoppage on sleeves in exterior or water-bearing walls.
- d. Provide a rubber caulking sealant or a modular mechanical unit to form a watertight seal in the annular space between pipes and sleeves.

PART 3 - EXECUTION

3.1 FABRICATION

A. General:

1. Exposed Surfaces Finish: Smooth, sharp, well-defined lines.
2. Provide necessary rabbets, lugs, and brackets so work can be assembled in neat, substantial manner.
3. Conceal fastenings where practical.
4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
5. Fabricate materials as specified.
6. Weld connections, except where bolting is directed.
7. Methods of fabrication not otherwise specified or shown shall be adequate for stress and as approved.
8. Grind exposed edges of welds smooth on walkways, guardrails, handrails, stairways, channel door frames, steel column bases and where shown.
9. Round sharp edges to 1/8-inch minimum radius. Grind burrs, jagged edges, and surface defects smooth.

B. Aluminum:

1. Fabricate as shown, and in accordance with the Aluminum Association Standards and manufacturer's recommendations as approved.
2. Grind smooth sheared edges exposed in finished work.

3.2 WELDING

A. General

1. Meet codes for Arc and Gas Welding in Building Construction of the AWS and AISC for techniques of welding employed, appearance, quality of welds made, and the methods of correcting defective work.
2. Welding Surfaces: Free from loose scale, rust, grease, paint, and other foreign material, except mill scale which will withstand vigorous wire brushing may remain.
3. A light film of linseed oil may likewise be disregarded.
4. Do not weld when temperature of base metal is lower than zero degrees F.
5. Finished members shall be true to line and free from twists.
6. Prepare welds and adjacent areas such that there is:
 - a. No undercutting or reverse ridges on the weld bead.
 - b. No weld spatter on or adjacent to the weld or any other area to be painted.
 - c. No sharp peaks or ridges along the weld bead.
7. Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.

- B. Welding Operators: As specified in PART 1, Article 1.3 QUALITY ASSURANCE.

3.3 INSTALLATION

- A. Set units accurately in location, alignment, and elevation, level, plumb, true, and square, measured from established lines and levels. Brace or anchor temporarily in formwork where units are to be built into concrete, masonry, or similar construction.
- B. Anchor securely as shown or as required for the intended use, using concealed anchors wherever possible.
- C. Fit exposed edges accurately together to form tight, hairline joints. Do not weld, cut, or abrade the surfaces of galvanized or anodized units which are intended for bolted or screwed connections.
- D. Field Welding: Where field welding is necessary, grind joints smooth and touch-up the shop paint. Comply with the applicable provisions of AWS D1.1 for the procedures of manual shielded metal-arc welding, the appearance and quality of welds made, and the methods used in correcting welding.
- E. Field Coat all miscellaneous ferrous and steel metals per Specification Section 09900 - Painting, System 300.
- F. Where aluminum is in contact with dissimilar metals, or embedded in masonry or concrete, protect surfaces as specified in Section 09900 - Painting, System 305.

3.4 FIELD QUALITY CONTROL

- A. The OWNER will employ a testing laboratory approved by the ENGINEER to perform field quality control testing to inspect and to perform tests and prepare test reports in accordance with CBC section 1705.2 and AISC 360.
 - 1. The testing agency shall conduct and interpret the tests and state in each report whether the test specimens comply with the requirements, and specifically state all deviations.
 - 2. Provide access for the testing agency to places where structural steel Work is being fabricated or produced so that required inspection and testing can be accomplished.
 - 3. The testing agency may inspect structural steel at the plant before shipment; however, ENGINEER reserves the right, at any time before Final Acceptance, to reject material not complying with specified requirements.
- B. Correct deficiencies in structural steel Work that inspection and/or laboratory test reports indicate do not comply with the Specifications. Perform additional tests, as may be required to reconfirm any non-compliance of the original Work, and as may be required to show compliance of corrected Work.

+ + END OF SECTION + +

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SECTION 05610

ALUMINUM HANDRAILS AND RAILINGS

PART 1 - GENERAL

1.1 SCOPE

- A. This section covers the supply and installation of welded or non-welded mechanical construction aluminum handrails and guardrails.

1.2 SUBMITTALS

- A. Shop Drawings: Submit Shop Drawings for the fabrication and erection of the handrails and guardrails. Include plans, elevations and details of sections and connections. Clearly show all field connections. Show anchorage and accessory items.
- B. Product Data: Submit copies of manufacturer's specifications, dimensions, anchor details, and installation instructions for manufactured products.

1.3 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. Aluminum Associate (AA)
 - a. Aluminum Standards and Data
 - b. Specifications for Aluminum Structures
- B. Design Criteria:
 - 1. Fabricate units to support a live load of 50 pounds per linear foot and a non-concurrent load of 200 pounds at the top of the railing, in any direction.
 - 2. Expansion/Contraction:
 - a. Provide linear expansion joints at a maximum spacing of 20'-0" designed for 1/4" expansion and 1/4" contraction.
 - b. Provide expansion joints in handrail and railing systems where systems cross expansion joints in structure.
- C. Allowable Tolerances:
 - 1. Limit variation of cast-in-place inserts, sleeves and field-drilled anchor and fastener holes to the following:
 - a. Spacing: $\pm 3/8$ -inch.
 - b. Alignment: $\pm 1/4$ -inch.
 - c. Plumbness: $\pm 1/8$ -inch.
 - 2. Minimum Handrails and Railings Systems Plumb Criteria:
 - a. Limit variation of completed handrail and railing system alignment to 1/4-inch in 12' - 0" with posts set plumb to within 1/16-inch in 3 foot - 0 inches.
 - b. Align rails so variations from level for horizontal members and from parallel with rake of stairs and ramps for sloping members do not exceed 1/4-inch in 12' - 0 inches.
- D. Obtain all handrails and railings systems components and accessories from the same manufacturer.

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1.4 DELIVERY, STORAGE AND HANDLING

- A. Protect aluminum work from abuse, staining, or damage during shipment, storage, erection and installation.
- B. Store in a manner to prevent warping of materials.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Fabricate aluminum to conform to AA standards.
- B. Handrails and railings may be either of welded construction, or non-welded mechanical construction.

2.2 MANUFACTURERS AND PRODUCTS

- A. Golden Railings, Inc.; TCF Bolted System.
- B. Superior Aluminum Products; Series 800 Pipe Railing.
- C. Or Equal.

2.3 MATERIALS

- A. Rails and Posts:
 - 1. Conform to ASTM B221.
 - 2. 1-1/2" nominal diameter, minimum
 - 3. Provide Schedule 40 pipe minimum for rails and Schedule 80 pipe minimum for posts, unless conditions of detail and fabrication require heavier pipe weights to comply with performance criteria specified.
 - 4. All rail, posts and components shall be Aluminum Alloy 6005-T5 or 6063-T6
 - 5. Clear satin anodized finish, 0.7 mil minimum (AA-M10-C22-A41).
- B. Fittings and Accessories:
 - 1. Either weld rail and post components, or provide mechanical fittings to join rail and post components using bolted connections.
 - 2. Provide floor flanges where indicated
 - 3. Provide wall brackets with 3-inch minimum clearance between handrail and finished wall surface and as indicated for ladder rails.
 - 4. Fasteners and anchors shall be Type 304 stainless steel and of type as required by substrate
- C. Toeboard (Kick Plate):
 - 1. Extruded, beveled aluminum 4-inch height, aluminum alloy 6063-T6.
 - 2. Furnish required stainless steel clamps and fasteners for complete installation.
 - 3. Manufacturer/Product:
 - a. Crane Veyor Corp., Toeboard No. C43880 with splice plates and corner connectors.
 - b. Or Equal.

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- D. Weep Holes:
 - 1. Fabricate joints, which will be exposed to the weather so as to exclude water.
 - 2. Provide 15/64-inch diameter weep holes at the lowest possible point on all handrail and railing systems posts.
 - 3. Provide pressure relief holes at closed ends of handrail and railing systems.

PART 3 - EXECUTION

3.1 GENERAL

- A. Conform to applicable AA standards.
- B. At locations where welds will be made (if applicable), the anodizing shall be ground off to ensure a proper weld is made. The weld shall then be ground smooth and burn marks removed. Completed welds shall be painted to match the anodizing of the pipe.
- C. Bituminous Coating:
 - 1. Protect aluminum in contact with other metals, grout and concrete by a heavy brush coat of alkali-resistant bituminous coating or a non-porous tape or gasket.
 - 2. Coating is not required for aluminum in contact with stainless steel bolts.
 - 3. Apply bituminous coating at 15-mil minimum dry film thickness.
 - 4. Manufacturer/Product:
 - a. Carboline – Bitumastic No. 50
 - b. Tnemec – Series 46-465
 - c. Or Equal.

3.2 INSTALLATION

- A. Space posts at a maximum of 4'-0" on center, except when a different spacing is indicated on the Drawings.
- B. Install toe boards (kick plates) and anchor to each post with clamps and bolts. Allow 1/4-inch space between bottom of toe board and top of floor surface.
- C. Install handrail to walls with brackets spaced not greater than 5'-0" on center, except where otherwise indicated.
 - 1. For connecting to concrete walls, use anchors as indicated.
 - 2. For connecting to hollow masonry walls, use toggle bolts having square heads.
- D. Cleaning: Clean all aluminum surfaces, after installation, free of smudges, stains, or other deleterious substances.
- E. Protect aluminum, after cleaning, with clear methacrylate lacquer coating.

+ + END OF SECTION + +

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SECTION 07200
ROOF INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies requirements for building insulation for roofs and associated accessories to result in complete assemblies.

1.2 SUBMITTALS

- A. Shop Drawings:
 - 1. Manufacturer's specifications and installation instructions for type of insulation required. Include data substantiating that the materials comply with specified requirements.
 - 2. Complete layout of all roof insulation showing sizes, placement and number of courses.
 - 3. Manufacturer's specifications and installation instructions showing the sizes and layout of the mechanical fasteners.

1.3 DELIVERY, HANDLING, AND STORAGE

- A. Package and protect during shipment.
- B. Inspect for damage, dampness, and wet storage stains upon delivery to the Work site.
- C. Remove and replace damaged or permanently stained materials that cannot be restored to like-new condition.
- D. Carefully handle to avoid damage to surfaces, edges, and ends.
- E. Do not open packages until ready for use.
- F. Store materials in dry, weathertight, ventilated areas until immediately prior to installation.

1.4 COORDINATION WITH OTHER ROOFING SYSTEM COMPONENTS

- A. Roof insulation shall be part of a coordinated, complete roof system which includes the roofing system and all other roofing system components.
- B. Roof insulation manufacturer shall certify that the roof insulation provided is completely compatible with the roofing system specified and all other roofing system components.

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PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE RIGID ROOF INSULATION

- A. Composed of extruded polystyrene (XPS) and water-resistant binders formed into rigid, non-combustible boards specifically designed for roofing applications with installation directly on structural steel decks beneath a sheet membrane or a standing seam metal roof.
- B. Size: 48-inches by 96-inches.
- C. Thickness:
 - 1. Base Layer: Thickness as shown in the Drawings.
- D. Provide the following physical properties:
 - 1. Thermal Resistance, R-Value, ASTM C518: 5.0 hr*ft²*°F/BTU/in.
 - 2. Water Vapor Permeance, ASTM E96: 1.5 maximum perm.
 - 3. Compressive Strength, ASTM D1621: 25 psi.
- E. Product and Manufacturer: Provide one of the following:
 - 1. STYROFOAM Brand DECKMATE Plus, by Dow Building Solutions.
 - 2. THERMAPINK 25 by Owens-Corning Fiberglass Corporation.
 - 3. Or equal.

2.2 ROOF INSULATION COVER BOARD

- A. Fiberglass-mat faced roof cover boards.
- B. Provide the following physical properties:
 - 1. Size: 48-inches by 96-inches, 1/2-inch thick
 - 2. Weight: 1.95 psf
 - 3. Water Adsorption, ASTM C1177: < 10%
 - 4. Compressive Strength, ASTM C472: 900 psi
- C. Product and Manufacturer: Provide one of the following:
 - 1. DensDeck Prime by Georgia-Pacific
 - 2. SecurRock by USG
 - 3. Or approved equal

2.3 MISCELLANEOUS MATERIALS:

- A. Mechanical Fasteners: Screw-type 6-gauge minimum self-drilling galvanized steel with sufficient length and quantity to securely anchor system into place and to withstand all super-imposed loads. Provide 1 1/2" diameter disc washers.
- B. Joint Tape: 6-inch wide glass fiber tape.

PART 3 - EXECUTION

3.1 SEQUENCING

- A. Proceed with and complete the Work only when materials, equipment and tradesmen required for the installation of the roofing membrane over the roof insulation are at the site and are ready to follow with this Work immediately (same day) behind the roof insulation Work.
- B. Do not install any more roof insulation each day than can be covered with complete elastic sheet roofing system by the end of that working day.

3.2 INSPECTION

- A. CONTRACTOR and his installer shall examine the substrate and the conditions under which the insulation Work is to be performed, and notify ENGINEER, in writing, of any unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.3 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's instructions for the particular conditions of installation in each case. If printed instructions are not available or do not apply to the project conditions, consult the manufacturer's technical representative for specific recommendations before proceeding with the Work.
 - 2. Where skylight or other roof openings are required, provide crickets shaped from tapered glass fiber board to direct roof drainage around opening and too roof drain.
 - 3. Extend roof insulations full thickness, as shown and specified, over entire surface to be insulated.
 - 4. Cut and fit roof insulation Work tightly around obstructions, and fill voids with insulation. Keep back 1/4-inch for all vertical flashings.
- B. Laying Roof Insulation Units:
 - 1. Apply rigid glass fiber board roof insulation to the thickness shown in the Drawings.
 - 2. Mechanically fasten insulation boards to substrate at the UL required spacing.
 - 3. Stagger end joints and stagger joints between courses where two or more courses are used.
 - 4. Lay insulation boards with edge in moderate contact without forcing.

3.4 PERFORMANCE

- A. Roof insulation Work shall withstand the uplift forces of wind, as defined by the Roofing System Guarantee. Refer to the roofing system specification. Failures of the roof insulation Work, or within the insulation, shall be considered failures of materials or workmanship under the Roofing System Guarantee.

+ + END OF SECTION + +

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SECTION 07320

STANDING SEAM METAL ROOF

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: This Section applies to design, manufacture and installation of standing seam metal roof paneling and associated materials.

1.2 QUALITY ASSURANCE

A. References

1. American Society for Testing and Materials (ASTM)
 - a. ASTM A653: Steel Sheet, Zinc-Coated by the Hot Dip Process
 - b. ASTM A792: Steel Sheet, Aluminum-Zinc Alloy Coated by the Hot Dip Process
 - c. ASTM B209: Aluminum and Aluminum Alloy Sheet and Plate
2. Underwriters Laboratory
 - a. UL Building Materials Directory
3. Sheet Metal and Air Condition Contractors National Association, Inc. (SMACNA)
 - a. SMACNA Architectural Sheet Metal Manual, 1993 Edition
4. American Iron and Steel Institute (AISI)
 - a. AISI Cold Formed Steel Design Manual
5. Aluminum Association
 - a. Aluminum Design Manual
6. Metal Construction Association (MCA)
 - a. Preformed Metal Wall Guidelines
7. Code References:
 - a. ASCE 7, Minimum Loads for Buildings and Other Structures
 - b. IBC, International Building Code

B. Experience:

1. Manufacturer shall have a minimum of ten (10) years experience in manufacturing standing seam metal roofing.
2. Panel installer shall have a minimum of two (2) years experience in the installation of standing seam metal roofing and shall show evidence of successful completion of at least three (3) projects of similar size, scope, and complexity.

1.3 SUBMITTALS

- A. Shop Drawings: Submit Shop Drawings showing roof plan with layout of panels, clips, clip attachment, underlayment and sections of each flashing/trim condition for approval prior to fabrication. Drawings shall contain material type, metal thickness and finish. Drawings shall distinguish between factory and field fabrication.
- B. Product Data: Submit manufacturer's specifications, standard profile sheet, product data brochure and finish warranty.
- C. Samples:

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1. Submit sample 12" long x full panel width showing proposed metal gauge, seam profile and specified finish.
 2. Submit manufacturer's standard colors for OWNER's selection. If design or bid documents specify a color, submit color specified.
- D. Test Reports: Submit the test reports prepared by Underwriters Laboratory indicating wind uplift rating of the proposed roof system. The manufacturer must be listed by name in the UL Directory.
- E. Certification: Submit manufacturer's certification that materials and finishes meet specification requirements.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Panels and flashings shall be protected and properly packaged to protect against transportation damage in transit to the jobsite.
- B. Upon delivery, exercise care in unloading, stacking, moving, storing and erecting panels and flashings to prevent twisting, bending, scratching or denting.
- C. Store panels and flashings in a safe, dry environment under a waterproof covering to prevent water damage. Allow adequate ventilation to prevent condensation. Panels and flashings with strippable film shall not be stored in direct sunlight.
- D. Upon installation immediately remove strippable film from panels and flashings. Protect panels and flashings from foot traffic and from all other trades.

1.5 WARRANTY

- A. Standing seam metal roof manufacturer shall provide a twenty (20) year warranty on the paint finish covering chalking, cracking, checking, chipping, blistering, peeling, flaking, and fading.
- B. Applicator shall furnish written warranty for a two (2) year period from date of substantial completion of building covering repairs required to maintain roof and flashings in watertight condition.

PART 2 - PRODUCTS

2.1 PRODUCT DESCRIPTION

- A. Performance Requirements: Provide factory formed, prefinished, snap-together, concealed clip structural standing seam metal roof system that has been pretested and certified by manufacturer to comply with specified requirements under installed conditions.
 1. Roof system shall meet the wind uplift test requirements in accordance with UL 580 Class 90 when the panels are attached to a substructure meeting the assembly requirements of UL 580.

- B. Structural Requirements: Engineer panels for structural properties in accordance with the latest edition of American Iron and Steel Institute's *Cold Formed Steel Design Manual* using "effective width" concept and Aluminum Association's *Aluminum Design Manual*.

2.2 SERVICE CONDITIONS AND PERFORMANCE

- A. System shall be designed to withstand service conditions described in 01610 – General Equipment Requirements and be in compliance with all applicable codes and regulations.

2.3 COMPONENTS

- A. Roof Panels:
1. Panels shall be constructed from 24-gauge, Grade 50 (50 ksi yield strength) structural steel with AZ50 (0.50 oz./ft.²) aluminum-zinc alloy coating, both conforming to ASTM A792.
 2. Each panel shall be formed with a 1-1/2" to 2-1/2" seam height
 3. Panel width will be between 12- and 18-inches from seam to seam. Between seams, each panel shall have two or more equally spaced ridges, or stiffeners running parallel with seams.
 4. Each panel shall be designed to be screwed to the roof substrate, then have the adjacent panel mechanically seamed with a field-operated, electric- seaming machine provided by the manufacturer in such a way that all screws are concealed.
 5. Roof panels shall use a standard UL 90 one-piece roof clip allowing for thermal movement of the panel system.
 6. Panels shall be designed for use on roofs with pitch as shallow as 3-inch per foot
 7. The panel system shall be a true standing seam shape requiring no trapezoidal foam closures, plugs, or fillers at eaves.
 8. Texture: panels shall be smooth or have striations to eliminate oil canning potential.
- B. Underlayment:
1. Asphalt-saturated organic felt meeting ASTM D226, Type II (No. 3).
 2. Ice and Water Shield Waterproofing Membrane: 40 mil self-adhered roofing underlayment meeting ASTM E96.
- C. Snow Guard:
1. Provide clamp on snow guards. Snow guards shall be compatible with the standing seam panel system.
 2. Snow guard color shall match the standing seam panel system.
 3. Provide a snow guard layout pattern approved by the roofing manufacturer.
- D. Flashing, Roof Jacks, and Trim
1. All flashing, roof jacks, and trim shall be of the same material, gauge, finish, and color as the roof panels and fabricated in accordance with standard SMACNA procedure and details.
 2. Provide transition rib covers where roofing changes pitch or Z-closure made from the same material.
 3. Provide rake and eave trim at the roof perimeter.
 4. Provide roof jacks at all roof penetrations.
 5. Fabricate gutters and downspouts in the same gauge, material, finish and color as the roof panels.
 6. Flashings shall be designed and installed to allow thermal expansion of the roofing system.

E. Closures:

1. Ridge and hip closures shall be protected and supported by a formed metal closure manufactured from the same material, color and finish as the panels.
2. Metal closures shall be factory fabricated and field-cut as needed.

F. Finish:

1. Metal Preparation: all metal shall have the surfaces carefully prepared for painting on a continuous process coil coating line by alkali cleaning, hot water rinsing, application of chemical conversion coating, cold water rinsing, sealing with an acid rinse, and thorough drying.
2. Prime Coating: a base coat of epoxy paint, specifically formulated to interact with the top-coat, shall be applied to the prepared surfaces by roll coating to a dry film thickness of 0.20 ± 0.05 mils. This prime coat shall be oven cured prior to application of finish coat.
3. Exterior Coating: a Kynar® 500/Hylar® 5000 finish coating shall be applied over the primer by roll coating to a dry film thickness of 0.80 ± 0.05 mils for a total dry film thickness of 1.00 ± 0.10 . This finish coating shall be oven-cured.
4. Interior Finish Coating: a washcoat shall be applied on the reverse side over the primer by roll coating to a dry film thickness of 0.30 ± 0.05 mils for a total dry film thickness of 0.50 ± 0.10 mils. The washcoat shall be oven-cured.
5. Color: Color shall be as noted on Drawings, or as selected by OWNER.

G. Fasteners:

1. Clips to Substrate: screws shall be #10 diameter, self-tapping type, zinc-plated steel, with Phillips style pancake head.
2. Flashings to Panels: exposed screws shall be zinc plated with a #14 x 1" combination steel and neoprene washer, color to match panel.

H. Sealants:

1. Shall not contain oil, asbestos or asphalt.
2. Field applied panel end sealant shall be mastic tape sealant.
3. Exposed sealant shall be one-part polyurethane joint sealant, color to coordinate with roof panels.

2.4 FABRICATION

- A. Field dimensions shall be taken prior to fabrication to verify jobsite conditions.
- B. Roof panels shall be formed in continuous lengths. End-laps will not be allowed.
- C. Panels shall be roll formed on a stationary industrial type rolling mill. Portable roll formers, rented or owned by the installer, are not acceptable.
- D. Fabricate flashings from the same material as the roof system.
- E. Follow tolerances in MCA's Preformed Metal Wall Guidelines.

2.5 PRODUCT AND MANUFACTURER:

- A. ATAS International: Field-Lok FLS
- B. Fabral: Stand'N Seam

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- C. MBCI: SuperLok
- D. Or Equal.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Examine roof deck for conditions that would prevent proper application of roofing. Immediately notify Contractor and Engineer of defects, and do not proceed with roofing operation until defects are corrected.
- B. Verify that surfaces to receive roofing are smooth, sound, clean and dry.

3.2 INSTALLATION

- A. Conform to manufacturers written instructions, the standard set forth in the SMACNA architectural sheet metal manuals and the approved shop drawings detailed for the project.
- B. Underlayment:
 - 1. Provide a double layer of underlayment.
 - 2. Provide 18" wide starter strip of underlayment at the eaves, followed by a 36" wide strip of underlayment which completely overlaps the 18" wide starter strip.
 - 3. Continue with consecutive 36" wide strips of underlayment, overlapping 19" at each course, shingle-style.
 - 4. Total of a double layer of underlayment plus 2" overlap at the horizontal seams is required.
 - 5. Overlap vertical seams 6" and minimize their occurrence.
 - 6. Provide ice and water shield membrane at all valley and eave conditions as well as any area at less than a 3:12 slope.
- C. Panel Installation:
 - 1. Install panels straight with the seams parallel, conforming to the design as indicated.
 - 2. Install panel system so it is watertight, without waves, warps, buckles or distortions, and allow for thermal movement considerations.
 - 3. Abrasive devices shall not be used to cut on or near the roof panel system.
 - 4. Apply sealant tape or caulking as necessary at flashing and panel joints to prevent water penetration.
 - 5. Remove any strippable film immediately upon exposure to direct sunlight.

3.3 CLEANING

- A. Dispose of any excess materials and debris from jobsite.
- B. Remove filings, grease, stains, marks, or excess sealants from roof panel system to prevent staining.
- C. Protect work from damage from other trades until final acceptance.

+ + END OF SECTION + +

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SECTION 07600
METAL FLASHING

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Shop Drawings: Provide documentation showing the flashing and cricket dimensions and material properties.

1.2 DELIVERY, HANDLING, AND STORAGE

- A. Package and protect during shipment.
- B. Inspect for damage, dampness, and wet storage stains upon delivery to the Work site.
- C. Remove and replace damaged or permanently stained materials that cannot be restored to like-new condition.
- D. Carefully handle to avoid damage to surfaces, edges, and ends.
- E. Do not open packages until ready for use.
- F. Store materials in dry, weathertight, ventilated areas until immediately prior to installation.

PART 2 - PRODUCTS

2.1 METAL

- A. Galvanized Sheet Steel: ASTM A653, G90, commercial quality copper bearing steel, thickness 24 gauge, unless otherwise shown.

2.2 ANCILLARY MATERIALS

- A. Solder: ASTM B32, alloy composition Sn 50.
- B. Soldering Flux: ASTM B32, Type RA.
- C. Sealer Tape: Polyisobutylene sealer tape as specified in Section 07900, JOINT SEALANTS.
- D. Isolation Paint: As specified in Section 09900, PAINTING AND PROTECTIVE COATINGS, System No. 27.
- E. Isolation Tape: Butyl or polyisobutylene, internally reinforced, or 20-mil thick minimum polyester.
- F. Plastic Roof Cement: ASTM D4586, Type II.

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- G. Fasteners:
 - 1. For Galvanized Steelwork: Steel, galvanized per ASTM A153 or stainless steel fasteners.
 - 2. Nails: Roofing nailhead, 10-gauge spiral or ring shank, lengths as required to penetrate wood at least 3/4-inch.

2.3 FABRICATION OF FLASHING

- A. Field measure prior to fabrication.
- B. Fabricate in accordance with SMACNA Architectural Sheet Metal Manual.
- C. Accurately form flashings to shapes shown and detailed, with angles and lines in true alignment.
- D. Form angles true to line and surfaces free of waves and buckles.
- E. Form bends to 1/16-inch inside radius.
- F. Hem exposed edges.
- G. Reinforcements and Supports: Provide same material as flashing unless other material is shown. Steel, where shown or required, shall be galvanized or stainless.
- H. Rigid Joints and Seams: Make mechanically strong. Solder galvanized and stainless steel metal joints. Do not use solder to transmit stress.
- I. At exposed ends of counterflashing furnish weathertight closures.
- J. Neutralize soldering flux.
- K. Solvent clean sheet metal. Surfaces to be in contact with roofing or otherwise concealed shall be coated with isolation paint.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Flashing:
 - 1. Coordinate flashing Work with roofing Work for weathertight and watertight assembly.
 - 2. Isolate metal from wood and concrete and from dissimilar metal with isolation tape or two coats of isolation paint.
 - 3. Use only stainless steel fasteners to connect isolated dissimilar metals.
 - 4. Set flanges of flashings and roof accessories on continuous sealer tape or in plastic roof cement on top of deck. Nail flanges through sealer tape and at 3-inch maximum spacing. Touch up isolation paint on flanges.
 - 5. Joints, Fastenings, Reinforcements, and Supports: Sized and located as required to preclude distortion or displacement due to thermal expansion and contraction.
 - 6. Provide continuous holddown clips at counterflashing and edge drips.
 - 7. Conceal fastenings wherever possible.

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8. Set flashing and sheet metal to straight, true lines with exposed faces aligned in proper plane without bulges or waves.

3.2 FINISH

- A. Exposed Surfaces of Flashing and Sheet Metalwork: Free of dents, scratches, abrasions, or other visible defects, and clean and ready for painting where applicable.

+ + END OF SECTION + +

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SECTION 07900

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Product Data: Surface preparation and installation instructions. Indicate where each product is proposed to be used. Provide sealant certified to NSF/ANSI Standard 61 where sealant is in direct contact with potable water.
- B. Samples: Material proposed for use showing color range available.
- C. Quality Control Submittals:
 - 1. Applicator Qualification: Documentation showing minimum of 5 years' experience installing sealants in projects of similar scope.
 - 2. Certificates of Compliance: Proposed materials meet Specification requirements.

1.2 ENVIRONMENTAL REQUIREMENTS

- A. Ambient Temperature: Between 40 and 80 degrees F (4 and 27 degrees C) when sealant is applied. Consult manufacturer when sealant cannot be applied within these temperature ranges.

PART 2 - PRODUCTS

2.1 SEALANT MATERIALS

- A. Sealant Characteristics:
 - 1. Uniform, homogeneous.
 - 2. Free from lumps, skins, and coarse particles when mixed.
 - 3. Nonstaining, nonbleeding.
 - 4. Hardness of 15 minimum and 50 maximum, measured by ASTM C661 method.
 - 5. Immersible may be substituted for nonimmersible.
- B. Sealant Color: To match adjacent surfaces or as selected by ENGINEER.
- C. One-Part Polyurethane, Immersible:
 - 1. Polyurethane base, single-component, moisture curing; ASTM C920, Type S, Grade NS or P, Class 25.
 - 2. Capable of being continuously immersed in water.
 - 3. Designed to be used where the maximum depth of sealant will not exceed 1/2 inch.
 - 4. Provide sealant certified to NSF/ANSI Standard 61 where sealant is in direct contact with potable water.
 - 5. Manufacturers and Products for Nonsag:
 - a. Sika Construction: Sikaflex-1a.
 - b. Tremco: Vulkem 116.
 - c. Or approved equal.
 - 6. Manufacturers and Products for Self-Leveling:

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- a. Sika Construction: Sikaflex-1C SL.
 - b. Tremco: Vulkem 45 SSL.
 - c. Or approved equal.
- D. Two-Part Polyurethane, Immersible:
 - 1. Polyurethane elastomeric, two-part, self leveling (or gun grade), non-staining, which cures at ambient temperature and conforms to ASTM C920.
 - 2. Designed to be used where the maximum depth of sealant will exceed 1/2 inch or where chemical curing is required.
 - 3. Manufacturers and Products:
 - a. Sika Construction: Sikaflex-2C.
 - b. Tremco: Dymeric 240FC.
 - c. Or approved equal.

2.2 BACKUP MATERIAL

- A. Nongassing, extruded, closed-cell round polyethylene foam rod, compatible with sealant used, and as recommended by sealant manufacturer.
- B. Size: As shown or as recommended by sealant material manufacturer. Provide for joints greater than 1/2-inch deep. Backup material should be sized to maintain 2:1 width to depth ratio to the greatest extent possible.
- C. Manufacturers and Products:
 - 1. Dow Corning; Ethafoam SB.
 - 2. Sonneborn; Sonofoam.
 - 3. Or approved equal.

2.3 ANCILLARY MATERIALS

- A. Bond Breaker: Pressure sensitive tape as recommended by sealant manufacturer to suit application. Provide bond breaker tape in the bottom of joints to prevent 3-sided joint sealant adhesion when backup material is not used.
- B. Joint Cleaner: Noncorrosive and nonstaining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Primer: Nonstaining type recommended by sealant manufacturer to suit application

PART 3 - EXECUTION

3.1 GENERAL

- A. Use of more than one material for the same joint is not allowed unless approved by the sealant manufacturer.
- B. Install joint sealants in accordance with ASTM C1193.
- C. Horizontal and Sloping Joints of 1 Percent Maximum Slope: Use self-leveling (Grade P) joint sealant.

- D. Steeper Sloped Joints, Vertical Joints, and Overhead Joints: Use nonsag (Grade NS) joint sealant.

3.2 PREPARATION

- A. Verify that joint dimensions, and physical and environmental conditions, are acceptable to receive sealant.
- B. Surfaces to be sealed shall be clean, dry, sound, and free of dust, loose mortar, oil, and other foreign materials.
 - 1. Mask adjacent surfaces where necessary to maintain neat edge.
 - 2. Starting of work will be construed as acceptance of subsurfaces.
 - 3. Apply primer to dry surfaces as recommended by sealant manufacturer.
- C. Verify that joint shaping materials and release tapes are compatible with sealant.
- D. Examine joint dimensions and size materials to achieve required width/depth ratios.
- E. Carefully follow manufacturer's instructions for mixing multi-component products.

3.3 INSTALLATION

- A. Use joint filler to achieve required joint depths, to allow sealants to perform intended function.
 - 1. Install backup material as recommended by sealant manufacturer.
 - 2. Where possible, provide full length sections without splices; minimize number of splices.
 - 3. Tape sealant may be used as joint filler if approved by sealant manufacturer.
- B. Use bond breaker where recommended by sealant manufacturer and in the bottom of joints to prevent 3-sided joint sealant adhesion.
- C. Seal joints around window, door and louver frames, expansion joints, and elsewhere as indicated.
- D. Joint Sealant Materials: Follow manufacturer's recommendation and instructions, filling joint completely from back to top, without voids.
- E. Joints: Tool slightly concave after sealant is installed.
 - 1. When tooling white or light color sealant, use a water wet tool.
 - 2. Finish joints free of air pockets, foreign embedded matter, ridges, and sags.
- F. Tape Sealant: Compress to 50 percent of expanded thickness and install in accordance with manufacturer's instructions.

3.4 CLEANING

- A. Clean surfaces next to the sealed joints of smears or other soiling resultant of sealing application.
- B. Replace damaged surfaces resulting from joint sealing or cleaning activities.

+ + END OF SECTION + +

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SECTION 08100

METAL DOORS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Provide and install metal doors.

1.2 SUBMITTALS

- A. Shop Drawings: Applicable information for each type of door and frame, including:
 - 1. Frame conditions, complete anchorage details, dimensions, glazing, fire ratings, etc.
 - 2. Reference door numbers used on Drawings and in Door Schedule on shop drawings.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Identify each door with number used on Drawings and in Door Schedule.
- B. Store doors upright, in protected dry area and provide for air circulation around each door. Store doors at least 4-inches off of the floor to prevent water damage and wear of door bottom on floor. Do not cover doors in plastic tarps or other storage provisions which promote water damage and rust. If door packaging becomes wet, remove it immediately.

PART 2 - PRODUCTS

2.1 HOLLOW STEEL DOORS

- A. General:
 - 1. Doors and Frames shall conform to SDI 100, except as modified herein.
 - 2. Doors and Frame cutouts, anchors and reinforcement shall conform to SDI 107 and ANSI A115 to receive hardware as specified elsewhere.
- B. Materials:
 - 1. Doors, frames and frame components shall be manufactured from commercial quality carbon steel conforming to ASTM designation A366, with an A60 zinc-iron alloy coating conforming to ASTM designation A653.
- C. Hollow Metal Doors:
 - 1. Flush Panel Doors: 16-gauge, Grade III, Model 1, with honeycomb or polyurethane core.
 - 2. Trim for doors with glass cutouts shall be 18-gauge galvanized steel. If the trim is installed using screws, screws shall be only visible from the non-secure side of the door. Trim shall be flush or shall protrude no more than 1/16" from the door face, and shall be the same on both sides of the door.
 - 3. All doors shall have flush end closure at top of doors to eliminate moisture penetration. Door tops shall no have holes or openings.

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4. All doors shall include a self-adjusting, concealed door sweep installed in the bottom channel. The bottom seal shall not include springs.
 5. Door swing shall be as shown on Drawings.
- D. Metal Frames:
1. Products of hollow metal door manufacturer, constructed to coordinate with hollow metal door.
 2. Frames for Doors 14-Gauge: Welded type, of cross-section shown.
 3. Finished size, shape, and profile of frame members as shown.
 4. Concealed fasteners or welding are preferred to through-the-face fasteners.
 5. Identification: Stamp opening number, as shown on Drawings and in Door Schedule, on center hinge reinforcement of each frame.
- E. Finish:
1. Doors and frames shall be cleaned and phosphate treated.
 2. Doors and frames shall be galvanized with A60 or G60 zinc coating in accordance with ASTM A525 (Wipe Coat galvanized coating is not acceptable).
 3. Doors and frames shall be finished with a baked-on rust-inhibiting primer in accordance with ANSI A250.3. Doors shall be field finished in accordance with Section 09900.
- F. Manufacturers and Models:
1. Steelcraft L series with F series frame
 2. Curries 727 series with M type frame
 3. Or equal.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean and prepare rough opening to accept metal frame. Identify and report any deficiencies in rough opening to Engineer prior to installing metal frame.

3.2 INSTALLATION

- A. Metal Frames:
1. Set all frames in accordance with SDI 105.
 2. Set welded frames in position prior to beginning partition work.
 3. Brace frames until permanent anchors are set.
 4. Set anchors for frames as work progresses.
 5. Install anchors at hinge and strike levels.
 6. Use temporary setting spreaders at all locations.
 7. Use intermediate spreaders to assure proper door clearances and header braces for grouted frames.
 8. Install frames in prepared openings in concrete and masonry walls using countersunk bolts and expansion shields.
- B. Hollow Metal Doors:
1. Install hollow metal doors in frames using hardware specified in Section 08700 Door Hardware.
 2. Clearances at edge of doors

- a. Between door and frame at head and jambs: 1/8 inch.
- b. At meeting edges pairs of doors and at mullions: 1/8 inch.
- c. At transom panels, without transom bars: 1/8 inch.
- d. At sills without thresholds: 5/8 inch maximum above finish floor.
- e. At sills with thresholds: 1/8 inch above threshold.

3.3 ADJUSTMENT AND CLEANING

- A. Remove dirt and excess sealants, mortar or glazing compounds from exposed surfaces.
- B. Adjust moving parts for smooth operation. Use shims if necessary to allow for proper closing.
- C. Fill all dents, holes, etc. with metal filler and sand smooth and flush with adjacent surfaces - Reprime/paint to match finish.

+ + END OF SECTION + +

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SECTION 08305
ACCESS HATCHES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Provide all materials, equipment, and accessories to furnish and install the following access hatches:
 - 1. Flush floor hatches
 - 2. Roof hatches

1.2 QUALITY ASSURANCE

- A. Warranty: Provide a 1-yr warranty on all hatches from date of installation. Warranty shall cover defects in workmanship, design, and materials. If any component should fail during the warranty period, it shall be corrected and the unit restored to service at no expense to the OWNER.

1.3 DESIGN REQUIREMENTS

- A. In Rights-of-way, service roads, and driveways, and where designated on the drawings, hatches shall be designed for H20 wheel loading.
- B. Roof hatches shall be designed for a minimum live load of 100 pounds per square foot.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Detailed drawings showing component and assembly dimensions, location of connections, weights of all equipment, installation details, and accessory details.
- B. Product Data:
 - 1. Descriptive literature, specifications, and engineering data.
 - 2. Materials of construction for all components and accessories.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. All equipment and accessories shall be properly protected during shipment such that no damage or deterioration shall occur between shipment and installation.
 - 1. Finished surfaces shall be protected by wooden blanks.
 - 2. Finished ferrous metal surfaces not painted shall be protected from corrosion.
 - 3. Each box and package shall be clearly marked with the contents and total weight.
- B. Manufacturer shall provide any special storage and handling instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. General: Acceptable manufacturers are listed below. Other manufacturers of equivalent products may be submitted.
 - 1. Aluminum hatches:
 - a. The Bilco Co.
 - b. Babcock-Davis, Inc.
 - c. Or Equal.

2.2 MATERIALS

- A. Unless otherwise noted, all access hatches shall be constructed of aluminum.
- B. Aluminum hatches shall be provided with aluminum frames and stainless-steel hardware.

2.3 FLUSH FLOOR HATCHES

- A. General
 - 1. Doors shall be pre-assembled from the manufacturer.
 - 2. Covers shall open 90 degrees and be equipped with a hold open arm which automatically locks the cover in the open position.
 - 3. Covers shall be fitted with the required number and size of compression spring operators. Springs shall have an electrocoated acrylic finish. Spring tubes shall be constructed of a reinforced nylon 6/6-based engineered composite material.
 - 4. A removable exterior turn/lift handle with a spring loaded ball detent shall be provided to open the cover and the latch release shall be protected by a flush, gasketed, removable screw plug.
 - 5. Hardware:
 - a. Hinges shall pivot so that the cover does not protrude into the channel frame.
 - b. A Type 316 stainless steel snap lock with fixed handle shall be mounted to the underside of the cover.
 - c. Hatch to have recessed locking hasp.
 - 6. Entire door and all hardware components shall be highly corrosion resistant.
 - 7. Doors shall be sealed with a gasket.

2.4 ROOF HATCHES

- A. General
 - 1. All roof hatches shall be preassembled from the manufacturer.
 - 2. Entire hatch shall be weathertight with fully welded corner joints on cover and curb.
 - 3. Cover:
 - a. Material: 11 gauge aluminum with a 3-inch beaded flange with formed reinforcing members.
 - b. Cover shall be reinforced to support a minimum live load of 40 psf with a maximum deflection of 1/150th of the span or 20 psf wind uplift.
 - c. Cover shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed on the top surface of the curb.
 - d. Cover insulation shall be fiberglass of 1-inch thickness, fully covered and protected by an 18 gauge aluminum liner.

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4. Curb:
 - a. Material: 11 gauge aluminum
 - b. The curb shall be 12 inches in height.
 - c. The curb shall be formed with a 3-1/2-inch flange with 7/16-inch holes provided for securing to the roof deck.
 - d. The curb shall be equipped with an integral metal capflashing of 11 gauge aluminum, fully welded at the corners.
 - e. Curb insulation shall be rigid, high-density fiberboard of 1-inch thickness on outside of curb.
5. Lifting Mechanisms:
 - a. Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide smooth, easy, and controlled cover operation.
 - b. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly.
 - c. The lower tube shall interlock with a flanged support shoe welded to the curb assembly.
6. Hardware:
 - a. Heavy pintle hinges shall be provided.
 - b. Cover shall be equipped with a spring latch with interior and exterior turn handles.
 - c. Roof hatch shall be equipped with interior and exterior padlock hasps.
 - d. The latch strike shall be a stamped component bolted to the curb assembly.
 - e. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1-inch diameter red vinyl grip handle to permit easy release for closing.
 - f. Compression spring tubes shall be an anti-corrosive composite material and all other hardware shall be zinc plated and chromate sealed. Springs shall have an electrocoated acrylic finish for corrosion resistance.
 - g. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.
7. Factory finish shall be mill finish aluminum.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install in accordance with the manufacturer's recommendations and approved shop drawings. Install level and square with other construction, without warp or rack.
- B. Unless otherwise shown, flush floor hatches shall be cast integrally with concrete vaults, and shall not be grouted in later.
- C. Coordinate precise location with equipment to be accessed thereby.
- D. Aluminum surfaces shall be protected with two heavy coats of asphaltic or zinc chromate paint, where they are in contact with concrete or masonry.

+ + END OF SECTION + +

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SECTION 08700
DOOR HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Provide all materials, equipment, and accessories to furnish and install door hardware.

1.2 SUBMITTALS

- A. Shop Drawings:
 - 1. Product Data: Manufacturers' literature for each item of finish hardware required herein, clearly marked.
 - 2. Finish Hardware Schedule: Furnish complete and detailed schedule, show product items, numbers, and finishes for all hardware for each separate opening.
 - 3. Special Tools: Provide listing and description of usage.

1.3 QUALITY ASSURANCE

- A. Qualifications of Supplier: A recognized supplier of architectural finish hardware, with warehousing facilities, who has been furnishing hardware in the vicinity of the Project for not less than 5 years, and who is, or who employs, an architectural hardware consultant.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Provide secure storage for all finish hardware until installation is made.
- B. Before delivery, clearly identify and tag each item of hardware with respect to specified description and location of installation.

1.5 SPECIAL TOOLS

- A. Provide two sets of special tools for installation and maintenance of hardware.

PART 2 - PRODUCTS

2.1 DOOR HARDWARE

- A. Provide all door hardware from a single manufacturer in order to have consistency in appearance, function and maintenance procedures.
- B. Fasteners:
 - 1. All fasteners shall be type 304 stainless steel.
- C. Butt Hinges:
 - 1. Conforming to ANSI A156.1-88.
 - 2. Quantity per Door Leaf (Minimum):

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DOOR HEIGHT	MINIMUM NUMBER OF HINGES PER LEAF
Up to 5'-0"	2 ea
5'-0" to 7'-7"	3 ea
7'-7" to 10'-0"	4 ea
10'-0" to 12'-6"	5 ea
Over 12'-6"	One for every 30" of door height, rounding up

3. Hinge Size: Except as otherwise specified or as required to comply with UL and NFPA, provide hinges of the following sizes:
 - a. Up to 36" wide: 4½" heavy weight.
 - b. Over 36" to 48" wide: 5" heavy weight.
 - c. Over 48" wide: 6" heavy weight.
 4. Types of Hinges: Full-mortise type, ball-bearing hinges swaged for mortise applications, inner leaf beveled, square cornered.
 5. Width: Minimum for clearance of trim and 180-degree swing.
 6. Exterior Hinges: Non-removable pin.
 7. Joint Tolerance: 0.012-inch maximum, gauged in CLOSED position.
 8. Material: type 304 stainless steel.
 - a. Finish: Satin stainless steel No. 630.
 9. Hinge Manufacturers and Models:
 - a. Stanley FBB191-32D
 - b. McKinney TB2314
 - c. Or Equal.
- D. Exit Devices
1. Provide exit devices on all exit doors complying with ANSI A156.3.
 2. Furnish cylinder where required.
 3. Trim:
 - a. Levers: Sargent LNL; Von Duprin 06, or equal.
 - b. Strikes: Use open back strike.
 4. Finish: Satin chromium-plated No. 626.
 5. Exit Device Manufacturers and Models:
 - a. Sargent 8313ET X LNL (Single Doors and Active Leaf of Double Doors) and 8710 (Passive Leaf of Double Doors)
 - b. Von Duprin 9975L-996-06 (Single Doors and Active Leaf of Double Doors) and 9927EO (Passive Leaf of Double Doors)
 - c. Or Equal.
- E. Coordinator:
1. Provide coordinator at all double doors.
 2. Coordinator Manufacturers and Models:
 - a. Ives COR7G.
 - b. Or Equal.
- F. Closers:
1. Provide closers on all exterior doors or as indicated in the door schedule which comply with ANSI A156.4.
 2. Size closers in accordance with manufacturer's standards. Mount regular arm closers on pull side of doors. Mount parallel arm closers on push side of doors. On pair of doors provide closer on active leaf only, unless noted otherwise.
 3. Closer Manufacturers and Models:
 - a. LCN 4110 Series
 - b. Sargent 351 Series

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c. Or Equal.

G. Thresholds:

1. Provide threshold at each door as indicated in the door schedule or shown on the drawings: One-piece full width of opening; extend beyond jamb where indicated.
2. Provide with stainless steel machine screws in threaded expansion anchors at concrete.
3. Finish: Mill finish aluminum, unless indicated otherwise.
4. Threshold Manufacturers and Models:
 - a. Pemko 274X4AFG
 - b. Reese Enterprises, Inc. S407A
 - c. Or Equal.

H. Weatherstrip:

1. Provide complete weatherstrip system at exterior doors, including rubber or vinyl at jambs and head, door sweep, rain drip, astragal seal for 2-leaf doors, and all other weatherstripping necessary to provide a weather-sealed door system which does not allow air or moisture movement through the gap between the door and frame.

I. Stops and Holders:

1. Provide stops and holders for all doors with closers in accordance with ANSI A156.16.
2. Finish: Satin chromium-plated No. 626.
3. Stop/Holder Manufacturers and Models:
 - a. Ives WS445
 - b. Hager Companies 256
 - c. Or Equal.

2.2 KEYING

- A. Coordinate Keying System with OWNER. Provide master-keying and local-keying to match OWNER's keying system.
- B. Provide removable construction core system for use during construction.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. In accordance with manufacturer's written instructions.
- B. Make Work neat and secure, develop full strength of components, and provide proper function.
- C. Prevent marring, scratching, or otherwise damaging adjacent finishes during hardware installation.
- D. Latchbolts: Install to engage in strikes automatically, whether activated by closers or manually. In no case shall additional manual pressure be required to engage latchbolt in strike.

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- E. Wall Mounted Hardware: Install over solid structural backing or solid blocking in hollow walls.
- F. Thresholds:
 - 1. Cope ends neatly to profile of jamb.
 - 2. Set in sealant and seal ends to jambs.
- G. Hardware: Adjust for easy, noise-free operation.
- H. Replace damaged hardware items.

3.2 MOUNTING DIMENSIONS

- A. Standard Door Hardware Locations: As recommended and published by the Door and Hardware Institute, except as noted or detailed otherwise.
- B. Door Silencers: Install 3 inches from top and bottom of jamb and 1 inch above strike at single doors, and 3 inches from edges of doors in head for pairs of doors.

3.3 MANUFACTURER'S SERVICES

- A. Deliver permanent lock cores to the site.
- B. Remove temporary construction cores and insert permanent cores.
- C. Inspect each lock set to ensure permanent cores are operating satisfactorily.
- D. Deliver to OWNER change and control keys for the permanent system.
- E. Return temporary construction cores to the manufacturer.

3.4 PROTECTION

- A. Cover and protect exposed surfaces of hardware during installation and until Substantial Completion.
- B. Fit, dismantle, and reinstall finish hardware as required for finish painting work.
- C. Protect and prevent staining of hardware during construction in accordance with manufacturer's recommendations.
- D. Remove protective measures and permanent lock cylinders installed prior to final cleaning.

+ + END OF SECTION + +

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SECTION 09900

PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Provide and install coatings on all exposed surfaces as indicated herein, in other Specification Sections, and on the Drawings.

1.2 QUALITY ASSURANCE

- A. Experience: Both Coatings Manufacturer and Coatings Installer shall have a minimum 5 years' experience in production and application, respectively, of specified products. Coatings Installer shall be approved and endorsed, in writing, by Coatings Manufacturer.
- B. Regulations: Meet federal, state, and local requirements which apply to the work, including, but not limited to those regulations limiting the emission of volatile organic compounds.
- C. Coatings Manufacturer Recommendations: Coatings Installer shall follow all recommendations of the Coatings Manufacturer regarding storage, handling, surface preparation, application of coatings, recoat times, environmental conditions during storage, preparation and application of coatings, and all other Coatings Manufacturer recommendations.
- D. Warranty: Both Coatings Manufacturer and Coatings Installer shall provide a 1-year complete replacement warranty for all coatings. Manufacturer shall provide 5-year warranty for long-term performance of coatings in addition to 1-year warranty.

1.3 SUBMITTALS

- A. Shop Drawings: Coatings Manufacturer shall submit for approval the following:
 - 1. Copies of Manufacturer's technical information and application instructions for each material proposed for use. Specify exactly which product is being proposed for each coating type (as specified below). This may be accomplished through a reference table along with information on the various products, or by a separate, tabbed section with information on products being submitted for each system in a separate tab of a binder. Submittal of general Manufacturer's literature without detailing which product is proposed for each paint system will be unacceptable.
 - 2. Copies of Manufacturer's complete color charts for each coating system.
 - 3. Letter from the Coatings Manufacturer approving and endorsing Coatings Installer.
 - 4. Furnish copies of the final, approved submittal to the Coatings Installer so that it is clear which product is to be used for which each system.
- B. Reference Samples:
 - 1. Provide reference samples of paint colors and textures as required by the ENGINEER. Reference samples will show the color and texture of the final paint to be applied and shall be approved by the ENGINEER prior to painting. Reference samples should be applied to similar substrates to the final surfaces to be painted. If ENGINEER chooses

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to forego reference samples, CONTRACTOR must receive the allowance to forego reference samples before painting begins or all painted surfaces will be re-painted at the ENGINEER's discretion and at no additional cost to the OWNER.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Protection: Protect all pre-coated items from coating damage during shipping.
- B. Store products in accordance with Manufacturer's directions.
- C. Store products in a neat, orderly fashion. Protect products from damage. Protect storage area from damage from stored products.

PART 2 - PRODUCTS

2.1 PRODUCT AND MANUFACTURER:

- A. Provide coating types as listed in the following table. The systems referenced in the table are those provided by Tnemec. Sherwin-Williams, or Equal are also acceptable manufacturers. If manufacturers other than Tnemec are desired, the CONTRACTOR shall submit equivalent paint systems.

COATING TYPE	DESCRIPTION	Sherwin Williams	TNEMEC SERIES
Clear Polyamine Epoxy	Clear Polyamine Epoxy, high solids, moisture resistant, designed as a one-coat wood sealer.	GP3477	Series 201, Epoxoprime
Polyamine Epoxy Sealer	Waterborne Polyamine Epoxy, penetrating, flexible and low-odor primer designed for sealing porous substrates.	Macropoxy 5000	Series 151, Elasto-Grip FC
Amine Epoxy	Polyamidoamine Epoxy designed for use on steel or other ferrous metals not in contact with potable water but submerged or immersed in wastewater or non potable water.	Sherglass FF	Series N69, Hi-Build Epoxoline II
	Polyamidoamine Epoxy designed for use on steel or other ferrous metals in contact with potable water.	Macropoxy 5500	Series 140, Pota-Pox Plus
Polyurethane	Aliphatic Acrylic Polyurethane designed for exterior weathering, abrasion and corrosion resistance	Hi Solids Polyurethane-100	Series 73, Endura-Shield

2.2 COLOR

- A. Color Pigments: Pure, nonfading, lead-free applicable types to suit the substrates and service indicated.
- B. Provide colors as described in the drawings or specifications, or as selected by ENGINEER from standard color palette. For piping system colors, reference pipe schedule.

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- C. Where existing colors are to be matched or satisfactory color is not available from standard color palette, provide custom-mixed colors.
- D. Provide samples of each color on the substrate to be coated for approval by the ENGINEER prior to beginning coating application.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Coatings Installer shall prepare all surfaces to be painted in strict accordance with Coatings Manufacturer's recommendations.
- B. Coatings Manufacturer representative shall observe Coatings Installer's methods of preparing surfaces and approve of the work prior to Coatings Installer beginning coating installation. If, after a period of time, Coatings Manufacturer is satisfied with Coatings Installers methods, Coatings Manufacturer can allow Coatings Installer to proceed without inspection following surface preparation. Coatings Manufacturer and installer will still both be held equally accountable for any coatings failure.

3.2 PROTECTION

- A. Protect all adjacent surfaces from overspray, dripping or other transfer of coatings not intended for those surfaces. Use masking, tape, drop cloths, plastic and other protective materials as appropriate.
 - 1. Remove, mask, or otherwise protect hardware, lighting fixtures, switchplates, aluminum surfaces, stainless steel surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not intended to be painted.
 - 2. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process. Mask openings in motors, fan housings, etc. to prevent coatings from falling inside.
 - 3. Correct all damages by cleaning, repairing or replacing, and repainting, as acceptable to ENGINEER.
- B. Completely remove all masking, tape, drop cloths, plastic and other protective materials within 48 hours of completion of application of finish coat. Take special care to remove masking and plastic which cover tank vent openings, HVAC registers, vents, motor vents, and other areas where airflow is critical to proper operation.

3.3 APPLICATION

- A. Paint all exposed surfaces not specifically excluded in 3.3.C, below. Provide and install Coatings in accordance with the following Table, unless otherwise specified in other Sections:

COATING SYSTEM NO.	SURFACE TO BE COATED	PRIMER COATING	NO OF PRIMER COATS	PRIME COAT THICKNESS (EACH COAT)	FINISH COATING	NO OF FINISH COATS	FINISH COAT THICKNESS (EACH COAT)
300	Exposed Ferrous Pipe Systems and Exposed Steel Items	Polyamidoamine Epoxy	2	4-6 MDFT	Polyurethane	2	2-3 MDFT
301	Exposed, Non-metallic Pipe Systems	Polyamidoamine Epoxy	1	3-5 MDFT	Polyurethane	2	3-5 MDFT
302	Immersed Ferrous Pipe Systems and Steel Items	Polyamidoamine Epoxy*	1	6-10 MDFT	Polyamidoamine Epoxy	1	6-10 MDFT
303	Immersed Non-metallic Pipe Systems	Polyamidoamine Epoxy	1	4-6 MDFT	Polyamidoamine Epoxy	1	4-6 MDFT
304	Buried Ferrous and Steel Items	Polyamidoamine Epoxy	1	8-10 MDFT	Polyamidoamine Epoxy	1	8-10 MDFT
305	Aluminum Surfaces in Contact with Concrete	Polyamidoamine Epoxy	1	4-6 MDFT	None		
	Pumps	Touch up factory applied coatings, per Pump Specifications					

* Where in contact with potable water, coating shall be NSF-61 certified.

- B. Items Delivered with Factory Applied Primer:

1. For items delivered with a factory applied primer and requiring painting under this Section, the factory applied primer may be used in lieu of field applied primer only under the following conditions:
 - a. The ENGINEER approves the use of the factory applied primer in lieu of field applied primer.
 - b. The factory applied primer is certified by the Coatings Manufacturer as compatible with the field applied finish coat.
 - c. The Coatings Manufacturer's recommended recoat time for the factory applied primer has not been exceeded.
2. If all of the above conditions are not met, the Coatings Installer shall re-prepare all surfaces to be painted in strict accordance with Coatings Manufacturer's recommendations and primer applied, in accordance with this Section.

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C. Table Definitions:

1. SF/Gal: Square foot of coverage per gallon of coating used.
2. MDFT: mil dry film thickness
3. mil: 1/1000 of an inch paint thickness
4. Ferrous Pipe: Includes Ductile Iron, Cast Iron, Steel, and Galvanized Steel piping
5. Steel Items: Includes steel and galvanized steel items such as structural steel, doors, window frames, overhead coiling doors, bollard posts, steel gates, steel fences, and all other steel and galvanized steel items.
6. Non-Metallic Pipe: Polyvinyl Chloride, Chlorinated Polyvinyl Chloride, Fiberglass Reinforced Plastic, High Density Polyethylene
7. Exposed: Located above grade, exposed to the atmosphere not submerged. Includes surfaces inside and outside of buildings.
8. Submerged: In an area which normally is under water or other liquid or is intermittently under water or other liquid.
9. Buried: Located below grade, surrounded by backfill.

D. Surfaces Not Requiring Painting:

1. Unless otherwise stated or shown below or in other sections, the following areas or items will not require painting or coating:
 - a. Concrete surfaces.
 - b. Reinforcing steel.
 - c. Copper, bronze, brass, Monel, aluminum, chromium plate, and stainless steel surfaces, except where:
 - 1) Required for electrical insulation between dissimilar metals.
 - 2) Aluminum embedded in concrete or masonry, or aluminum is in contact with concrete or masonry.
 - 3) Color coding of equipment and piping is required.
 - d. Pipe unions or portions of piping systems where painting would make disassembly difficult or impossible.
 - e. Prefinished electrical, mechanical and architectural items such as motor control centers, switchboards, switchgear, panelboards, transformers, disconnect switches, HVAC equipment enclosures, ductwork, acoustical tile, cabinets, louvers, and wall panels.
 - f. Electrical conduits.
 - g. Cathodic protection anodes.
 - h. Insulated piping and insulated piping with jacket will require prime coat only.
 - i. Fiberglass reinforced plastic (FRP) surfaces with an integral ultra-violet resistant colored gel coat do not require painting, provided the color is as selected.
 - j. Glass, plexiglass or other transparent or translucent material intended to allow passage of light.
 - k. Civil/site materials such as asphalt, gravel, rock, chain-link fence, and plantings.

3.4 RECOAT TIMES:

- A. Coatings Installer shall observe all requirements of the Coatings Manufacturer regarding recoat times.

3.5 PAINT LOG

- A. Coatings Installer shall keep a paint log
1. Specific details of the contents and format paint log shall be determined by the Coatings Installer and approved by the ENGINEER.

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2. At a minimum, paint log shall record, on a daily basis for any day when coating work is performed:
 - a. Weather conditions, including 3-day forecast
 - b. Which surfaces were prepared for coating
 - c. Approval of surface preparation by the Coatings Manufacturer representative
 - d. Which surfaces or systems were coated that day
 - e. Who the installer was (specific names of persons on crew)
 - f. Which coating type was used
 - g. Which coat was installed
 - h. What the application rate or MDFT was (as approved by ENGINEER)
3. Paint log shall be kept on-site. Paint log shall be signed on a daily basis, for any day when coating work is performed, by the supervisor of the coatings installer field crew and by the ENGINEER.
4. Any painted surface which was not recorded in the paint log shall be stripped, re-prepared, and recoated at the ENGINEER's discretion.

3.6 WARRANTY INSPECTION

- A. Warranty inspection shall be conducted during the eleventh month following completion of the Work. All defective Work shall be repaired by the CONTRACTOR in accordance with this Specification and to the satisfaction of the ENGINEER and at the CONTRACTOR'S expense.
- B. Any location where paint has peeled, bubbled, or cracked and any location where rusting is evident shall be considered to be a failure of the system. The CONTRACTOR shall make repair at all points where failures are observed by removing the deteriorated paint, cleaning the surface, and recoating or repainting with the same system. If the area of failure exceeds 25 percent of the total coated or painted surface, the entire coating or paint system may be required to be removed and repainted in accordance with this specification as determined by the ENGINEER.
- C. All costs for CONTRACTOR'S inspection, Manufacturer's inspection and all costs for repair shall be borne by the CONTRACTOR.

+ + END OF SECTION + +

SECTION 10400
IDENTIFICATION DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Furnish and install signs, placards, and labels for safety equipment, hazards, and equipment and piping identification.

1.2 SUBMITTALS

- A. Shop Drawings:
1. Provide manufacturer's literature showing available letter sizes and styles, standard and custom colors, and standard mounting details.
 2. Provide drawings showing layouts, actual letter sizes and styles, colors, and project-specific mounting details.

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHER LOCATION SIGNS

- A. Material:
1. Subsurface silkscreened graphics on a transparent acrylic sheet, 0.08" thick with Helvetica Medium alphabet and matching arrows type face.
 2. Provide 2" high upper case letters and 1" high lower case letters.
- B. Fire Extinguisher Identification Sign:
1. Provide 15"x 15" with 1" radiused corners, unframed.
 2. Provide one for each surface mounted fire extinguisher.
 3. Background color shall be red with white lettering.
 4. Signs shall incorporate a white directional arrow as located by ENGINEER.
- C. Product and Manufacturer: Provide one of the following:
1. ASI/SPE MH (Four Corners) Plaque by ASI Sign Systems, Incorporated.
 2. Or equal.

2.2 FIRE PROTECTION PLACARDS

- A. Fire Protection Placards:
1. Provide diamond-shaped placards: 15" square of 0.125" rigid polyethylene.
 2. The placard shall meet NFPA 704.
- B. Product and Manufacturer: Provide one of the following:
1. W.H. Brady Company
 2. Seton Name Plate Company
 3. Or Equal

2.3 MISCELLANEOUS SAFETY SIGNAGE

- A. Safety signs shall comply with the following standards:
1. Occupational Safety and Health Administration (OSHA), Standards for General Industry, Subparts 1910.200 Hazard Communication (July, 1986).
 2. National Fire Protection Association (NFPA) Standard No. 704 - Label System.
 3. Uniform Fire Code, Latest Edition.
 4. Uniform Fire Code Standard 79-3.
- B. Safety signs shall be of height and width required by layout and shall be formed from semi-rigid butyrate, polyethylene or fiberglass. Lettering shall be 3-inches high and 1/2-inch in stroke.
- C. Provide one of the following safety signs at the Zone A pump station (interior wall location to be identified by ENGINEER):

DRAWING REFERENCE NUMBER	TEXT	BACKGROUND COLOR	LETTERING COLOR
S-100	CAUTION: EQUIPMENT STARTS AUTOMATICALLY	Yellow	Black

2.4 EXIT SIGNS

- A. Material: Plastic, 1/8-inch minimum thickness.
- B. Lettering: 6 inches high, 3/4-inch stroke, white letters on red background.

2.5 IDENTIFICATION LABELS

- A. Pipe Labels and Flow Direction Arrows:
1. Label, Lettering Color, Size and Placement: In accordance with ANSI A13.1, and as listed below.
 2. Label Colors:

Fluid Service	Background Color	Letter Color
Potable, cooling, boiler feed, and other water	Safety green	White

3. Label Size:

Outside Diameter of Pipe Covering, inches	Length of Color Field, inches	Size of Letters, inches
3/4 to 1-1/4	8	1/2
1-1/2 to 2	8	3/4
2-1/2 to 6	12	1-1/4
8 to 10	24	2-1/2
Over 10	32	3-1/2

4. Label Placement:

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- a. Labels shall be positioned on the pipes so they can be easily read. Proper label placement is on the lower side of the pipe if the employee has to look up to the pipe, on the upper side of the pipe if the employee has to look down towards the pipe, or directly facing the employee if on the same level as the pipe. Labels should be located near valves, branches, where a change in direction occurs, on entry/re-entry points through walls or floors, and on straight segments with spacing between labels that allows for easy identification.
 - 5. Material: Manufacture from or encase in outdoor grade plastic or vinyl that will resist damage or fading from washdown, sunlight, mildly corrosive atmosphere, dirt, grease, and abrasion.
 - 6. Message: See Piping Schedule.
 - 7. Labels:
 - a. Snap-Around Type: Size for finished outside diameter of pipe and insulation.
 - b. For 6 Inches and Over Diameter Pipe: May furnish strap-on type fastened without use of tools with plastic or stainless steel straps.
 - c. Firmly grip pipe so labels remain fixed in vertical pipe runs.
 - 8. Manufacturers and Products:
 - a. T & B/Westline, Rariton, NJ, Model WSS Snap-Around.
 - b. Seton Name Plate Corp., New Haven, CT, Setmark Series.
 - c. Or equal.
- B. Equipment Labels:
- 1. Applies to equipment with assigned tag numbers wherever specified.
 - 2. Lettering: Black bold face, 3/4-inch minimum high.
 - 3. Background: OSHA safety yellow.
 - 4. Materials: Either of the following:
 - a. Aluminum or stainless steel base with a baked-on finish that is suitable for use on wet, oily, exposed, abrasive, and corrosive areas.
 - b. Fiberglass with fiberglass-encased lettering.
 - 5. Furnish 1-inch margin on each end of label for mounting. On fiberglass labels furnish grommets at each end for mounting.
 - 6. Size:
 - a. As appropriate for lettering provided.
 - b. Provide same-size labels for equipment series which are adjacent.
 - 7. Message: Equipment names and tag numbers as used in Sections where equipment is specified and/or on Drawings.
 - 8. Manufacturers and Products:
 - a. T & B/Westline Co., Rariton, NJ; Type KQ.
 - b. Seton Name Plate Corp., New Haven, CT; Style EB.
 - c. Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION OF SIGNS

- A. Install Fire Extinguisher location signs at all fire extinguisher locations, approximately 12" above fire extinguisher mounting bracket.
- B. Install Exit Signs mounted to each door which leads to the outside of the building, on the panic bar side of the door, mounted to the door approximately 5'-6" above finished floor.

- C. Install all other signs at locations as shown on the drawings. Signs should be installed approximately 5'-6" off of finished floor, attached to doors where appropriate. Where two signs are indicated in the same location, signs should be mounted side-by-side, where possible.
- D. Install all signs plumb and level. They shall be attached with four stainless steel screws or anchor bolts as required for substrate. Provide theft/tamper-resistant fasteners on all signs.

3.2 INSTALLATION OF PIPE IDENTIFICATION LABELS

- A. Provide pipe identification label with flow arrows on all exposed piping systems as follows:
 - 1. At all connections to equipment, valves, tees or wall penetrations.
 - 2. At intervals along piping not greater than 18 feet on center with at least one label applied to each exposed horizontal and vertical run of pipe.
- B. Install pipe identification labels after all painting has been completed.

3.3 INSTALLATION OF EQUIPMENT IDENTIFICATION LABELS

- A. Install equipment identification labels on all equipment which has been given an equipment number in the Drawings or Specifications. Provide identification label which includes equipment name and tag number.
- B. Where no damage will be caused to equipment, mount equipment identification label directly to equipment. Otherwise, mount equipment identification labels to concrete equipment base or wall space. Install equipment identification label such that it is clear which piece of equipment is being labeled.
- C. Anchor to equipment or base for easy removal and replacement with ordinary hand tools.

+ + END OF SECTION + +

SECTION 10520
SAFETY EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
 - 1. The following safety equipment is to be provided and installed by CONTRACTOR so that it may be integrated into OWNER's safety program for operation of the facility into which it is installed.
 - 2. The following safety equipment does not represent a complete package of safety equipment required to operate the facility. Refer to OWNER's safety program for all required safety equipment and procedures.

1.2 SUBMITTALS

- A. Shop Drawings: Provide manufacturer's product data for each item including sizes, ratings, UL listings, OSHA certifications or other certifications, and mounting/installation information.
- B. Warranty: Provide manufacturer's 5-year warranty on all products provided.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Protect all equipment provided from all damage until such time as it is turned over to the OWNER.
- B. Safety equipment provided under this specification shall not be used by the CONTRACTOR in the construction of the facility. Safety equipment shall be turned over to the OWNER in new condition.

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHERS

- A. Provide at all locations labeled "FEXT" on Drawings.
- B. Provide Fire Extinguishers which Conform to NFPA-10 and as follows:
 - 1. Tri-class dry chemical extinguishing agent.
 - 2. Pressurized, red enameled steel shell cylinder.
 - 3. Activated by top squeeze handle.
 - 4. Agent propelled through hose or opening at top of unit.
 - 5. For use on A, B, and C class fires.
 - 6. Minimum UL Rating: 4A:60B:C, 10-pound capacity.
- C. Mounting Hardware:
 - 1. Furnish heavy-duty brackets with clip-together strap for wall mounting.
 - 2. Use all stainless steel fasteners for attaching brackets to wall.

- D. Manufacturers:
1. Walter Kidde
 2. Master Protection Enterprises
 3. Or Equal

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install all safety equipment per manufacturers written instructions.
- B. Install fire extinguishers where "FEXT" is called out on the drawings, 48" above finished floor or adjacent grade.

+ + END OF SECTION + +

SECTION 11200

VERTICAL TURBINE PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: Provide all materials, equipment, and accessories necessary to furnish and install multi-stage vertical turbine pumps, complete and operational with drivers, suction barrels, anchor bolting systems, and variable frequency drives where specified.
- B. The following equipment numbers have been assigned to the equipment that shall be provided. See attached pump and motor data sheets for detailed descriptions:
 - 1. Zone A Pump Station
 - a. P-100
 - b. P-200
 - c. P-300
 - d. P-400

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with requirements and recommendations of the following references, except as otherwise specified:
 - 1. Hydraulic Institute (HI)
 - 2. American Water Works Association (AWWA)
 - 3. National Electric Code (NEC)
 - 4. National Electrical Manufacturers Association (NEMA)
 - 5. Institute of Electrical and Electronic Engineers (IEEE)
 - 6. American Gear Manufacturers Association (AGMA)
 - 7. American National Standards Institute (ANSI)
 - 8. ASTM International (ASTM)
 - 9. Anti-Friction Bearing Manufacturers Association (ABMA)
 - 10. American Petroleum Institute (API)
- B. Quality Certification: Manufacturer supplying equipment furnished under this section shall hold current ISO 9001 certification.
- C. The complete pump assembly shall be certified to NSF/ANSI standard 61. This certification shall cover all wetted components of the pump, including but not limited to the bowl assembly, column assembly, discharge head assembly & suction barrel. Manufactures without NSF61 certification will not be considered. Written documentation demonstrating full compliance to NSF61 shall be provided as part of the submittal package. The pump discharge head shall be fitted with a separate nameplate displaying the NSF61 logo. No exceptions.
- D. Unit Responsibility: All equipment specified herein shall be coordinated and provided by the pump manufacturer. Manufacturer assumes full responsibility for coordination of all components.

- E. Factory Tests: The selected manufacturer shall provide the following factory tests for approval upon acceptance of shop drawings:
1. Provide manufacturer's standard functional test on all equipment.
 2. Performance Test:
 - a. Conduct on each pump in conformance with the test standards and procedures specified in the Hydraulic Institute Standards and ANSI/AWWA E1103.
 - b. Conduct the test using complete pump bowl assembly at manufacturer's standard testing procedure from shut-off head to maximum capacity. Record resulting curve showing head, flow, brake horsepower, speed, pump efficiency, and net positive suction head required (NPSHr). NPSHr values may be obtained from previous tests of the same pump model. Plot results for a minimum of seven (7) evenly spaced measurements, including shut-off head, primary design point, best efficiency point, and maximum capacity.
 - c. Pump performance results compared to rated speed and capacity at the primary design point shall be within tolerances specified by Hydraulic Institute Standards 14.6 – 2011 acceptance grade level 1U.
 - d. Pumps shall not be shipped prior to ENGINEER's approval of test results.
 3. Hydrostatic Test: test discharge heads, suction barrels and bowl assemblies at either twice the total dynamic head or one and a half times the shutoff head, whichever is greater.
 4. Motor Test: Provide short commercial motor test per IEEE 115.
- F. Warranty:
1. Provide a 1-yr warranty on all equipment from date of start-up. Warranty shall cover defects in workmanship, design, and materials. If any component should fail during the warranty period, it shall be corrected and the unit restored to service at no expense to the OWNER.

1.3 SUBMITTALS

- A. Submit the following items to the ENGINEER for approval:
1. Shop drawings:
 - a. Detailed drawings showing component and assembly dimensions, location of mechanical and electrical connections, weights of all equipment, installation details, and accessory details.
 - b. Power and control wiring diagrams, including terminals and numbers.
 - c. Drawings, templates and directions for installation of anchor bolts.
 2. Product data:
 - a. Descriptive literature, specifications, and engineering data.
 - b. Materials of construction for all components and accessories.
 - c. Impeller type and diameter, including rated diameter and minimum and maximum diameter available for the pump model.
 - d. Pump weight, motor weight, and complete assembly weight.
 - e. Complete motor nameplate data, as defined by NEMA.
 - f. Where specified, complete variable frequency drive information.
 - g. Factory finish system description.
 - h. Critical speeds of the pumps supplied.
 - i. Motor data:
 - 1) Test results
 - 2) Motor manufacturer
 - 3) Type
 - 4) Enclosure

- 5) Service Factor
 - 6) Phase
 - 7) Voltage
 - 8) Rated Horsepower
 - 9) Speed
 - 10) Full load and locked rotor amperage
 - 11) Temperature rating
 - 12) Estimated bearing life under design conditions.
 - 13) Minimum efficiency at $\frac{1}{4}$, $\frac{3}{4}$, and full load.
 - 14) Descriptive literature including description of motor insulation.
3. Performance data:
 - a. Pump rated speed.
 - b. Rated and maximum pump horsepower, and driver horsepower.
 - c. Casing working pressure.
 - d. Minimum submergence.
 - e. Maximum down and up thrust.
 - f. Efficiency and NPSHr at each specified operating condition.
 4. Submit Pump Performance Curves:
 - a. Provide pump curves showing head, brake horsepower, pump efficiency, and NPSHr and capacity, for the entire operating range of the pump.
 - b. Correct curves for pump losses and shaft friction horsepower losses. Include pump losses, column and discharge head losses.
 - c. All curves shall clearly display the specified operating conditions and the manufacturers Allowable Operating Region (AOR) and Preferred Operating Region (POR) as defined under ANSI/HI 9.6.3.
 - d. Where variable speed drives are specified, curves shall have at least five (5) speeds plotted between maximum and minimum speed.
 - e. Speed shall be clearly shown on all curves.
 5. Manufacturer's Certificate of Proper Installation.
 6. Operations and Maintenance Manuals: The selected manufacturer shall provide six sets of operation and maintenance manuals for the equipment provided. The manuals shall contain the following information at minimum:
 - a. Equipment description.
 - b. Recommended and limiting operational range.
 - c. Installation instructions including assembly, alignment, and adjustment procedures.
 - d. Operation instructions including start-up and shutdown procedures, and troubleshooting guide.
 - e. Lubrication and regular maintenance instructions.
 - f. Shop drawings.
 - g. Parts list with catalog numbers.
 - h. Performance curves.
- B. Quality Control Submittals:
1. A list of any and all instances where the equipment proposed deviates from these specifications.
 2. Names and addresses of the factory authorized service organization nearest to project site.
 3. Guarantee pump efficiency and NPSHr at the specified operating points.
 4. Upon approval of shop drawings, manufacturer shall provide certified copies of factory test reports for functional, performance and hydrostatic tests as specified.

5. Upon approval of shop drawings, manufacturer shall provide printed installation instructions.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. All equipment and accessories shall be properly protected during shipment such that no damage or deterioration shall occur between shipment and installation.
 1. Finished surfaces shall be protected by wooden blanks.
 2. Finished ferrous metal surfaces not painted shall be protected from corrosion.
 3. Each box and package shall be clearly marked with the contents and total weight.
- B. Factory assembled parts and components shall not be dismantled for shipment until permission is received in writing from the ENGINEER.
- C. Manufacturer shall provide any special storage and handling instructions.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide pumps with performance curves with constantly increasing head from maximum capacity to shut-off head.
- B. Pumps shall rotate counter-clockwise when viewed from above.
- C. Balancing: Pump assemblies shall be dynamically and statically balanced. Vibration at any point of pumps operation shall not exceed the upper limits of the Hydraulic Institute Standards.

2.2 PRODUCT AND MANUFACTURER:

- A. Weir Floway Inc.
- B. Fairbanks and Morse
- C. Or Equal

2.3 SERVICE CONDITIONS AND PERFORMANCE

- A. See attached data sheets for service conditions and performance requirements.
- B. Pumps shall have capacity no less than 98% and no greater than 103% of the specified capacity at each of the total dynamic head operating conditions shown.

2.4 COMPONENTS

- A. Coatings:
 1. Exterior of discharge head and motor shall be painted per OWNER'S selection. Provide color samples to OWNER for color selection during submittal process. Prepare surfaces to be painted per coating manufacturer's requirements.
 - a. Primer: 2 coats polyamidolamine epoxy, 4-6 mil thickness

- 1) Series N69, Hi-Build Epoxoline II
 - 2) Or Equal
- b. Polyurethane: 1 coat Aliphatic Acrylic Polyurethane designed for exterior weathering, abrasion and corrosion resistance, 2-3 mil thickness
 - 1) Series 73, Endura-Shield
 - 2) Or Equal
2. All wetted ferrous metal surfaces, including interior and exterior of suction barrel, exterior of bowl assembly, interior and exterior of column, and interior of discharge head shall be coated with an ANSI/NSF STD 61 approved bonded epoxy, minimum thickness 8-10 mils. Prepare surfaces to be painted per coating manufacturer's requirements.
 - a. Coatings:
 - 1) Tnemec Pota-Pox Plus Series N140
 - 2) Carboguard 891
 - 3) Or Equal
- B. Fasteners: Provide Type 316 stainless steel fasteners, bolts, nuts and washers conforming to ASTM A276 where exposed to liquid and where fasteners contact tapped holes.
- C. Suction Flange:
 1. Material: Fabricated steel conforming to ASTM A36 & A53.
 2. Location: below grade on suction barrel.
 3. Flange rating shall be ANSI 150# minimum.
- D. Suction Barrel:
 1. Fabricated steel conforming to ASTM A36 & A53.
 2. Barrel shall have 0.375-inch minimum wall thickness.
 3. Suitable for encapsulation in concrete with mortar conforming to AWWA C205.
 4. Flanged mount for discharge head assembly designed to withstand 150% of maximum operating thrust loads.
 5. Manufacturer shall be responsible for verification of barrel dimensions to provide acceptable hydraulic conditions at column inlet and minimal vibration per ANSI/HI 2.3.
 6. Barrel shall include internal guide vanes to prevent fluid rotation.
 7. At minimum, suction barrel shall be sized to accept one inch larger diameter bowls and one additional stage.
- E. Suction Bell:
 1. Material: ASTM A48 Class 30.
 2. Internal vanes shall be provided.
- F. Column:
 1. Material: Fabricated steel conforming to ASTM A36.
 2. Threaded connections shall be provided at column section, bowl, and discharge head connections.
 3. Provide O-ring seals at all flange connections.
 4. Column section length shall be five (5) ft maximum.
 5. Align and support lineshaft bearings.
 6. Column diameter:
 - a. Outside diameter shall match standard pipe outside diameters as specified in ANSI B36.10

- b. Columns 6-inch in diameter and less shall be at least Schedule 40
 - c. Columns 8-inch to 16-inch shall be at least Schedule 30
- 7. The column pipe shall be sized such that the friction loss will not exceed 5 feet per 100 feet, based on the rated capacity of the pump.
- G. Bowl Assembly:
 - 1. Bowls shall be cast iron conforming to ASTM A48, Class 30, with a minimum tensile strength of 30,000 psi.
 - 2. Interior of bowls shall be lined with porcelain enamel or abrasion resistant epoxy.
 - 3. Where specified, each bowl shall have replaceable wear rings.
 - a. Material shall be ASTM B505 aluminum bronze, composite, or stainless steel conforming to the requirements of API 610.
 - 4. Bolted flange connections shall be provided between bowls with O-ring seals.
 - 5. Bowl bearings shall be bronze conforming to ASTM B505, C89835
 - 6. Bowls shall be able to withstand the greater of twice the total head or one and a half times the shutoff head.
- H. Impellers:
 - 1. Material: ASTM B584 C90300 bronze alloy.
 - 2. Enclosed design.
 - 3. Securely fasten impellers to impeller shaft with Type stainless steel tapered lock collets.
 - 4. Impellers shall be vertically adjustable using a flanged adjustable spacer coupling accessible through the discharge head openings.
- I. Shaft
 - 1. Material: 416 stainless steel conforming to ASTM 582
 - 2. Shaft sizing shall conform to ANSI/AWWA E101-88, and shall be of sufficient size to prevent excessive elongation and transmit required torque without distortion in both forward and reverse direction.
 - 3. Maximum combined shear stress shall not exceed 30% of the elastic limit in tension or be more than 18% of the ultimate tensile strength of the shaft material.
 - 4. Shaft shall have a first critical speed not less than 20% above maximum operating speed.
 - 5. Section length shall be no longer than column length.
 - 6. Minimum of two line shaft bearings shall be provided.
 - 7. Maximum spacing of bearing intervals shall be 5 feet.
 - 8. Line shaft couplings shall be ASTM 582 416 stainless steel, left-hand threaded type with perfect butt-fit. Couplings shall be designed with safety factor equal to 1.5 times the shaft safety factor.
 - 9. Shaft bearings shall be neoprene or bronze, lubricated by the pumped liquid.
- J. Shaft Seal:
 - 1. Cartridge style mechanical seal with adjustable spacer coupling shall be provided in discharge head at terminus of lineshaft.
 - 2. Material:
 - a. Metal parts: 316 stainless steel.
 - b. Seal faces shall be tungsten carbide or sintered silicon carbide.
 - c. Elastomer bellows secondary seal.
 - 3. Manufacturer:
 - a. Environamics
 - b. Flowserve ISC Series

- c. Crane 5610
- d. Or Equal

K. Discharge Head Assembly:

- 1. Location: above grade
- 2. Assembly shall be of sufficient design to support the entire weight of pump assembly and NEMA rated driver and transmit all loads to the foundation with minimum vibration.
- 3. Material: Fabricated Steel conforming to ASTM A36 & A53
- 4. Discharge head natural frequency shall be elevated above maximum operating speed.
- 5. Discharge flange rating shall conform to AWWA C207 for Fabricated Steel.
- 6. Openings shall be screened to prevent access to rotating equipment.

L. Mounting Plates:

- 1. Manufacturer shall provide all supporting sole plates and fabricated steel base plates necessary to properly mount the equipment.

M. Equipment Identification Plate: 16-gauge stainless steel with the following information at minimum:

- 1. Equipment number.
- 2. Manufacturer's model and serial number.
- 3. Rated capacity and discharge head.
- 4. Speed.

N. Motors

- 1. Motors shall be solid shaft, squirrel-cage induction motors meeting the requirements of NEMA MG 1.
- 2. Motor manufacturer shall be ISO9000 certified.
- 3. Where variable frequency drives are specified, motor shall be inverter duty.
- 4. Motors shall be adequately sized to prevent overload above nameplate horsepower at maximum pump brake horsepower.
- 5. Motors shall have the guaranteed minimum efficiencies at full load as determined by IEEE 112-B
- 6. Motors shall have minimum power factor of 87%.
- 7. Totally Enclosed Fan-Cooled enclosures shall be provided.
- 8. Provide thrust bearings with a minimum L-10 life of 30,000 hours, as defined by AGMA, at the worst operating condition.
 - a. Minimum L-10 bearing life at normal operating conditions shall be 60,000 hours.
- 9. Manufacturer's recommended bearing lubrication shall be provided.
- 10. Where specified motors shall be provided with normally closed thermostat switches.
 - a. Switch shall shutdown the motor upon exceedance of the motor's maximum temperature rating.
- 11. Where bearing thermostat switches are specified, motor and bearing thermostat contacts shall be wired in series and leads shall be wired to the motor terminal box.
- 12. Where specified motors shall be provided with 120V single phase space heaters wired to a terminal box.
- 13. Where specified motors shall have a vibration switch with automatic alarm and shutdown limits.
 - a. Provide adjustable time delay to prevent nuisance trips.
- 14. Provide oversized terminal box with terminal for connection of equipment grounding wire.

15. Provide stainless steel nameplate with the following information, at minimum:
 - a. Manufacturer's name, make, and serial number
 - b. Type
 - c. Voltage
 - d. Frame
 - e. Insulation
 - f. Class
 - g. HP
 - h. Full load amps
 - i. RPM
- O. Spare Parts: Provide the following spare parts for each pump:
 1. One set of all gaskets and O-ring seals.
 2. One complete set of line shaft bearings.
 3. One set of wearing rings.
 4. One set of set keys, dowels, or pins.
 5. One complete mechanical seal.
 6. One set of any special tools required to dismantle the pump.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Manufacturer's representative shall inspect and approve the installation before operation.
- B. Installation Test: Performed by manufacturer's representative in the presence of ENGINEER or OWNER
 1. Functional test complete assemblies for proper alignment, connection, and operation.
 2. Vibration Test: Results shall not exceed Hydraulic Institute Standards recommendations.
 - a. Test from shut-off head to maximum capacity.
 - b. Units exceeding the vibration limit recommendations of the Hydraulic Institute Standards shall be adjusted or modified as necessary. Units which can not meet Hydraulic Institute Standards shall be replaced.
 3. Installation Performance Test shall be conducted in conformance with Hydraulic Institute Standards ANSI/HI 2.6-2000. Conformance with performance requirements shall be verified.
 4. Monitor bearing and motor temperatures during all tests and correct overheating if necessary.

3.2 MANUFACTURERS SERVICES

- A. Pump manufacturer shall provide the services of an authorized service representative for not less than four (4) days, for the following:
 1. One (1) day for installation assistance.
 2. Two (2) days for inspection of installation, start-up instruction, performance testing supervision, and adjustment assistance.
 3. One (1) day for training of OWNER's personnel.

Section 11212
Pump and Drive Data Sheet

Project	Paradise Irrigation District
Equipment Numbers	P-100, P-200, P-300, P-400
Equipment Location	Zone A Pump Station
Drive Description:	
Drive Type	Constant Speed
Motor	3 PH 460V 60 HZ
Motor Horsepower	75 hp
Pump Description:	
Pump Type	Canned Vertical Turbine
Suction Diameter	12 in
Discharge Diameter	8 in
Operating Conditions:	
Liquid Pumped	Potable water
Temperature	50 to 80 degrees F, 60 deg average
Site Altitude	2200 ft
Pump Operating Conditions:	
Pump Rated Speed	1770 rpm
Minimum NPSHr	10 ft
Minimum Shutoff Head	350 ft
Pump Design Points:	
1 st Operating Point:	
Capacity (gpm)	760 gpm
Total Dynamic Head (ft)	251 ft
Minimum Pump Efficiency	72%
2 nd Operating Point:	
Capacity (gpm)	1050 gpm
Total Dynamic Head (ft)	203 ft
Minimum Pump Efficiency	81%
3 rd Operating Point:	
Capacity (gpm)	1350 gpm
Total Dynamic Head (ft)	141 ft
Minimum Pump Efficiency	73%
Appurtenances:	
Motor Winding Thermostat	Yes
Bearing Thermostat Switch	No
Wear Rings	Yes
Vibration Switch	No
Motor Space Heater	Yes

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+ + END OF SECTION + +

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SECTION 13300 – INSTRUMENTATION AND CONTROLS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This Section covers the Instrumentation and Controls (I&C) system, complete; except for field interconnection wire and conduit, which is specified under Section 16050-ELECTRICAL. The work includes furnishing, installing, calibrating, adjusting, testing, documenting, and starting up the I&C system. The work also includes training of the Owner's personnel.
- B. Provide labor and material as required for a complete operating I&C system.
- C. The instrumentation and control system includes programmed systems, as specified in Section 13350, PROGRAMMED SYSTEMS.

1.2 GENERAL

- A. Intent of Drawings: Exact locations are not shown unless so indicated or specifically dimensioned.
- B. Departures from Drawings: Submit to the Engineer, in writing for review, details of any necessary proposed departures from these Contract Documents, and the reasons therefore, as soon as practicable and within 30 days after the award of the Contract. Make no such departures without the prior written direction from the Engineer.
- C. Functional requirements of the I&C system are depicted primarily in the process and instrumentation diagrams (P&IDs), control diagrams, and the Control Strategies in Attachment A of this Section.
- D. See Section 13350, PROGRAMMED SYSTEMS for qualifications requirements which apply to the programmed systems supplier.

1.3 CODES, PERMITS, AND REGULATIONS

- A. Do all work and install materials and equipment in accordance with the requirements of the National Electrical Code (NEC) and applicable State and local laws and ordinances.
- B. Conflicts, if any, that may exist among the above items will be resolved at the discretion of the Engineer.
- C. Wherever the requirements of the Specifications or Drawings exceed those of the items above, the requirements of the Specifications or Drawings shall govern.

1.4 CONTROL SYSTEMS INSTALLATION SUPERVISOR

- A. The Contractor shall designate an individual as project control systems installation supervisor. This individual shall have at least 5 years of total experience in selection of instrumentation components, preparation of shop drawings, and startup and commissioning of instrumentation and control systems for municipal water or wastewater treatment plants.
- B. The control systems installation supervisor shall oversee all activities associated with planning, scheduling, documenting, and executing startup and testing of plant instrumentation and control systems. Systems include everything specified in Sections 13300, 13350, 16050, 16150, 16200, and applicable instrumentation and controls described in mechanical and package system specifications.
- C. Within 3 weeks of Notice to Proceed, the General Contractor shall provide a formal submittal declaring the identity of the Control Systems Installation Supervisor, including evidence of his or her qualifications. This individual, once qualifications are favorably reviewed by the Engineer, may not be replaced without written consent of the Owner.
- D. The control systems installation supervisor's responsibilities shall include, but not be limited to, the following:
 - 1. Participate in development of overall project schedules and construction sequencing, with specific attention to instrumentation and controls prerequisites and milestones. Lead development of and incorporate any and all schedule contents specified in Section 13300, INSTRUMENTATION AND CONTROLS, and Section 13350, PROGRAMMED SYSTEMS.
 - 2. Take the lead in coordinating signal definitions and quantities, data formats, communications protocols and standards (hardware and software), control interfaces, and other aspects of integration with the facility control system. The control systems installation supervisor shall document and resolve interface issues among the Contractor's organization, and for items irresolvable within the organization develop explicit RFIs. RFIs shall include specific suggestions as to options and recommendations for resolution.
 - 3. Review and coordinate interconnection including control wiring, signal wiring, and communications interconnection among systems, devices, and sources of supply. This includes devices and systems covered under Paragraph B above, as well as existing systems with which this project interfaces.
 - 4. Develop and/or review each submittal and RFI relating to instrumentation and controls. Included are submittals for instrumentation and controls associated with the Sections identified in paragraph B above.
 - 5. Coordinate instrument and process control ranges and setpoints. Review instrument and programming submittals and test procedures for these items, and coordinate among disciplines. Supervise selection of instrument options and ranges, mounting heights, and zero and span settings. Supervise development of preliminary instrument datasheets, and following facility startup(s) supervise issuance of comprehensive instrument "as-built" settings.
 - 6. Review each applicable schedule, submittal, RFI, test procedure, test results, change, and other documents which include any instrumentation and/or controls to be transmitted to the Owner (regardless of where specified), and include with that transmittal a declaration such as the following:

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“I, _____, have reviewed the accompanying documentation and find that it is in conformance with the requirements of the Contract Documents. I further attest that the signal interfaces and senses/ranges have been coordinated among devices and systems, that the functional requirements are met, that the physical characteristics and installations are coordinated and are suitable for the application, and that interconnection has been coordinated.”

7. Prior to submissions, review test plans and results specified in this Section, Section 13350, and in Division 16 with hardwired interfaces or networked interfaces with the plant control system. The supervisor shall provide a written statement similar to that above, to be included with each submittal, that the test plans and results have been fully reviewed and are in conformance with the requirements of the contract documents.
8. Participate in all project testing and training activities as described elsewhere in the Specifications.
9. Prepare and submit a formal Instrumentation and Control Systems Startup Plan. The plan shall incorporate systems and activities associated with paragraph B above. Lead development of and incorporate the startup plan content specified in Section 13350.
10. Supervise startup of instrumentation and control systems, regardless of where specified.
11. Supervise unwitnessed and witnessed factory and field testing of instrumentation and control systems specified herein, in Section 13350 and in Division 16.
12. Coordinate integration work with the existing facility control system.
13. Following startup, prepare and submit a comprehensive accounting of as-built process ranges and setpoints for all instruments, hardwired functions, and software functions.

1.5 SHUTDOWNS

- A. Any activities which require a partial or complete shutdown of equipment, treatment processes, process monitoring, or process control shall be planned, coordinated with the District, and documented. Each shutdown shall be accompanied by a detailed shutdown plan, which shall comprise a formal submittal. Meet the requirements specified elsewhere in these Specifications.

1.6 SUBMITTALS

- A. General:
 1. Provide complete submittals as specified herein and as required to completely describe the equipment and systems being provided.
 2. In addition to the schedule requirements herein, the Contractor is responsible for providing submittals in a timely manner as required to meet the overall project schedule.
 3. In cases where existing circuits or devices are to be modified or connected to, drawings called for in this Section shall show existing items, modifications, and the points of interface. Drawings shall not be limited to new circuits, but instead shall show new plus existing. Provide drawings which fully depict the final arrangement, plus annotate or add detail to illustrate that the Contractor fully understands and

has a plan for cutting over to new systems. As-built drawings to be provided at the end of the project shall show the final arrangement only.

4. Should any item which deviates from these Specifications be included, the deviation shall be clearly indicated and explained at the time of submittal.
5. Submittals shall be complete, neat, orderly, and indexed. The Contractor shall check submittals for number of copies, adequate identification, correctness, and compliance with the Drawings and Specifications, and shall initial all copies.
6. Revise and resubmit all submittal information until favorably reviewed by the Engineer.
7. Review of submittal information by the Engineer shall not relieve the Contractor of responsibility for meeting the requirements of the Drawings and Specifications or for errors and omissions in submittals.

B. Product Submittals:

1. Product submittals shall be submitted within 45 days after the Notice to Proceed. In addition, no products shall be fabricated or shipped until the applicable submittals have been favorably reviewed by the Engineer.
2. As-built copies of product submittals shall be included in the O&M manuals.
3. Before any material is fabricated or shipped, furnish to the Engineer full details, shop drawings, dimensions, catalog cuts, schematic (elementary) diagrams, wiring diagrams, and other descriptive matter as required to fully describe the equipment specified under this Section.
4. Provide submittals as called out in Section 01610, GENERAL PRODUCT REQUIREMENTS, which demonstrate that design, fabrication, and installation of products meet the seismic requirements of that Section.
5. Provide a bill of materials, which is a listing that includes all of the panels, instruments, components, and devices provided under this Section. Components on and within panels shall be included on the bill of material for the panel. All components shall be grouped by component type, with the identification code used in these Specifications. The list shall contain the following, as a minimum:
 - a. Instrument, panel, or device tag number
 - b. Description
 - c. Quantity supplied
 - d. Reference to component data sheet and/or catalog cut
 - e. Component type
6. Provide complete submittal information on control panels, field panels, and other control enclosures.
 - a. Provide panel construction drawings, including shop drawings and catalog material. Drawings shall include dimensions and shall show the location of all panel-mounted devices as well as doors, hinges, fasteners, louvers, and subpanels. Drawings shall include a panel legend and a bill of materials. The panel legend shall list and identify front-of-panel devices by their assigned tag numbers, nameplate inscriptions, and service legends. The bill of materials shall list all devices mounted within the panel that are not listed in the panel legend, and shall include the tag number, description, manufacturer, and model number for each.
 - b. Panel Temperature Control: Provide calculations for panels, and determine heat dissipation, and panel operating temperature. Heat dissipation shall be minimum and stated in BTU per hour or watts. Operating temperature shall be calculated at a maximum ambient temperatures of 40 degrees C and based on any heating and/or cooling provisions that may be required.

- c. If ventilation fans are used, submit audible sound level data for the fans.
- d. Panel Power: Provide calculations for panels to determine panel electrical power required. Power requirements shall state required voltages, currents, and phases.
- 7. Electrical drawings and data shall be complete and shall represent the equipment proposed for this project. Drawings and data shall be adequate to demonstrate that the equipment meets the requirements of the Contract Drawings and Specifications, and also to be used by the Owner for operation, maintenance, and troubleshooting of the facility.
- 8. Provide electrical schematic diagrams and connection (wiring) diagrams which show locations and wiring for items specified in this Section, and also show interface wiring between items specified in this Section and other items on this project.
- 9. Provide complete drawings and descriptive data for control panels.
- 10. Electrical schematic diagrams shall show circuits and device elements in ladder-diagram form without regard to physical location. "Typical" schematic diagrams are not acceptable; provide individual diagrams for multiple pieces of equipment.
- 11. Connection (wiring) diagrams shall show the connections and physical relationship of electrical devices and apparatus in circuits or groups of circuits within each control panel or other identifiable unit of equipment.
- 12. For the drawings described above, manufacturer's standard drawings may be used, provided that they are annotated to reflect the configuration for this project. For example, equipment numbers and descriptions unique to this project should be used, options not included should be stricken, signal interfaces with outside systems should be marked up to depict the actual interfaces on this project, and other standard provisions should be annotated to match this project.
- 13. Loop Diagrams: Provide an individual loop diagram for each analog or discrete loop (control circuit) in the I&C system showing all terminal numbers, the location of the dc power supply, the location of any common dropping resistors, input/output module connections, and all other components. Switching contacts in analog loops and output contacts of analog devices shall be shown on the loop diagrams. Reference shall be made to the specific control diagrams where the functions of these contacts are shown. As a minimum, the loop diagrams shall meet the requirements of ISA S5.4. In addition, each loop diagram shall be divided into at least three areas for identification of element locations: panel face, back of panel, and field, respectively. Loop diagrams shall be on individual 11-inch by 17-inch drawings. See example loop diagram at the end of this Section.

C. Programmed Systems Submittals:

- 1. Additional submittal requirements for application program listings, hardware and software products, and related items are covered in Section 13350, PROGRAMMED SYSTEMS.

D. Testing Submittals:

- 1. Submittal requirements for testing, test plans, and test reports are covered under the Article, TESTING.

E. Field Wiring Interconnection Diagram:

- 1. The Contractor shall prepare and submit a complete interconnection diagram for field wiring. The Contractor shall determine which member or members of the Contractor's team shall provide this Drawing(s).

2. The supplier(s) and/or subcontractor(s) supplying the equipment and systems covered under this Section shall provide to the Contractor complete information required by the Contractor for installation of field interconnection wiring and for preparation of field interconnection wiring diagrams. As a minimum, this information shall include the following items for all equipment and systems covered under this Section:
 - a. Tabulation of interconnection wiring, with recommended wire and conduit sizes
 - b. Equipment terminal points
 - c. Internal wire identifications
3. The interconnection diagram shall show all electrical connections between equipment, panels, and field-mounted components; all component and panel terminal board identification numbers; and external wire and cable numbers. This diagram shall include all intermediate terminations between field elements and panels, such as terminal junction boxes and pull boxes. Diagrams, device designations, and symbols shall be in accordance with NEMA ICS 1-101.

1.7 OPERATION AND MAINTENANCE MANUALS

- A. Provide operation and maintenance manuals within 20 days after the start of the functional acceptance test (FAT). Include the following (both hardcopies and electronic copies on CD):
 1. Corrected submittals as required herein.
 2. Record (as-built) wiring diagrams, control schematic (elementary) diagrams, interconnection diagrams, and equipment drawings.
 3. For all equipment suppliers, list of current names, addresses, and telephone numbers of those who should be contacted for service, information, and assistance.
 4. Record (as-built) Contract Drawings marked with red pencil to show revisions to the electrical work and the underground raceways and cabling when different from the original Contract Drawings. Prepare by obtaining new, clean sets of Contract Drawings from the Engineer, and pay all costs for same.
 5. Test results.
- B. The O&M manuals shall include operating and maintenance information for all subsystems and components covered in this Section. The O&M information shall be in sufficient detail to allow the operation, removal, installation, adjustment, calibration, and maintenance of each component provided under this Section down to the printed circuit board level.
- C. Each set of manuals shall be assembled in one or more three-ring binders, each with a title page, table of contents, and heavy section dividers with labeled index tabs. When more than one binder is required, the binders shall be labeled "Volume 1," "Volume 2," etc. The table of contents shall encompass the entire set of O&M manuals, shall list the contents of each volume, and shall appear in each binder.
- D. Additional O&M requirements are described in Section 01330, SUBMITTAL PROCEDURES, and in Section 13350, PROGRAMMED SYSTEMS.

1.8 CONSTRUCTION CONSTRAINTS

A. Construction Sequencing Plan

1. The Contractor shall develop and submit a detailed construction sequencing plan which integrates all aspects of the project into a single, unified plan. The plan shall include an overall project schedule, plus narrative describing activities and provisions necessary to meet the requirements specified herein. Sequences, precedents, and other requirements in these Specifications are basic requirements; and they are not intended to identify all aspects of construction sequencing. The Contractor shall anticipate and document all required activities.
2. Construction sequencing, continuous automatic control requirements, downtime requirements, testing, and other cutover requirements for this project are extensive. The Contractor shall carefully plan the work and allocate resources as required during cutovers to ensure that the work is performed as planned. The Engineer's review of the construction sequencing plan shall not be construed to be an endorsement of the Contractor's approach or agreement on resources required.
3. Schedules and project drawings referenced elsewhere in these Specifications shall be integrated with the overall schedule.
4. Site outage times shall be minimized.
5. Systems shall be fully documented and tested prior to shipping. In the event that tests fail or documentation is incomplete, the schedule shall be revised accordingly.
6. The schedule shall allow for the submittal review durations called for under General Conditions. The schedule shall include reasonable expectations for resubmittals. A schedule which relies on submittals receiving favorable reviews when first submitted is unrealistic and will not be accepted.
7. In the event that the submittal process requires resubmittals beyond what the Contractor allowed for in the schedule, the Contractor shall revise the schedule. The Owner is under no obligation to provide favorable submittal reviews to meet the Contractor's schedule.

B. Factory Testing

1. This paragraph pertains to scheduling of factory testing for instrumentation and control systems, plus programmed systems. Refer to testing Articles in each section for technical requirements associated with factory testing.

C. Sequence of the Work

1. This paragraph describes general sequencing of the work, and is not intended to identify all activities. The Contractor's Construction Sequencing Plan shall identify all activities.
2. Refer also to Section 01110, SUMMARY OF WORK, and Section 01130, SPECIAL PROJECT CONSTRAINTS for additional requirements.
3. Perform field investigations, prepare submittals, revise and resubmit as required.
4. Perform fabrication and programming.
5. Perform factory testing in the sequence as described above.
6. Install Control Panels and complete all construction at that process area.
7. Perform requisite coordination with the electric utility for
tie-in to existing switchgear at the Water Treatment Plant.
8. Execute system Functional Acceptance Test.

D. Cutovers

1. This Section describes selected requirements pertaining to Contractor activities. The Contractor shall account for these requirements, plus any others relevant to successfully performing the work, in sequencing and executing the work.
2. All cutover activities shall be reversible. For each cutover, the Contractor's plan shall anticipate and document the steps necessary to recover from a failed cutover. This project results in items rendered unused being demolished, and messy wiring and systems cleaned up. Accordingly, reversibility as defined herein means to in some manner restore prior functionality in the event of a failed cutover. Wiring and parts in addition to what was originally in place are allowed in the process of recovery, and these items shall be available onsite in the event that a cutover needs to be reversed.
3. In the event that cutover activities cannot be completed within a day, prior to leaving the facility, all alarm and control functions previously available shall be made functional and proven out.
4. At the end of each day where cutover activities have been undertaken, whether or not they are completed, the Contractor shall successfully test at a minimum each automatic control system, each hardwired backup system, and each alarm previously available. Alarms shall be proven out to the SCADA Server. The Contractor shall prepare a written checklist itemizing each alarm and control function tested, and shall sign and submit a checklist daily for each site where cutover activities have been performed.
5. For deenergization of commercial power required to work on the electric power system, the Contractor shall prepare all documentation and coordinate with the power company.
6. Where cutover activities will interrupt commercial power, onsite standby power, including fuel cost, shall be provided by the Contractor. Standby generator shall be suitably rated to supply full facility loads.
7. Where power transducers are required, the Contractor is reminded that current transformer leads shall be terminated with the electrical supply deenergized.
8. Where cutover activities disable (even temporarily) level indication, the Contractor shall provide temporary local level indication.

1.9 FIELD INVESTIGATIONS AND PREPARATION OF DRAWINGS

- A. This project includes field investigation, demolition, and rehabilitation of existing equipment. Downtime at operating facilities will be required, with incumbent planning requirements.
- B. Prior to preparing any submittals associated with site installations and prior to performing any construction work at a site, perform a field investigation of that site and prepare related drawings as described below.
- C. Using detailed information ascertained during the field investigation, prepare and submit the following drawings as specified in Section 16050, ELECTRICAL:
 1. Elementary diagrams
 2. Wiring diagrams
 3. Layout submittals

D. Control Wiring Modifications:

1. The control schematics included in the Contract Documents are schematic in nature and do not represent all of the physical wiring details required for the work. Further, the control schematics are based on the best available information at the time of design, but will require field verification prior to construction.
2. Prior to preparing wiring submittals, the Contractor shall carefully inspect each control circuit to be modified and verify the exact field conditions, review the control diagrams (elementary diagrams) in the Contract Documents, and then verify that the circuits shown will operate in a reasonable and logical fashion and in accordance with the applicable Control Strategies. The Contractor shall then prepare and submit elementary diagrams and wiring diagrams.

E. Enclosures and Panels:

1. Prior to submitting panel construction drawings for a new enclosure, or for modifications to an existing enclosure, the Contractor shall inspect the field conditions to determine all site-specific requirements, including the size, layout, and details of existing panels and enclosures as required to perform the work.
2. The Contractor shall verify available space and review surrounding conditions for suitability of installing new enclosures. After thorough field inspection, the Contractor shall then submit panel drawings.

F. Instruments:

1. Prior to submission of instrument information and loop diagrams, the Contractor shall inspect existing instruments and the installation locations for new instruments, verify the condition and determine the wiring requirements for each instrument, and determine the exact installation location and conduit routing for each new instrument. After thorough site inspection, the Contractor shall prepare and submit loop diagrams and electrical drawings related to instrument conduit and wire.

G. SCADA Computers/Main Recorder Panel:

1. Prior to developing any submittals associated with the use of facility networks, perform field investigations. Prepare and submit applicable drawings above, plus documentation as called for in Section 13350, PROGRAMMED SYSTEMS.

1.10 WARRANTY

- A. The work and materials covered in this Section shall be guaranteed for a period of 1 year from the date of acceptance thereof against defective materials, design, and workmanship.
- B. Warranty coverage shall include any and all costs for labor, travel, lodging, and parts.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Unless otherwise indicated, provide all first-quality new materials, free from any defects, and suitable for the intended use and the space provided. Provide materials approved by UL wherever standards have been established by that organization.

- B. Furnish and install all incidental items not specifically shown or specified which are required by good practice to provide the complete systems specified herein.
- C. Refer to Attachment C for additional component specifications.
- D. Where two or more units of the same class of material or equipment are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer.

2.2 SEISMIC REQUIREMENTS

- A. Products shall be designed and fabricated to meet the applicable requirements of Section 01610, GENERAL PRODUCT REQUIREMENTS. Product submittals shall confirm that product seismic requirements are satisfied.
- B. This Article covers the following items:
 - 1. Boxes/enclosures greater than 12 inches in any dimension (other than buried boxes, handholes, and pullboxes)
 - 2. Fans (12-inch diameter or greater)
 - 3. Control panels
 - 4. Other items of weight 40 pounds or greater

2.3 STANDARD PRODUCTS

- A. Unless otherwise indicated, provide materials and equipment which are products of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturer's latest design that conforms to these Specifications.

2.4 ELECTRICAL DEVICES

- A. Circuit breakers and other electrical devices and equipment not specified in this Section shall meet the requirements of Section 16050, ELECTRICAL.

2.5 SUPPLY VOLTAGE DISTORTION

- A. Electrical (60 Hz) power for equipment furnished under this Section may contain up to 10% harmonic distortion in voltage. All systems and equipment covered in this Section shall operate properly under this condition of supply voltage distortion.

2.6 EQUIPMENT FINISH

- A. Unless otherwise indicated, finish for electrical equipment and enclosures shall be manufacturer's standard gray or ANSI 61 gray over a primer and rust inhibitor.

2.7 ENCLOSURES

- A. Unless indicated otherwise, provide suitable NEMA-rated enclosures for all devices and equipment.

2.8 NAMEPLATES, NAME TAGS, AND SERVICE LEGENDS

- A. All components provided under this Section, both field- and panel-mounted, shall be provided with permanently mounted name tags bearing the entire tag number of the component. Panel-mounted tags shall be phenolic; field-mounted tags shall be stamped stainless steel.
- B. The panel drawings refer to nameplates and service legends. Nameplates are defined as inscribed, laminated phenolic plates mounted under or near a panel-mounted instrument. Service legends are defined as inscribed, laminated plastic integrally mounted on a panel-mounted instrument.
- C. Service legends and nameplates shall be engraved, rigid, laminated phenolic type with adhesive back. Unless otherwise noted, color shall be black with white letters and letter height shall be 3/16 inch.
- D. Components mounted inside panels shall have laminated phenolic nameplates with 3/16-inch-high characters. Unless otherwise noted, color shall be black with white letters.
- E. Field-mounted tags shall be 16 gauge, stainless steel, with 3/16-inch-high characters. Each tag shall be affixed to the instrument with stainless steel wire.
- F. Each panel shall be provided with a face-mounted laminated nameplate as specified above. Unless otherwise noted, color shall be black with 1/2-inch-high white letters.

2.9 SPARE PARTS, CONSUMABLE ITEMS, AND TOOLS

- A. Fuses: Provide 20% of each size and type used rounded to the next whole number, but no less than five of each size and type.
- B. Indicating Light Bulb: Provide 20% of each size and type used rounded to the next whole number, but no less than 10 of each type. This requirement applies to annunciator light bulbs as well, if any are supplied under this Section.
- C. Corrosion-Inhibiting Vapor Capsules: 2-year supply.

2.10 PANELS

- A. General:
 - 1. Unless otherwise approved by the Engineer, all panels shall be constructed with external dimensions as shown on the Drawings. Instrument arrangement shall be as shown, with minor modifications as may be required for the particular equipment furnished. Modifications shall be subject to the approval of the Engineer.
 - 2. Freestanding panels shall be completely fabricated, with the instruments and components installed and wired at the Contractor's or panel builder's factory.
- B. Environmental Requirements:
 - 1. Panels shall be designed for continuous operation in the environments in which they are to be installed.

2. Panels shall be NEMA 3R, except indoor panels may be NEMA 12.
3. In addition to the NEMA standards, panels shall be painted carbon steel with 316 stainless steel mounting hardware.

C. Temperature Control:

1. Panels shall be equipped with thermostat and space heater to mitigate condensation and to maintain a minimum internal temperature. Panel minimum internal temperature shall not be less than 35 degrees F or the highest lower limit of any panel mounted equipment, whichever temperature is higher.
2. Unless noted otherwise, panel temperature control shall be based on maximum and minimum ambient temperatures of 40 degrees C and -10 degrees C, respectively.
3. Panels shall be sized and equipped to adequately dissipate heat generated by equipment mounted inside or in the panel face. Panel maximum internal temperatures shall not exceed 140 degrees F or the lowest upper limit of any panel mounted equipment, whichever temperature is lower.
4. Panels shall be provided with louvers and forced ventilation to prevent temperature buildup. Louvers shall be provided with washable or replaceable filters and shall be located top and bottom on opposite sides of panels. For panels located outdoors, louvers shall include a rain shield designed to prevent rain from entering the panel.
5. Forced-ventilation fans shall provide a positive internal pressure within the panel. Fan motors shall operate on 120-volt, 60-Hz power.
6. Temperature loss and/or temperature rise calculations shall be submitted to support panel temperature control requirements and methods.

D. Corrosion Control: All panels shall be protected from internal corrosion by the use of corrosion-inhibiting vapor capsules manufactured by Northern Instruments, Hoffman Engineering, or equal.

E. Freestanding Panel Construction:

1. Fabricate each panel from sheet steel with a minimum 12-gauge thickness. Panel fronts shall be fabricated from a single piece of sheet steel. The panels shall be so constructed that no seams or bolt heads are visible when viewed from the front. Panel cutouts for instruments and other devices (e.g., lights and switches) shall be cut, punched, or drilled and smoothly finished with rounded edges.
2. Provide angle and/or plate stiffeners on the back of the panel face as required to prevent panel deflection under instrument loading or operation. Internally, the panels shall be supplied with a structural framework for instrument support purposes and panel bracing. The internal framework shall permit panel lifting without racking or distortion. Provide removable lifting rings designed to facilitate simple, safe rigging and lifting of the panel during installation. Plugs shall be provided and shall unobtrusively fill the panel lifting ring holes when substituted for the lift rings after installation is complete. Where panels are shown mounted immediately adjacent to MCC equipment, they shall be securely bolted together with their front faces parallel.
3. Each panel shall be provided with full-height, fully gasketed access doors where shown. Doors shall be provided with three-point latches, lockable with a padlock. All panel access doors shall be provided with full-length, continuous, piano-type steel hinges with stainless steel pins.

E. Not Used

F. Smaller Panel Construction:

1. Minimum metal thickness shall be 14 gauge.
2. All doors shall be rubber gasketed, with continuous hinges.
3. Wherever practical, enclosures shall be a manufactured item, such as Hoffman, H.F. Cox, or equal.

G. Panel, Painting:

1. All panels fabricated from carbon steel shall have their internal and external surfaces prepared, primed, and painted. Sand panel and remove all mill scale, rust, grease, and oil. Fill all imperfections and sand smooth. Paint panel interior and exterior with one coat of epoxy coating metal primer and two finish coats of two-component-type epoxy enamel. Sand surfaces lightly between coats.

H. Panel, Electrical:

1. Power Distribution Within Panels:

- a. Each panel shall be provided with one or more 120-volt ac, 60-Hz feeder circuit as shown. On each panel, make provisions for feeder circuit conduit entry and provide a terminal board for termination of the wires.
- b. Branch circuit breakers shall meet the requirements of Section 16050-ELECTRICAL, unless stated otherwise herein. Control power circuit breakers shall be DIN rail mount, snap action, thermal magnetic circuit breakers. Breakers shall be rated for use with both ac and dc power circuits, and be capable of interrupting a minimum of 10,000 amps at 240V ac. Circuit breakers shall be Eaton, Type WMS, or equal.
- c. Provide 120-volt plug-mold to plug in line cords for all panel components with line cords.
- d. Provide an indicating fuse for each dc supply line to each individual two-wire and four-wire transmitter. Provide additional fusing as called for in these Specifications and shown on the Drawings. Fuses shall be DIN rail mounted and located so that they can be easily seen and replaced.
- e. Power and control wiring shall be Type SIS or Type MTW.

2. Analog Signal Distribution:

- a. 4- to 20-mA signals distributed outside panels shall be provided with signal isolators.
- b. All signal wiring shall be twisted, shielded pair cable. Cable shall be UL listed as Type PLTC/ITC for use in industrial instrumentation circuits, and shall be AWG 18, 19-strand tinned-copper, with PVC insulation rated 300 volts. The shield shall be aluminum polyester with copper drain wire. The outer jacket shall be PVC. The cable shall be rated 90 degrees C, minimum. The cable shall be Belden 9318, Type PLTC/ITC, or equal.

3. Terminal Strips:

- a. Provide terminal strips with a separate terminal for every wire entering or leaving the panel, including spare wires, plus 25% spare terminals, minimum.
- b. Provide DIN rail-mounted, modular feed-through type blocks. High-density ("double-deck") terminals are not acceptable. Terminal strips shall be Weidmuller SAK-6, Allen-Bradley 1492-J Series, or equal.

4. Plug-In Relays:
 - a. Refer to Component Specification H 23, Attachment C to this Section for the Specification for Plug-In Relays.
5. Power Supplies:
 - a. Provide dc power supplies of the quantity and rating as required to power instruments requiring external dc power, including two-wire transmitters and dc relays. Power supplies shall be mounted such that dissipated heat does not adversely affect other components.
 - b. The dc power supplies shall be sized to drive all loads, including all connected loops at 30mA, plus 30% spare overhead, minimum.
 - c. DC Power Supply: The dc power supplies shall operate on 120 volts, 60 Hz input and shall produce dc power of the appropriate voltage, with 1% regulation and no greater than 0.1% ripple under rated load.
 - d. The dc power supplies shall be self-contained units with output overvoltage and overcurrent protective circuits.
 - e. Refer to Component Specification Y60, in Attachment C to this Section for additional requirements.
6. Standard Colors And Inscriptions For Pushbuttons And Indicating Lights:
 - a. Unless otherwise noted, the following color code and inscriptions shall be followed for all pushbuttons and indicating lights:

TAG FUNCTION	INSCRIPTION(S)	COLOR
OO	ON OFF	Red Green
HOA	HAND OFF AUTO	Red Green White
RESET	RESET	Red
ALARMS	--	Amber

- b. All unused or non-inscribed buttons shall be black. Lettering shall be black on white and yellow buttons. Lettering shall be white on black, red, and green buttons.
 - c. Refer to Component Specifications, H 17, in Attachment C to this Section for the Specifications for pushbuttons, selector switches, and indicating lights.
7. Internal Panel Lights:
 - a. Panels shall be provided with switched LED light strips. One light shall be provided for every 4 feet or less of panel width.
 - b. Light strips shall be LED type, 4,000K color temperature, medium diffuse lens, mounted inside and in the top of the back-of-panel area.
 - c. Coordinate all necessary connectors with the manufacturer.
 - d. Light strips shall be Lithonia, or equal.
8. Service Outlets:
 - a. Freestanding panels shall be provided with a minimum of one three-wire, 120-volt, 15-ampere, GFCI duplex receptacle.

PART 3 - EXECUTION

3.1 GENERAL

- A. Work shall be performed in a workmanlike manner by craftsmen skilled in the particular trade. Work shall be performed in accordance with the Drawings, Specifications, manufacturers' recommendations, and the best practice of the trade. Completed work shall present a neat and finished appearance.
- B. Coordinate the work covered in this Section with the Owner and the work of other trades to avoid conflicts, errors, delays, and unnecessary interference during construction.

3.2 PROTECTION DURING CONSTRUCTION

- A. Throughout this Contract, provide protection for materials and equipment against loss, damage, and the effects of weather. Prior to installation, store items to be installed in indoor locations. Items subject to corrosion under damp conditions and items containing insulation, such as control panels and instruments, shall be stored in indoor, heated, dry locations.
- B. Following installation, protect materials and equipment from corrosion, physical damage, and the effects of moisture on insulation. Keep openings in boxes or equipment closed during construction.

3.3 MATERIAL AND EQUIPMENT INSTALLATION

- A. Follow the manufacturer's installation recommendations, unless otherwise indicated. Follow the Engineer's decision, at no additional cost to the Owner, wherever any conflict arises between the manufacturer's instructions, State or other codes and regulations, and these Contract Documents. Keep a copy of the manufacturer's installation instructions available on the jobsite for review at all times.
- B. Secure control panels and other freestanding equipment rigidly to floors or mounting pads with anchor bolts, expansion shields, or other approved means per the manufacturer's recommendations.
- C. The installed height of enclosures covered under this Section shall not exceed 72" above the surrounding surface unless specifically dimensioned, or approved by the Engineer.
- D. Seismic Requirements
 - 1. Installation of products provided under this Section shall meet the applicable requirements of Section 01610, GENERAL PRODUCT REQUIREMENTS.
 - 2. Provide calculations signed by a registered civil or structural engineer registered in the state where the project is located. Product installation shall meet the requirements of the calculations.

3.4 DEMOLITION

- A. This is a rehabilitation project which includes demolition, as described in the Drawings and Specifications. Required demolition of I&C equipment, wire and conduit, and other equipment is covered under this Section. Demolition work includes disconnecting, removing, capping, patching, painting, and cleanup.
- B. Where existing materials and equipment are removed or relocated, remove all materials no longer used, such as studs, straps, conduits, and wires. Remove or cut off concealed or embedded conduit, boxes, or other materials and equipment to a point at least 3/4 inch below the final finished surface.
- C. Repair affected surfaces to conform to the type, quality, and finish of the surrounding surface in a neat and workmanlike manner. Follow any specific instructions in other sections of these Specifications. Utilize skilled craftsmen of the trades involved.

3.5 CUTTING AND PATCHING

- A. Do not cut or notch any structural member or building surface without specific approval of the Engineer. Carefully carry out any cutting, channeling, chasing, or drilling of floors, walls, ceilings, paving, or other surfaces required for the installation, support, or anchorage of materials and equipment. Following such work, restore surfaces neatly to new condition using skilled craftsmen of the trades involved, at no additional cost to the Owner.

3.6 CLEANING AND TOUCHUP PAINTING

- A. Keep the premises free from accumulation of waste material or rubbish. Upon completion of work, remove materials, scraps, and debris from the premises and from the interior and exterior of all devices and equipment. Refinish damaged surfaces to new condition using skilled craftsmen of the trades involved, at no additional cost to the Owner.

3.7 ELECTRICAL

- A. Unless noted otherwise, electrical work shall meet the requirements of Section 16050-ELECTRICAL.

3.8 TESTING, GENERAL

- A. Testing, test plans, and test reports shall be provided by the Contractor as specified herein. The Contractor shall perform tests as required to demonstrate that the equipment and systems covered in this Section operate safely and meet the requirements of these Specifications. The Contractor shall provide labor, instruments, and other material to complete the tests.
- B. Test plans and test reports shall be submitted as formal submittals and shall meet all applicable requirements of the Article, SUBMITTALS.

- C. Requirements for testing and documentation of software-related systems are covered under Section 13350, PROGRAMMED SYSTEMS. Fully integrate testing specified in this Section with that specified in Section 13350, PROGRAMMED SYSTEMS.
- D. Tests and test plans shall be in the cause and effect format. The person conducting the test shall initiate an action (cause) and, upon the system's or subsystem's producing the correct result (effect), the specific test requirement will have been satisfied. See Attachment E for an acceptable format.
- E. Tests and test plans shall be integrated across equipment and systems. The Contractor shall coordinate and integrate the documentation and efforts of suppliers and subcontractors to achieve unified tests and test plans.

3.9 UNWITNESSED FACTORY TESTS (UFT)

- A. The UFT shall be performed by the Contractor from a test plan prepared by the Contractor. The test shall demonstrate on a paragraph-by-paragraph, loop-by-loop basis that the listed components and subsystems meet the requirements of the Drawings and Specifications. If any component or subsystem fails the UFT, the Contractor shall correct the problem and shall repeat the test until it is successful.
- B. After completion of each UFT, the Contractor shall prepare a test report and certification and shall submit it for review.
 - 1. The certifications shall read:

"The UFT has been successfully completed on the following systems: (The Contractor shall list here the tested systems.) All functions were verified, with the following exceptions: (The Contractor shall list here unresolved failures and functions which were not tested.) All of the deficiencies above will be corrected and retested prior to the FDT."

This certification shall be signed by the Contractor and by representatives of all firm(s) contractually responsible for the items tested.
 - 2. Any functions not successfully completed shall be described in detail in the certification above. Should the exceptions be significant in the Engineer's opinion, retesting and resubmission of the certification will be required prior to execution of the FDT.
 - 3. The components and subsystems shall not be shipped to the jobsite, nor shall the Factory Demonstration Test (FDT) be performed, until the test has been successfully completed and the test report has been favorably reviewed by the Engineer. The Contractor shall incorporate the applicable Engineer's comments on the UFT test report into the test plan for the FAT.
- C. Inputs and outputs of the listed equipment shall be simulated so that all elements of each panel are tested.

3.10 FACTORY DEMONSTRATION TEST (FDT)

- A. The Contractor shall perform the FDT from a test plan prepared by the Contractor and revised by the Contractor to incorporate the Engineer's comments on the UFT test report.

- B. The FDT will be witnessed by an Owner's representative and shall demonstrate on a paragraph-by-paragraph, loop-by-loop basis that the listed components and subsystems meet the requirements of the Drawings and Specifications. If any component or subsystem fails the FDT, the Contractor shall correct the problem and shall repeat the test until it is successful.
- C. After completion of the FDT, the Contractor shall prepare a test report and shall submit it for review. The listed components and subsystems shall not be shipped to the jobsite until the test has been successfully completed and the test report has been favorably reviewed by the Engineer.
- D. Inputs and outputs of the listed equipment shall be simulated so that all elements can be tested.

3.11 OPERATIONAL READINESS TEST (ORT)

- A. The Contractor shall provide labor, equipment, and material to perform the ORT.
- B. Prior to startup, all equipment and systems specified under this Section shall be inspected and tested to show that they are ready for operation.
- C. The test shall be performed from a test plan prepared by the Contractor.
- D. The ORT shall include the following for each facility:
 - 1. Perform a detailed line-by-line check of the control sequence from the control diagrams.
 - 2. Perform a detailed check of each I/O point to and from all instrumentation and control devices. This check shall confirm the correct polarity, where applicable, of each signal. This check shall include verification locally, and at the SCADA Server, that each point is accessible at every location. The test procedure shall contain a point-by-point list of I/O to allow for field verification of each item.
 - 3. Calibrate each instrument and device, where applicable.
 - 4. Simulate commercial and localized power outages, and demonstrate the system's backup capabilities and recovery.
- E. The ORT shall demonstrate on a subsystem or loop-by-loop basis that the complete interconnected systems specified under this Section meet the requirements of the Drawings and Specifications.
- F. After completion of the ORT, the Contractor shall prepare a test report and shall submit it for review. The ORT shall be successfully completed and the test report submitted to and favorably reviewed by the Engineer before the FAT (functional acceptance test) is performed. As a minimum, the ORT test report shall include the following:
 - 1. Written confirmation by the Contractor that the ORT has been completed.
 - 2. Calibration data for each instrument and device, where applicable.

3.12 FUNCTIONAL ACCEPTANCE TEST (FAT)

- A. Once the system has been started up and is operating, and after favorable review of the ORT test report by the Engineer, a witnessed FAT shall be performed on the

equipment and systems specified under this Section to demonstrate that they are operating as specified and meet the requirements of the Specifications.

- B. The FAT shall be performed by the Contractor and may be coordinated with testing of equipment and systems covered under other sections of these Specifications.
- C. The Contractor shall prepare a test plan for the FAT and shall submit it for review at least 30 days before the FAT is performed. As part of the test plan, the Contractor shall identify the proposed test dates and list the personnel who will be present to assist with and witness the FAT. This list shall include any Contractor's personnel, subcontractors, suppliers' representatives, and other necessary personnel.
- D. Each specified function shall be demonstrated on a paragraph-by-paragraph, loop-by-loop basis.
- E. The FAT shall operate all equipment and systems over the full operating range, shall demonstrate proper operation of alarms and indicators, and, in general, shall demonstrate that the equipment and systems meet the requirements of the Drawings and Specifications.
- F. If any equipment or system fails the FAT, the Contractor shall correct the problem and shall repeat the test until it is successful.
- G. The FAT shall be performed in the presence of the Engineer.
- H. After completion of the FAT, the Contractor shall prepare a test report and shall submit it for review. The system will not be accepted before the FAT is successfully completed and the test report submitted to and favorably reviewed by the Engineer.

3.13 FINAL ADJUSTMENTS

- A. Upon completion of the FAT, final adjustments shall be made to the equipment as necessary.

3.14 FIELD SUPPORT

- A. Provide the services of an experienced, factory-trained service engineer or technician to assist with installation, checkout, startup, and testing.
- B. Timing and length of site visits shall be coordinated with the Contractor, but minimum effort shall be 4 man-days on the site for installation and checkout. The service engineer or technician shall also be present during the ORT and FAT for the systems and equipment specified in this Section. This time does not include training of Owner's personnel.

3.15 TRAINING

- A. Provide the services of an experienced, factory-trained service engineer or technician to train the Owner's personnel in operation, maintenance, and troubleshooting of the systems and equipment specified in this Section.

- B. Timing of training sessions shall be on dates and at times mutually agreeable to the Contractor and the Owner. Minimum effort for training shall be 8 hours. Training sessions may need to be spread over several days, depending on availability of Owner's personnel.

END OF SECTION

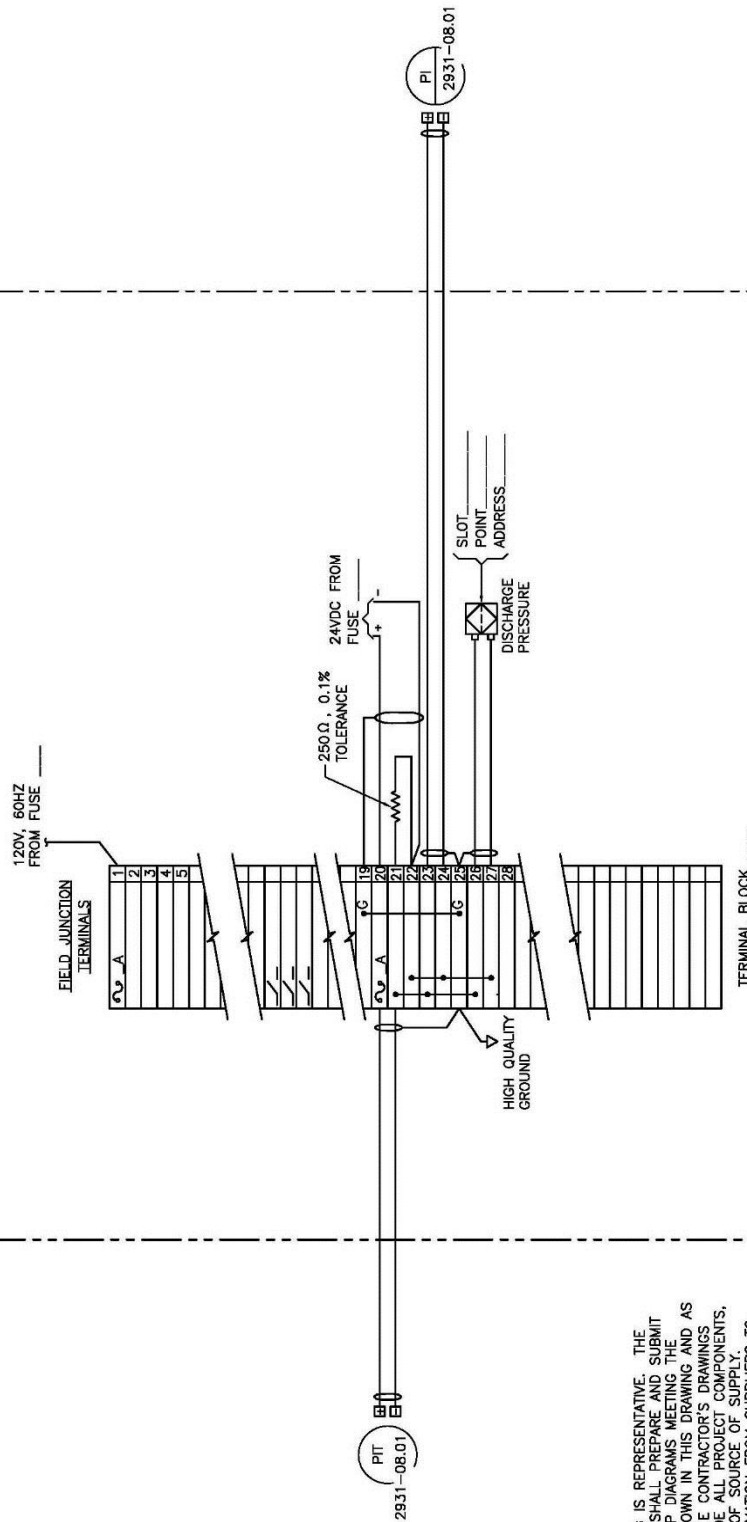
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FIELD

BACK OF PANEL CP-1

FRONT OF PANEL CP-1



NOTES:

1. THIS DRAWING IS REPRESENTATIVE. THE CONTRACTOR SHALL PREPARE AND SUBMIT PROJECT LOOP DIAGRAMS MEETING THE STANDARD SHOWN IN THIS DRAWING AND AS SPECIFIED. THE CONTRACTOR'S DRAWINGS SHALL INCLUDE ALL PROJECT COMPONENTS, REGARDLESS OF SOURCE OF SUPPLY. OBTAIN INFORMATION FROM SUPPLIERS TO PREPARE THE LOOP DIAGRAMS. OBTAIN UPDATED INFORMATION AT THE END OF THE PROJECT TO PREPARE AS-BUILT LOOP DIAGRAMS.
2. ALL WIRES AND CABLES SHALL BE IDENTIFIED WITH CABLE AND CONDUCTOR NUMBER AS SPECIFIED.

IDENTIFICATION	PI-2931-08.01	PIT-2931-08.01	RESISTOR
SPECIFICATIONS	NEWPORT MODEL IDP	FOXBORO IGP-20 SERIES	250 Ω, 0.1%
COMMENTS	_____ TO _____ PSI	BLOCK & BLEED, QUICK CONNECT	

LOOP DIAGRAM TEMPLATE

NOT TO SCALE

SECTION 13300 – INSTRUMENTATION & CONTROLS

ATTACHMENT A - LOOP SPECIFICATIONS

INSTRUMENTATION & CONTROLS SYSTEM FUNCTIONAL REQUIREMENTS

A. General:

1. Functional requirements of the I&C system are depicted primarily in the process and instrumentation diagrams (P&ID's), control diagrams, and the following loop specifications (also referred to as control strategies).
2. Nomenclature in the P&ID's and loop specifications generally follows Instrument Society of America (ISA) standards as covered in document ISA S5.1.
3. Loop specifications are in three parts: Components, Hardwired Functions, Software (PLC and SCADA) Functions.
4. Hardwired Functions are those functions implemented with individual analog components and discrete control components. Examples of analog components are individual process controllers, analog switches, and analog indicators. Examples of discrete components are relays, switches, and indicating lights.
5. Components are listed by tag number, with component name and options such as range, setting, size, or mounting type. Component specifications are covered under Section 13300, Attachment C, COMPONENT SPECIFICATIONS.
6. PLC Functions are those functions implemented primarily in PLC software. In some cases PLC functions may make use of some discrete and analog components for signal isolation, redundant signal paths, or other purposes. The Contractor shall provide all required devices.
7. SCADA Functions are those functions implemented at the supervisory level within the server.
8. Section 13350, PROGRAMMED SYSTEMS, includes general requirements for displays within the SCADA system. Those general requirements, in addition to the functional and process-related requirements in this Section, shall be the basis for overall display development for this project.
9. In cases where the loop specifications have blanks in lieu of ranges or setpoints, the ranges and setpoints will be provided during construction.

B. Use of Owner Standards:

1. This Project modifies the District's existing Supervisory software programming, with the intent being that modifications to the graphic screens will emulate existing screen layouts, colors, navigation, etc. The Contractor shall formally request (by RFI) screenshots of the existing graphics screens, which shall constitute the 'Standard' for graphic screen development.
2. Any documentation or standards provided by the Owner will not reduce the requirements for this project. Provide all required and specified functions, regardless of whether or not standards are furnished.
3. Standards apply to items such as the following:
 - a. Wire colors and numbering
 - b. Signal/variable descriptions/tag names
 - c. Program organization and annotation
 - d. Screen layouts

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C. General Functions:

1. Displays shall meet the requirements of Section 13350, PROGRAMMED SYSTEMS. Display characteristics such as organization and display-to-display relationships, layout, two-dimensional and three-dimensional depictions, use of color, and other characteristics are covered in that Section.
2. Develop displays using the SCADA development software which will run on a portable programming computer to provide easy access to process signals, statuses, alarms, inputs/outputs, setpoints, variables, and other data and functions within the PLC. The displays shall be graphical in nature. Displays shall be of sufficient detail to provide operators with complete facility access without the aid of additional references or documentation.
3. In the loop specifications later in this document, PLC functions include selected descriptions of operator inputs, statuses, and alarms.
4. For all alarms, provide delays to prevent nuisance alarms due to transients. Time delays for each alarm shall be adjustable.
5. Monitor and Display All Discrete Inputs: Receive inputs and display. Alarm where applicable. Provide alarm logging.
6. Monitor and Display Analog Inputs: Receive inputs and display. Provide configurable low and high alarm setpoints for each signal. Trend each input for a configurable interval, in a first-in/first-out arrangement. Provide resettable and nonresettable totalizers for each applicable input.
7. When two or more instruments monitor the same process condition, such as level, compare the signals and when they differ by an adjustable interval, set initially to plus or minus 10% of full scale, initiate an alarm. This function shall also be provided for discrete devices which back up analog devices (e.g., TWST level). Coordinate and document setpoints of discrete devices to allow these comparisons and alarming to be executed.
8. Elapsed Time: Provide resettable and nonresettable elapsed time integrators for equipment runtime. For the resettable variable, provide a configurable setpoint unique to each item of equipment at which an alarm will occur, triggering the need for service. Provide reset capability for resettable totalizers.
9. Loss of Input: Hold the last known value, and initiate an alarm.
10. Attempt to Command Only Controllable Equipment: Monitor equipment status where available (MANUAL/AUTO selection, FAIL status, etc.) and attempt to control only equipment which is available to the PLC and which has not failed.
11. Equipment Fail: On receipt of a FAIL or similar discrete input, or when the item of equipment fails to attain the commanded state within a configurable interval, initiate an alarm. Provide a configurable interval for each item of equipment. Lock out the item of equipment until a RESET command is issued.
12. Simultaneous Equipment Starts: Equipment shall not be allowed to start simultaneously.
13. Equipment Manual Start, Automatic Stop Mode: Provide manual start, with automatic stop based on setpoint.
14. Equipment Manual Start, Manual Stop Mode: Provide manual start and stop.
15. Equipment Sequencing: Provide a PLC-based alternation function which, when enabled, will alternate the call sequence of the parallel equipment units (e.g., finished water pumps). When the alternation function is disabled, start equipment in the fixed sequence of operation. With either automatic alternation, or with a fixed sequence, on FAIL automatically proceed to the next available unit. Track starts per hour against an adjustable value, and prohibit starts beyond the limit in any given hour. If a unit is requested and the starts per hour would be exceeded, proceed to the next available unit, and alarm.

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16. Bumpless Transfer: Provide bumpless transfers between all control modes and loss/restoration of power.
 17. Loss of Communications: On loss of communications, alarm. Provide mode selection: OFF/STAND-ALONE. When selected OFF, stop equipment on loss of communications. When selected STAND-ALONE, continue operating equipment.
 18. Designation of Equipment as Available: Equipment selected AUTO at the equipment, not FAILED, and not ON shall be designated as AVAILABLE.
 19. START/STOP Control and Load Shedding: On loss of commercial power, the plant standby generator will automatically start. This generator does not have sufficient capacity to serve all plant loads. Upon receipt of ATS in standby, block operation of the Zone A Pump Station, and commence pumping of Pump Station PS2.
 20. Overrides for Sequences and Interlocking: For functions which require interlocking between items of equipment or sequences which call for steps to be proven successful prior to proceeding, provide password-protected overrides and alarm on override. These overrides shall be suitable for operators to continue a sequence or operation uninhibited by the failed interlock.
 21. Monitor PLC and communications statuses and health. Provide graphic screen(s) laid out resembling the physical arrangement of the PLCs to illustrate this information.
 22. Incorporate provisions to periodically transfer data to the SCADA Master.
 23. Assignments of registers within the PLC shall be done to facilitate logical acquisition of blocks of data by the SCADA Master.
- D. General Functions of the SCADA System:
1. The existing SCADA system consists of a personal computer (PC)-based master station. Plant processes shall be controlled at the PLC level, and the SCADA master station shall monitor and display plant activity via the PLC.
 2. At the SCADA master level, replicate the process displays, controls, and alarms provided within the PLC. Provide password protection.
 3. Refer to Section 13350, PROGRAMMED SYSTEMS, for additional requirements.
- E. The following control strategies, complete, should be reaffirmed during programming workshops specified in Section 13350.

CONTROL STRATEGY CS-1, ZONE A PUMP STATION (FACILITY 20) FINISHED WATER PUMPING

Reference P&ID:

20-I-1

Equipment Nos.:

<u>Finished Water Pumps</u>	<u>Motor Controllers</u>
P-100	RVSS-100
P-200	RVSS-200
P-300	RVSS-300
P-400	RVSS-400

Instrumentation:

Reservoir A Level (Pressure), Existing Transmitter
Low-Low Level Switch (TWST) – LSLL-001
High Temperature Switches – TSH-100, TSH-200, TSH-300, TSH-400
High Pressure Switches – PSH-100, PSH-200, PSH-300, PSH-400
Pressure Transmitter – PIT-600
Magnetic Flowmeter – FE/FIT-600

Overview:

1. Four vertical turbine pumps in the Zone A Pump Station convey finished water to the Zone A distribution system including Reservoir A in a LEAD/LAG1/LAG2/STANDBY (3+1) arrangement. Each pump has a dedicated reduced voltage solid-state starter (RVSS) motor controller.
2. Under PLC automatic control the pumps shall be controlled based on the level in Reservoir A, monitored by a level transducer local to the Zone A Reservoir site. The Reservoir A level signal will be acquired by the Zone A Pump Station via a network connection between the Zone A Pump Station PLC and SCADA. The LEAD, LAG1, and LAG2 pumps are called based on operator configured Zone A Reservoir level setpoints.

Hardwired Functions:

1. For each finished water pump monitor motor temperature. In the event of HIGH TEMPERATURE, initiate an alarm at the RVSS, transmit a discrete signal to the PLC, and shut down and lock out the affected pump (local/manual reset required).
2. For each finished water pump monitor pump discharge pressure. In the event of pump discharge HIGH PRESSURE, transmit a discrete signal to the PLC, and shut down and lock out the affected pump (local/manual reset required).

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3. RVSS I/O is shown on the P&ID. Each finished water pump RVSS shall send the following signals to the PLC:

AUTO (HOA switch selection)
ON
FAULT
HIGH TEMPERATURE (motor)
HIGH PRESSURE (discharge)
LOSS OF CONTROL POWER

4. When selected AUTO at a pump RVSS, act on a RUN command from the PLC.
5. Monitor and indicate level in the Treated Water Storage Tank (TWST, transmitter LIT-001, and LOW-LOW level float switch LSL-001. Transmit to the PLC an analog LEVEL signal and discrete LOW-LOW level signals. In the event of LOW-LOW level, initiate an alarm at the Zone A Pump Station control panel, transmit a discrete signal to the RVSS and to the PLC, and shut down all finished water pumps. Provide a switch on the Zone A Pump Station control panel to override the TWST LOW-LOW LEVEL lockout. TWST LOW-LOW LEVEL is not a lockout condition. Once LOW-LOW is cleared, and following a configurable delay set initially to 5 minutes, finished water pumps will be available to be called.
6. Monitor and indicate pressure in the pump discharge header (pressure transmitter PIT-600). Transmit an analog PRESSURE signal to the PLC.
7. Monitor and indicate flow in the finished water pump discharge header (meter FE/FIT-600). Transmit an analog FLOW signal to the PLC.

Software Functions:

1. Receive PLC signals described above under Hardwired Functions. Receive from and transmit to signals from the supervisory system via radio as needed to effect the functions herein. Modify the supervisory system, data structures, and communications management as needed.
2. Provide MANUAL/AUTO selection for each pump selected AUTO at the starter. Provide manual START/STOP control. When selected AUTO, control pumps based on Reservoir A level, as described later.
3. Provide LEAD/LAG1/LAG2/STANDBY selection for each pump.
 - When selected AUTO, pumps shall run based on operator configurable level setpoints for the Zone A Reservoir. The level setpoints shall be constrained between 14 feet and 26 feet.

Reservoir A Level Setpoint	Control System Response
L5	Stop all pumps (Stop PS#2)
L4	Start LEAD Pump
L3	Start LAG1 Pump
L2	Start LAG2 Pump
L1	Start Pump Station #2

4. Display READY status in SCADA for each finished water pump, and assign PUMP READY status when all of the following conditions are met:

- The pump is not ON.
- T1 has elapsed since the pump was last on.
- The pump has not FAILED.
- The RVSS HOA is selected AUTO.
- The RVSS has not FAILED ("FAULT").
- The pump is selected AUTO at the SCADA node.
- RVSS control power is on (no LOSS OF CONTROL POWER signal).

The PLC shall only attempt to start pumps which are READY. Should a pump be required and the desired pump in the pumping sequence is not ready, then the next ready pump in the sequence, or the standby pump, shall be called.

5. In the event of a finished water pump RVSS FAULT, HIGH TEMPERATURE, or HIGH DISCHARGE PRESSURE, initiate an alarm and shut down and lock out the affected pump. After an adjustable time (initial setting 10 seconds), elevate the STANDBY pump to the failed pump's position in the call order and run in place of the failed pump as required by process conditions.
6. In the event of LOW-LOW LEVEL in the TWST, initiate an alarm and shut down and lock out all finished water pumps. This lockout shall be automatically reset after a configurable delay following clearing of the TWST LOW-LOW LEVEL.
7. Provide the following time setpoints for use in pump starts and stops:

Name	Description	Initial Setting
T1	Minimum off time to restart pump	10 minutes
T2	Time between starts of different pumps	10 seconds
T3	Time between pump stops	3 seconds
T4	Time to fail a pump on ON	5 seconds
T5	Time to fail a pump on OFF	10 seconds

8. Provide the following functions:

- Two pumps shall not be allowed to start simultaneously.

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- Time T2 shall elapse after any pump goes ON or is FAILED before calling another pump to run.
 - Time T3 shall elapse after any pump goes OFF or is FAILED before stopping another pump.
 - When the LEAD pump is called to run, if the pump is not detected ON within time T4, then remove the RUN command, assign FAILED status to the pump, and start the LAG1 pump. (Repeat process for LAG1/LAG2 pumps.)
 - When a pump is called to stop, if the pump is not detected OFF within time T5, then assign FAILED status to the pump.
 - When the ON status signal is no longer received by the PLC but the pump continues to be commanded to run, assign FAILED status to the pump.
 - Should a pump be required but no pump is READY, waive the T1 requirement and attempt to start the pump which is closest to satisfying the T1 requirement. (During construction, consider striking this requirement – this pumping is non-critical and can probably afford to wait T1).
9. On loss of communication between the Zone A Pump Station and the plant SCADA system initiate a COMMUNICATIONS TROUBLE alarm:
- a. If finished water pumps are running, continue running for an adjustable time (range 0 to 120 minutes) based on last known Reservoir A %-full value, then stop. The following table provides an example of these setpoints:

Name	Description	Initial Setting
T1	Reservoir A < 25% Full	20 minutes
T2	25% Full < Reservoir A Level < 50% Full	15 minutes
T3	50% Full < Reservoir A Level < 75% Full	10 minutes
T4	Reservoir A Level > 75% Full	Stop Pumping

The initial settings in the above table shall be confirmed during startup.

- b. Do not commence finished water pumping until communication is re-established.
 - c. The plant SCADA system shall run Pump Station #2, based on existing control strategies.
10. Within SCADA, provide an operator override function to allow manual operation of finished water pumping regardless of:
- a. Reservoir A level
 - b. TWST level
 - c. Zone A Pump Station discharge flow

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11. On receipt of the plant's automatic transfer switch (ATS) in STANDBY, the SCADA system shall stop all finished water pumps selected for AUTO operation. Allow resumption of Zone A Pump Station finished water pumping after an operator configurable delay, following receipt of the plant ATS in UTILITY.

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SECTION 13300 - INSTRUMENTATION AND CONTROLS
ATTACHMENT B
INSTRUMENT LIST

TAG NO.		DESCRIPTION	COMPONENT SPECIFICATION	P&ID	PROCESS RANGE	SIGNAL INPUT	SIGNAL OUTPUT	SETPOINT	NEMA RATING	PROCESS CONNECTION	NOTES
ISA PREFIX	LOOP NO.										
FE/FIT	600	Flow Transmitter	F10	20-I-1							
LSLL	001	Low Low Level Switch	L8	20-I-1							
PI	600	Pressure Indicator	P42	20-I-1							
PIT	600	Pressure Transmitter	P12	20-I-1							
PSH	100	High Pressure Switch	P3	20-I-1							
PSH	200	High Pressure Switch	P3	20-I-1							
PSH	300	High Pressure Switch	P3	20-I-1							
PSH	400	High Pressure Switch	P3	20-I-1							
TSH	100	High Temperature Switch	N/A	20-I-1							Supplied with Motor
TSH	200	High Temperature Switch	N/A	20-I-1							Supplied with Motor
TSH	300	High Temperature Switch	N/A	20-I-1							Supplied with Motor
TSH	400	High Temperature Switch	N/A	20-I-1							Supplied with Motor

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SECTION 13300 – INSTRUMENTATION AND CONTROLS

ATTACHMENT C

COMPONENTS

1.1 GENERAL

- A. This Attachment C specifies I&C components. The alpha-numeric designation preceding the following component descriptions is an identification code for reference purposes and is not meant to be cross-referenced elsewhere in the Specifications or on the Contract Drawings. When used, the alpha-numeric designations in parentheses following the component descriptions are the tag numbers used on the Contract Drawings and Components List.

1.2 PRODUCTS

- F10 – Magnetic Flowmeter
- H17 – Pushbuttons, Selector Switches, and Indicating Lights
- H23 – Plug-In Relays
- L8 – Level Switch, Float Type
- P3 – Pressure Switch, Adjustable Deadband
- P12 – Pressure Transmitter, Electronic
- P42 – Pressure Gauge, Process
- Y60 – DC Power Supplies
- Z1 – Switch, Position-Actuated, Industrial Type
- Z90 – Switch, Motion-Actuated

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F 10 MAGNETIC FLOWMETER (FE/FIT-600)

- A. The magnetic flowmeter shall consist of a flow element, transmitter, indicator, and interconnecting cable.
- B. The flow element shall be suitable for use with potable water, and shall be of the electromagnetic type utilizing the pulsed dc-type coil excitation principle with high pre-amp input impedance.
- C. The flow measuring system, which consists of flow element, transmitter, and appurtenances, shall have an overall accuracy of plus or minus 0.5% of actual flow rate for all flows resulting from pipe velocities in the range 1.5 to 30 feet per second, and plus or minus 1% or better for flows resulting from fluid velocities in the range 1 to 1.5 feet per second.
- D. The system shall be calibrated such that transmitter output of 4 to 20 milliamps corresponds to a flow range of zero to the flow range specified in the loop specifications.
- E. Flowmeter accuracy shall be verified by calibration in a flow laboratory traceable to the NIST (National Institute of Standards and Technology). Calibration documents shall be submitted to the Engineer for favorable review and shall meet all applicable requirements called out under SUBMITTALS.
- F. The flowmeter shall operate on 120 volts, 60 Hz, plus or minus 10%. The same power source shall supply both the flow element and the transmitter, with the power source connected at the transmitter.
- G. The system shall have a zero stability feature, thereby eliminating the need to stop flow to check or calibrate output for zero flow.
- H. The unit shall incorporate an empty pipe detection feature and shall have output damping to provide a means to reduce the frequency response of the transmitter.
- I. The flow element shall be of watertight construction.
- J. The flow element shall consist of a meter tube, 300-pound ANSI carbon steel raised-face flanges, polyurethane or neoprene liner, and 316 stainless steel electrodes. Suitable covers shall be provided for flow element ends to protect the tube liner during shipment. Each unit shall be furnished with a grounding ring on the inlet side of the flowmeter to protect the leading edge of the flowmeter's liner from erosion due to scouring action of the process fluid.
- K. Install flowmeters according to the manufacturer's recommendations. Furnish and install bonding jumpers and/or grounding electrodes as recommended by the manufacturer.
- L. The transmitter shall be microprocessor-based and shall indicate, totalize, and transmit flow. The transmitter output shall be a 4- to 20-mA dc signal in linear proportion to flow and shall drive loads with impedances in the range of 0 to 800

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ohms without adjustments. Units shall be provided with a liquid crystal display. The transmitter shall be remote from the flow element and shall be suitable for wall mounting, as shown on the Plans.

- M. Sufficient manufacturer cable(s) shall be provided for interconnection between the flow element and the transmitter. Cable(s) shall facilitate both signal and power for the flow element.
- N. The flowmeter shall be Rosemount 8705, Sparling Tigermag Model 656, Fischer-Porter Model 10D1435A/U, Siemens/Danfoss MAG3100W with MAG5000 signal converter, or equal.

H 17 PUSHBUTTONS, SELECTOR SWITCHES, AND INDICATING LIGHTS

- A. Pushbuttons, selector switches, and indicating lights shall be heavy duty oiltight, manufactured to the requirements of NEMA ICS. Provide suitable NEMA-rated enclosures or mount in panels as indicated.
- B. Unless noted otherwise, provide extra-large, integral, metal service legends (legend plates) indicating their specific functions and laminated phenolic nameplates indicating the equipment they control.
- C. Unless noted otherwise, pushbuttons shall be momentary contact and shall have the number and type of contacts as indicated or as required.
- D. Unless noted otherwise, selector switches shall be maintained contact, shall have the number of positions indicated, and shall have the number and type of contacts as indicated or as required.
- E. Indicating lights shall be transformer, LED-type indicators, unless noted otherwise. Indicating assemblies shall have push-to-test feature.
- F. Pushbuttons, selector switches, and indicating lights shall be Square D Type K Heavy Duty, Allen-Bradley Bulletin 800T, Eaton/Cutler-Hammer 1025OT Series, General Electric CR104P Heavy Duty, or equal.

H 23 PLUG-IN RELAYS

- A. Plug-in relays shall be UL listed, enclosed, with silver or silver cadmium contacts rated 10 amps at 120 volts, 60 Hz, and 28 volts dc. Enclosures shall be clear plastic. Relays shall have indicating lights or mechanical indicators. Relays shall operate reliably at 80% of rated coil voltage. Coil burdens shall be not greater than 1.5 watt for dc coils or 2.6 voltamperes for 60-Hz coils. The relays shall be Potter and Brumfield KRPA Series, IDEC RR Series, Square D Type K, or equal.
- B. Time delay relays with ranges up to 180 seconds shall be enclosed and shall operate properly at any voltage within plus or minus 15% of the nominal voltage rating, and shall have a time delay on energization or deenergization, as required for the application (see control diagrams). Time delay shall be knob-adjustable over the range 2 to 180 seconds. They shall have double-pole, double-throw contacts rated 10

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amps at 120 volts, 60 Hz. Relays shall have indicating lights or mechanical indicators. The relays shall be Potter and Brumfield CD Series, or equal.

- C. Relays shall be plugged into DIN rail mounted sockets with saddle clamp terminals. Terminals shall have a permanent, legible identification. Relays shall be mounted such that the terminal identifications are clearly visible and the terminals are readily accessible.

P 3 PRESSURE SWITCH, ADJUSTABLE DEADBAND (BOURDON TYPE)

- A. Unit shall be a Bourdon tube actuated, double-adjustment, SPDT, snap-action switch type rated for a minimum of 4 amps at 120 volts ac. The adjustable range shall be nominally twice the noted setpoint, unless otherwise noted.
- B. The switch shall have a calibrated dial, externally adjusted setpoint, and deadband pointers and visible on-off indication. Unless otherwise noted, the unit shall be automatic reset type.
- C. Switches shall have a 1/2-inch bottom connection.
- D. The switch enclosures shall have a NEMA rating suitable for the environment in which the switch is installed.

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- E. Wetted parts shall be suitable for the intended service and as a minimum, the Bourdon tube shall be 316 stainless steel, unless otherwise noted.
- F. Unit shall be Mercoid Series DA, or equal.

P12 PRESSURE TRANSMITTER, ELECTRONIC

- A. The unit shall be a capacitance-type instrument producing a 4- to 20-mA dc signal linearly or square root proportional to sensed pressure. Wetted parts shall be 316 stainless steel, unless otherwise noted. Process temperature range shall be -40 degrees F to +250 degrees F minimum. The unit shall be fluid damped and shall be capable of withstanding 200% overpressure without damage.
- B. The transmitter shall be of the 2-wire type and shall transmit a 4- to 20-mA dc signal into a load impedance in the range of 0 to 590 ohms when fed by a 24-volt dc supply. The unit shall have an adjustable range as noted. The unit shall be designed such that the unit range noted lies between 60% and 80% of the unit's maximum range. Accuracy shall be plus or minus 0.5% of span. The enclosure shall be NEMA 4, unless otherwise noted.
- C. Units shall be provided with an LCD indicator having programmable engineering and measurement units.
- D. Units shall be provided with a stainless steel block and bleed valve manifold with test/vent taps. Units shall be provided with brackets for pipe stand or wall mounting, as required.
- E. The unit shall be Rosemount 3015P sole-source, no exceptions, to match existing equipment.

P 42 PRESSURE GAUGE, PROCESS

- A. Pressure gauges for measurement of process variables shall be of the direct-reading, capsule, or bellows type for ranges below 10 psig and shall be Bourdon-tube-actuated for pressures 10 psig and above.
- B. Range shall be as noted.
- C. Gauge wetted parts shall be suitable for the service intended and as a minimum, bellows gauges shall have 316SS bellows and socket, and Bourdon tube gauges shall have 316SS tube and socket, unless otherwise noted.
- D. When so noted, provide pulsation dampener and/or compound scale.
- E. Unless noted otherwise, pressure gauges shall meet the following requirements:
 - Plus or minus 0.5% accuracy, for ranges 10 psi and above
 - Plus or minus 2-1/2% accuracy, for ranges below 10 psi
 - Stem mounting, 1/2-inch
 - 4-1/2-inch diameter dial

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- Solid front with pressure relief back

F. Bellows-type gauges shall be Ashcroft General Service Series 1180, U.S. Gauge/Ametek 1919, Robertshaw Acragage, or equal. Bourdon-tube-type gauges shall be Ashcroft Duragauge Model 1279/1379, U.S. Gauge/Ametek 1980, or equal.

Y 60 DC POWER SUPPLIES

- A. DC power supplies shall have an output voltage as indicated on the drawings, plus or minus 1%, and provide a minimum 30 watts of power, and shall be DIN rail or chassis mounted.
- B. Supplies shall be suitable for an operating temperature of -25 to +65 degrees C.
- C. Supplies shall be capable of providing continuous overload and short-circuit protection, and be capable of powering on when connected to rated load.
- D. Supplies shall have screw-type terminals for connection of ac power and dc power.
- E. Supplies shall be SOLA SCD30S24-DN, Lambda RWS-30A-24/A, or equal.

Y 99 MAINTENANCE BYPASS SWITCH

- A. Maintenance bypass switch shall accept an input voltage of 120-125 volts ac with a nominal output voltage of 120 volts ac, shall contain integral overload protection, shall be suitable for use with UPS's up to 3kVA, and shall be DIN rail or chassis mounted with six (6) NEMA 5-15R and two (2) NEMA 5-20R outlets.
- B. Switch shall be suitable for an operating temperature of 0 to 40 degrees C.
- C. Switch shall be APC SBP2200RM, or equal.

Z 1 SWITCH, POSITION-ACTUATED, INDUSTRIAL-TYPE

- A. The switch shall be snap action; of the heavy-duty industrial type in a cast housing; and with a spring-return, lever-type actuator. The housing shall be oiltight and watertight.
- B. Contacts shall be single-pole, double-throw, and shall have a rating of 600 volts and 5 amps minimum at 120 volts, 60 Hz, and 0.2 amp minimum at 120 volts dc.
- C. The switch shall be Cutler-Hammer E50, General Electric CR115G, Allen-Bradley Bulletin 802M, or equal.

Z 90 SWITCH, MOTION-ACTUATED

- A. The switch shall be of the dual technology type (PIR and microwave) and programmable. The housing shall be constructed of high-impact ABS plastic with UV protection.

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- B. The assembly shall be suitable for an operating temperature rating of –30 to +65 degrees C. 1
- C. Contacts shall have a rating of 50 mA minimum at 24 volts dc.
- D. The switch shall be Interlogix DDI602U-F1, or equal.

END OF SECTION

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SECTION 13300 - INSTRUMENTATION AND CONTROLS
ATTACHMENT D
I/O LIST

PLC	AREA NAME	ISA PREFIX	PROCESS AREA	LOOP NO.	DESCRIPTION	P&ID	INPUT/OUTPUT TYPE				COMMENTS
							DI	DO	AI	AO	
PLC-20	Facility 20		20		CP-20 CONTROL POWER FAIL	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.1 FAULT	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.1 HIGH PRESSURE	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.1 HIGH TEMP	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.1 in AUTO	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.1 LOSS OF CONTROL POWER	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.1 ON	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.2 FAULT	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.2 HIGH PRESSURE	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.2 HIGH TEMP	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.2 in AUTO	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.2 LOSS OF CONTROL POWER	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.2 ON	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.3 FAULT	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.3 HIGH PRESSURE	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.3 HIGH TEMP	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.3 in AUTO	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.3 LOSS OF CONTROL POWER	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.3 ON	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.4 FAULT	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.4 HIGH PRESSURE	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.4 HIGH TEMP	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.4 in AUTO	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.4 LOSS OF CONTROL POWER	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.4 ON	20-I-1	1				
PLC-20	Facility 20		20		TWST LOW LEVEL OVERRIDE	20-I-1	1				
PLC-20	Facility 20	LSLL	20	001	TWST LOW LOW LEVEL	20-I-1	1				
PLC-20	Facility 20		20		UPS FAULT	20-I-1	1				
PLC-20	Facility 20		20		UPS LOW BATTERY	20-I-1	1				
PLC-20	Facility 20		20		UPS ON	20-I-1	1				
PLC-20	Facility 20		20		Finished Water Pump No.1 RUN	20-I-1		1			
PLC-20	Facility 20		20		Finished Water Pump No.2 RUN	20-I-1		1			
PLC-20	Facility 20		20		Finished Water Pump No.3 RUN	20-I-1		1			
PLC-20	Facility 20		20		Finished Water Pump No.4 RUN	20-I-1		1			
PLC-20	Facility 20	FIT	20	600	Pump Station FLOW	20-I-1			1		

SECTION 13300 - INSTRUMENTATION AND CONTROLS
ATTACHMENT D
I/O LIST

PLC	AREA NAME	ISA PREFIX	PROCESS AREA	LOOP NO.	DESCRIPTION	P&ID	INPUT/OUTPUT TYPE				COMMENTS
							DI	DO	AI	AO	
PLC-20	Facility 20	PIT	20	600	Pump Station Discharge PRESSURE	20-I-1			1		
					Total Input/Output - PLC-20 (Zone A Pump Station)		30	4	2	0	

SECTION 13300 – INSTRUMENTATION & CONTROLS

ATTACHMENT E SAMPLE TEST PROCEDURES

Overview

Following is a sample test format; Contractor's test format may differ. Testing shall be in a cause and effect format with the cause (input) and effect (result or output) clearly described in the test documentation, including the specific materials and/or equipment required.

Contractor's procedures shall provide descriptions of each test.

Tools And Instruments Required

Contractor's procedures shall list tools and instruments required.

Test Setup

Contractor's procedures shall describe process-related and other setup required at the beginning of the procedure, and throughout the procedure.

STEP	ACTION	RESULT	CHECK OFF
1	Adjust level in the wet well to 6"	<ul style="list-style-type: none">• LT-A1-1 outputs 4.8mA• LI-A1-1 indicates 0.5'• Wet well level 0.5' signal is sent to the PLC and is displayed on the OIP• Wet well level of 0.5' is displayed within SCADA• LSLL-A1-1 is closed and CR1 is energized• LSL-A1-1 is closed and CR2 is energized• LSL-A1-1 signal is received by the PLC• LSLL-A1-1 signal is received by the PLC• LSL-A1-1 is indicated on the OIP• LSLL-A1-1 is annunciated on the OIP• LSL-A1-1 is indicated within SCADA• LSLL-A1-1 is alarmed within SCADA• A STATION COMMON ALARM is annunciated at the Main Wastewater Treatment Plant	<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"/> <input type="checkbox"/> <input type="checkbox"/>

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STEP	ACTION	RESULT	CHECK OFF
2	Adjust level in the wet well to 18"	<ul style="list-style-type: none"> • LT-A1-1 outputs 6.4mA • LI-A1-1 indicates 1.5' • Wet well level 1.5' signal is sent to the PLC and is displayed on the OIP • Wet well level 1.5' is displayed within SCADA • LSL-A1-1 opens and CR1 is deenergized • LSL-A1-1 signal is no longer received by the PLC • LSL-A1-1 is no longer annunciated on the OIP • LSL-A1-1 is no longer alarmed within SCADA • A STATION COMMON ALARM is no longer annunciated at the Main Wastewater Treatment Plant 	<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"/>
3	Adjust level in the wet well to 24"	<ul style="list-style-type: none"> • LT-A1-1 outputs 5.2mA • LI-A1-1 indicates 2.0' • Wet well level 2.0' signal is sent to the PLC and is displayed on the OIP • Wet well level of 2.0' is displayed within SCADA • LSL-A1-1 opens and CR2 is deenergized • LSL-A1-1 signal is no longer received by the PLC • LSL-A1-1 is no longer indicated on the OIP • LSL-A1-1 is no longer indicated within SCADA 	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
4	Adjust level in the wet well to 5'	<ul style="list-style-type: none"> • LT-A1-1 outputs 12.0mA • LI-A1-1 indicates 5.0' • Wet well level 5.0' signal is sent to the PLC and is displayed on the OIP • Wet well level of 5.0' is displayed within SCADA 	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
5	Adjust level in the wet well to 8.5'	<ul style="list-style-type: none"> • LT-A1-1 outputs 13.6mA • LI-A1-1 indicates 8.5' • Wet well level 8.5' signal is sent to the PLC and is displayed on the OIP • Wet well level of 8.5' is displayed within SCADA • LSH-A1-1 closes and CR3 is energized • LSH-A1-1 signal is received by the PLC • LSH-A1-1 is indicated on the OIP • LSH-A1-1 is indicated within SCADA 	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

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STEP	ACTION	RESULT	CHECK OFF
6	Adjust level in the wet well to 9.5'	<ul style="list-style-type: none"> • LT-A1-1 outputs 15.2mA • LI-A1-1 indicates 9.5' • Wet well level 9.5' signal is sent to the PLC and is displayed on the OIP • Wet well level of 9.5' is displayed within SCADA • LSHH-A1-1 closes and CR4 is energized • LSH-A1-1 signal is received by the PLC • LSHH-A1-1 signal is received by the PLC • LSH-A1-1 is indicated on the OIP • LSHH-A1-1 is annunciated on the OIP • LSH-A1-1 is indicated within SCADA • LSHH-A1-1 is alarmed within SCADA • A STATION COMMON ALARM is annunciated at the Main Wastewater Treatment Plant 	<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"/> <input type="checkbox"/>

Test Executed By: _____
Date: _____
Test Witnessed By: _____

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SECTION 13350

PROGRAMMED SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This Section covers programmed systems, complete. Provide labor and materials as required for complete operating programmed systems, including all of the control functions described in Section 13300, INSTRUMENTATION AND CONTROLS. The Contractor shall furnish and install all hardware and software on the project including all program development software.
- B. This Section covers the following items, as a minimum:
 - 1. Programmable Logic Controller (PLC) Systems
 - 2. Input/Output modules (I/O modules)
 - 3. Supervisory Control and Data Acquisition System (SCADA)
 - 4. Operator Interface Panel (OIP)
 - 5. Smart Uninterruptable Power Supplies (UPSs)
 - 6. Plant Networks
 - 7. Wireless Appliances
 - 8. Programming
- C. Programming covered under this Section includes modifying the District's existing Wonderware SCADA system. Modifications include integrating the Zone A Pump Station, complete, and all associated data structures, communications management, alarming and interfaces required to fully integrate these sites as described herein.
- D. This Section hereby includes all applicable requirements of Section 13300, INSTRUMENTATION AND CONTROLS, including but not limited to submittals, O&M manuals, and warranty.
- E. The Contractor shall furnish and install all required materials and labor to deliver a fully functioning, documented system.

1.2 GENERAL

- A. Programmed systems is a part of the instrumentation and controls system. In addition to the requirements in this Section the supplier of the programmed systems shall meet all the applicable requirements of the Section 13300, INSTRUMENTATION AND CONTROLS, except where those requirements are modified by this Section. These requirements include, but are not limited to, the following:
 - 1. Controls functions
 - 2. Applicable system requirements
 - 3. Applicable product specifications
 - 4. Applicable workmanship requirements
 - 5. Seismic requirements

- B. In addition to requiring a fully documented and tested system at project completion, it is the intent of these requirements to ensure that programmed systems are complete, documented, and tested prior to shipping systems to the jobsite. The documentation requirements are significant and require planning to ensure that submittals are provided sufficiently in advance of certain activities.
- C. The plant control system will command equipment. The Contractor shall furnish a comprehensive list, for each item of equipment, of operational conditions that will need to be adhered to in order to avoid equipment damage, including but not limited to the following:
 - 1. Starts-per-hour limits
 - 2. Operating on low- or high-level conditions
 - 3. Interlocking with other equipment
 - 4. Other conditions as they apply

1.3 SUBMITTALS

- A. General
 - 1. Provide complete submittals for programmed systems covered under this Section. Where programmed systems are part of a system also having hardwired instrumentation and controls, these requirements apply to the combined hardwired and programmed system, complete.
 - 2. Submittals shall meet the applicable requirements of Section 13300, INSTRUMENTATION AND CONTROLS.
 - 3. Where programs are coded (written) to result in functions different from the Contract Documents, submittals shall clearly describe the deviations and reasons therefore.
 - 4. Where resubmittals of program listings or other documentation result in renumbering and/or resequencing of pages, ladders, loops, or the like, provide reference information which ties prior review comments to the new pages. This information shall be sufficient for the reviewer to easily identify the specific location in the resubmittal which pertains to each prior comment.
- B. Submittal Sequencing
 - 1. Submittals listed below are described in later paragraphs. Provide submittals in the following sequence:
 - a. First submittal pertaining to programmed systems:
 - Schedule
 - b. Prior to commencing programming:
 - Preparatory and Followup Reporting For Workshops
 - Application Program Format Submittal
 - Hardware and Software Products List
 - c. Early in the programming process:
 - Sample color screen prints for typical displays submittal.
 - Screen development workshop conducted by Contractor at Owner facilities.
 - Displays and Reports Submittal.
 - d. Following program development and 4 weeks prior to UFT execution:
 - Factory Demonstration Test (FDT) plan
 - Application program listing
 - Point listing
 - Reference program documentation
 - e. Following UFT execution and 3 weeks prior to FDT execution:

- Revised FDT plan; resubmit if designated
- UFT certification
- f. Following FDT execution and 2 weeks prior to shipping systems to the field:
 - FDT test report
- g. Prior to system acceptance, complete operation and maintenance documentation, including the following:
 - Complete vendor documentation on hardware and software operation and maintenance, including applications manuals, users' manuals, reference manuals, and configuration manuals.
 - Operation and maintenance descriptions, as-built.
 - Hardcopy and electronic file of point listing, in Microsoft Excel format, latest version.
 - Hardcopy and electronic files of final source code.
 - Operations and maintenance information as required elsewhere in these Specifications.
- h. Provide additional submittals as required.

C. Schedule

1. This submittal shall list projected dates for all submittal and testing activities for programmed systems. In addition, the schedule shall show durations and milestones for system development, including but not limited to milestones identified elsewhere in this Section.
2. The Contractor, as part of this submittal, shall certify that he has reviewed the programmed systems schedule and finds it to be in compliance with the overall project schedule.

D. Application Program Format Submittal

1. This submittal shall demonstrate the Contractor's proposed format for program listings and shall show a typical program table of contents, program organization, annotation, cross-references, and other listings for each programmed system. This submittal will not be reviewed for function; therefore, the Contractor may choose to illustrate format with program functions from this project or from another past similar project.
2. Prior to submission of this format submittal, the Contractor shall review the program listing requirements and carefully tailor the format submittal to comply with these Contract Documents. The submittal shall demonstrate that the Contractor has reviewed, and will comply with, standards and approaches preferred by the Owner.

E. Hardware and Software Products List

1. This submittal shall identify all hardware and software products which will be part of each programmed system. The following list is typical of products required:
 - a. PLCs
 - b. OIP's
 - c. Enclosures, or other mounting equipment
 - d. Uninterruptable power supplies (UPSs)
 - e. Peripherals
 - f. Networking hardware (switches)
 - g. Radios and other communications equipment
 - h. Programming application software and version
 - i. HMI/SCADA application software and version
 - j. Communication cables and connectors
 - k. Accessories

F. Displays and Reports Submittal

1. Submit color screen prints of all graphical displays. Submit additional information as required to fully describe display function, operator interfaces, display hierarchy and navigation, and display attributes such as animation and flashing.
2. Submit sample reports for each report available, with representations of each option available. Include sample data points for format review.
3. It is one objective of this project to define display standards to be used uniformly throughout this project, and for future Owner projects. Accordingly, the Displays and Reports submittal shall include at the front end a tabulation of the standards applied to the project. Items to be addressed include the following:
 - a. Standard Depictions
 - b. Use of Color
 - c. Use of Animation, Flashing
 - d. Transitions
 - e. Alarming
 - f. Layout, Proportions, and Other Aspects of Presentation
 - g. Help
4. Sample use of color, and use of animation.

Display Type	Color	Solid	Blinking
RUN	Red	X	
OFF	Green	X	
Out of Service Unavailable	Yellow	X	
Discrete Point In Alarm	Yellow		X

5. The Engineer will review and mark up the standards, screen prints, and reports. Incorporate the marks, and resubmit.

G. Runtime Application Program Listing

1. Program listings for runtime applications shall be complete, logically organized, and fully annotated to the best practices of the industry. Listings should be provided with a table of contents which details the following, as applicable:
 - a. Program sections, identified by loop numbers and loop titles, as shown in the Contract Documents
 - b. Tables, lists, cross-references
2. Annotations shall include comment blocks throughout the program, which overview each program function. For example, one or more comment blocks would be used to overview control of a single item of equipment. In addition, individual lines of code should be annotated, or, in the case of ladder logic programs, program annotations shall be sufficient to identify the function of each element, rung, and ladder within the program.
3. For programs with ladder logic portions, the following are required:
 - a. Each control element shall be annotated with contract tag number if applicable, English description, and program internal point number as needed to reference other locations in the program. Where annotations are truncated in certain listings, structure the annotations to provide the crucial information at the beginning of each annotation. Cross-reference lists shall be provided which list all appearances of any given element (such as a relay) throughout the program.
 - b. Each ladder shall be preceded by comment blocks describing the function and structure of that ladder.
 - c. Where possible, page breaks shall be organized to place complete ladders on individual sheets.

4. For programs with graphical programming languages, the following are required:
 - a. The Contractor shall provide a complete description of the program hierarchy. The Contractor shall include in each hierarchy level descriptive text blocks and functional block titles.
 - b. Symbols and text for each hierarchy level shall be scaled and optimized such that they can be read on one screen without zooming in.
 - c. Every data path line shall be descriptively labeled.
 - d. All internal and external I/O points shall be labeled with a signal name, data type, and destination.
- H. Point Listing
 1. Prepare a point listing. The point listing shall identify all inputs, outputs, and program internal points. Figure 1 at the end of this Section is a sample listing indicating the information required. Alternative formats which convey the required information are acceptable. In addition to hardcopy submittals, provide an as-built Excel format file at the completion of the project.
- I. Reference Documentation
 1. With program listing and related submittals, provide copies of all relevant reference documentation, such as manufacturer's configuration and programming manuals. This information will be used during review of the submittals to interpret the program listing.
- J. Operation and Maintenance Descriptions
 1. Operational Description: Provide a narrative which describes each program function. As a minimum, this narrative shall include the following content and features:
 - a. Table of contents.
 - b. Glossary.
 - c. Page numbers.
 - d. Applicable references to other submitted items.
 - e. The document shall be logically organized by function and shall be bound and segregated with dividers.
 2. Maintenance Description: Provide a narrative which includes the following descriptions as a minimum:
 - a. How to start up the program
 - b. How to shut down the program
 - c. How to back up the program
 - d. How to restore the program
 - e. How to reset the system
 - f. Recommended file management procedures, including procedures relating to multiple copies/versions/licenses for SCADA master software.
 - g. How to adjust setpoints, timers, and other program parameters
- K. Test Plans, Reports, and Certifications
 1. As identified in the Article, "Testing."
- L. Operation and Maintenance (O&M) Manuals
 1. As identified below.

1.4 OPERATION AND MAINTENANCE MANUALS

- A. Provide operation and maintenance manuals within 20 days after the completion of the Functional Acceptance Test (FAT). Include the following (both hardcopies and electronic copies on CD):
 - 1. Corrected submittals as required herein.
 - 2. Record (as-built) wiring diagrams, control schematic (elementary) diagrams, interconnection diagrams, and equipment drawings.
 - 3. Record (as-built) program listings, point listings, reference documentation, and operation and maintenance descriptions.
 - 4. For all equipment suppliers, list of current names, addresses, and telephone numbers of those who should be contacted for service, information, and assistance.
 - 5. Record (as-built) Contract Drawings marked with red pencil to show revisions to the electrical work when different from the original Contract Drawings. Prepare by obtaining new, clean sets of Contract Drawings.
 - 6. Record (as-built) control strategies
 - 7. Test results.
- B. The O&M manuals shall include operating and maintenance information for all subsystems and components covered in this Section. The O&M information shall be in sufficient detail to allow the operation, removal, installation, adjustment, calibration, and maintenance of each component provided, down to the printed circuit board level.
- C. Each set of manuals shall be assembled in one or more three-ring binders, each with a title page, table of contents, and heavy section dividers with labeled index tabs. When more than one binder is required, the binders shall be labeled "Volume 1 of x," "Volume 2 of x," etc. The table of contents shall encompass the entire set of O&M manuals, shall list the contents of each volume, and shall appear in each binder.
- D. Provide integrated O&M's, regardless of source of supply.
- E. Additional O&M requirements are described in Section 01330, SUBMITTAL PROCEDURES.

1.5 QUALIFICATIONS

- A. The entity or entities responsible for furnishing and installing programmed systems shall meet the following minimum qualifications:
 - 1. Be regularly engaged in fabricating, programming, installing, and documenting systems comparable to what is included in this project.
 - 2. Have a manufacturing and service facility, with at least four full-time technical staffers, within a 200-mile radius of the project site, which has been in operation within that radius for a minimum of 1 year.
 - 3. Have successfully completed five projects within the last 8 years using the hardware and software to be provided on this project.
 - 4. The PLC programmer shall have successfully completed three projects in the last 5 years using the hardware and software to be provided on this project. At least one of these projects shall overlap with the firm's experience above.
 - 5. The SCADA programmer shall have successfully completed three projects in the last 5 years using the SCADA software specified for this project.
 - 6. Submit evidence of the qualifications above, including the following:
 - a. Project names

- b. Project dates
- c. Project I/O point count, PLC count, and other evidence of size
- d. Owner names and phone numbers
- e. Names of personnel responsible for the work
- f. Address of manufacturing and installation facility meeting the location requirements

PART 2 - PRODUCTS

2.1 GENERAL

- A. Unless otherwise indicated, provide all first-quality new materials, free from any defects, and suitable for the intended use and the space provided. Provide materials approved by UL wherever standards have been established by that organization.
- B. Furnish and install all incidental items not specifically shown or specified which are required by good practice to provide the complete systems specified herein.
- C. Where two or more units of the same class of material or equipment are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer.
- D. In addition to the requirements of this Section, the work covered in this Section hereby includes the applicable requirements of Section 13300, INSTRUMENTATION AND CONTROLS for the following work:
 - 1. Seismic requirements
 - 2. Standard products
 - 3. Supply voltage distortion
 - 4. Equipment finish
 - 5. Enclosures
 - 6. Warranty

2.2 STANDARD PRODUCTS

- A. Unless otherwise indicated, provide materials and equipment which are products of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturer's latest design that conforms to these Specifications.

2.3 ENCLOSURES

- A. Unless indicated otherwise, provide suitable mounting and enclosure systems for all devices and equipment.
- B. All other enclosures shall be in accordance with the requirements in Section 13300, INSTRUMENTATION AND CONTROLS.

2.4 NAMEPLATES, NAME TAGS, AND SERVICE LEGENDS

- A. All components provided under this Section, both field- and panel-mounted, shall be provided with permanently mounted name tags bearing the entire tag number of the component. Panel-mounted tags shall be plastic or metallic fastened with stainless steel

screws or drive pins; field-mounted tags shall be stamped stainless steel affixed with stainless steel wire.

- B. Refer to Section 13300, INSTRUMENTATION AND CONTROLS, for additional labeling requirements.

2.5 CABLE MANAGEMENT

- A. This Article covers installation and labeling of cabling and exposed wiring for programmed systems.
- B. Labeling: All cables shall be labeled in a permanent, consistent manner, in accordance with the best practices of the industry. Label both ends of each cable. Labels shall be permanently affixed to the cable per the manufacturer's recommendations, and shall meet the applicable requirements of Section 13300, INSTRUMENTATION AND CONTROLS and Section 16050, ELECTRICAL. Handwritten labels are not allowed. Prior to installation, the Contractor shall provide interconnection schematics showing all cabling, including suggested cable naming. The Engineer will mark up the interconnection schematics.
- C. Routing: All cables shall be routed in an orderly fashion. Groups of compatible cables routed to/from the same locations shall be bundled, run in channel, or wire tied. Cables shall be routed parallel to equipment structures and shall be of sufficient length not to cut corners. Excess cable length shall be neatly coiled and wire tied. Where disconnection requires equipment removal, allow adequate slack. Wire ties shall be Velcro, adjustable type.
- D. Support: All cables and cable bundles shall be periodically supported by wire tie anchor points. Where possible, wire ties shall loop through fixed equipment attachment points. When fixed equipment anchor points are not available, wire tie anchors shall be adhesive type (minimum 2-inch by 2-inch) and shall be sized according to the wire tie size and mechanical cable load.
- E. Connectors and terminations: Connectors and terminations shall be in accordance with the best practices of the industry. Where connectors are field attached to cables, heat-shrink tubing shall be used to separate conductors; and an overall heat-shrink tube shall be used over the termination. All stranded conductors shall be tinned with solder before insertion into connectors. Electrical tape is not an allowable means of insulating or finishing cable fabrication or terminations.
- F. Penetrations: Passageways for cabling shall be logically located and finished off with grommet or other suitable means.

2.6 SPARE PARTS, CONSUMABLE ITEMS, AND TOOLS

- A. For spare parts, refer to additional requirements as specified in Section 13300, INSTRUMENTATION AND CONTROLS.
- B. Fuses: Provide 20% of each size and type used, rounded to the next whole number, but no less than five of each size and type.

- C. For the PLCs, provide 25% spare capacity of each I/O type. Furnish one spare module for each type of I/O.
- D. For PLC modules other than I/O modules, furnish one spare, uninstalled module of each type used.
- E. Furnish one spare backplane of each type used for the PLC.
- F. Furnish two spare communications cables, with connectors for each type of cable used.
- G. Furnish one spare dc power supply of each type used.
- H. Furnish 25% spares for each type of connector, terminator, and adaptor used.

2.7 ELECTRONIC FILES OF APPLICATIONS AND DEVELOPMENT SOFTWARE

- A. Applications software consists of those programs and other files which accomplish the specific functions of the programmed system. Development software consists of those programs and other files which provide the framework and tools used to create applications software.
- B. Provide files on CD-ROM or other medium compatible with the systems on this project.
- C. Provide all registered versions of software required to develop, modify, operate, and maintain the programmed system, including applications and development software, compilers/decoders/interpreters, operating systems, communications programs, utility programs, documentation programs, etc.
- D. Provide licensing and registration for all programs, including documentation substantiating each license and registration. Register all software to the Owner. Where software applications are available in different licensing and use versions (i.e., client-server, multiuser, single user, development, runtime, 500 point, unlimited point, etc.), provide the Owner with the most comprehensive license/version available, with a minimum of three simultaneous users.
- E. Program versions shall be the latest available at the start of factory testing.

2.8 PLC SYSTEM

- A. PLC Hardware
 - 1. Each PLC shall have a primary backplane, with microprocessor-based, programmable CPU module.
 - 2. PLC programs shall be stored in nonvolatile memory and shall be uploaded from either the PLC data network or a direct serial connection to a PC. PLC programs shall be retained on loss of power and shall automatically restart upon restoration of power.
 - 3. All PLC I/O shall be configurable to fail to a preprogrammed, assigned condition.
 - 4. I/O points shall be assigned to modules, with special regard to failure modes. I/O for the various loops, described under Loop Descriptions, shall be separated among modules so that failure of one module does not shut down an entire process.

5. Communications: PLC's shall provide a peripheral means to transfer data between PLCs and various external devices such as an OIP and/or the SCADA system. Communications shall be accomplished via a digital communication link using an industry standard protocol. Communications links shall support data transfer rates of 1 million bits per second, minimum. The communication protocol shall employ a token-based network.
6. The PLC system shall be 100% compatible with the existing SCADA software. PLCs shall be programmed to operate with the SCADA software.
7. Each PLC shall communicate with physically separate backplanes containing all process I/O modules.

B. PLC Modules

1. Backplane: Backplanes shall be universal, with any module mountable in any slot. PLC backplanes shall have a minimum of 6 slots. Backplanes shall be Allen-Bradley ControlLogix (for pump station) sole source, no exception.
2. Central Processing Unit (CPU) Module: CPU modules shall be an x86 processor-based with a minimum of 2MB of RAM. CPU modules shall have an on-board math coprocessor and shall be rated to operate in temperatures ranging from 0 to 60 degrees Celsius. CPU modules shall be UL and CSA listed. CPU modules shall be Allen-Bradley ControlLogix (for pump station) sole source, no exception.
3. Power Supply: Power supply modules shall be hot-swappable. Each power supply module shall be individually capable of supplying power to all PLC modules on the backplane. Provide two power supply modules for each PLC and I/O backplane. Power supply modules shall be Allen-Bradley ControlLogix (for pump station) sole source, no exception.
4. Analog Input Module: Analog input modules shall operate on differential voltage input isolated for each channel. Analog input modules shall be suitable for use with 4- to 20-milliamp loops. Digital resolution shall be 14 bits, minimum, with a maximum conversion time of 10 milliseconds. Accuracy shall be 0.05% of full scale. Analog input module shall be Allen-Bradley ControlLogix (for pump station) sole source, no exception.
5. Analog Output Module: Analog output modules shall be suitable for voltage and/or current output. Outputs shall be accurate to within plus or minus 0.2% of full scale, with 12-bit digital resolution, and shall have a conversion time of less than 5 milliseconds. Outputs shall be suitable for use with an external 24-volt dc power supply and shall be electrically isolated up to 500 volts, 60 Hz. Analog output modules shall be suitable for use with 4- to 20-milliamp loops. Analog output module shall be Allen-Bradley ControlLogix (for pump station) sole source, no exception.
6. Discrete Input Module: Discrete input modules shall accept 115-volt, 60-Hz isolated discrete inputs and shall have a 13-millisecond response time, maximum. Maximum rated input voltage shall be 132 volts, 60 Hz, continuous. Discrete input module shall be Allen-Bradley ControlLogix (for pump station) sole source, no exception.
7. Discrete Output Module: Discrete output modules shall be isolated dry-contact type, rated 250 volts, 60 Hz, 2 amps, continuous. Response time shall be 20 milliseconds, maximum. Discrete output module shall be Allen-Bradley ControlLogix (for pump station) sole source, no exception.

C. PLC System Additional Equipment

1. 24-Volt DC Loop Power Supply: The 24-volt dc loop power supplies shall operate on 120 volts, 60 Hz, and shall produce 24 volts dc, with 0.05% regulation and no greater than 0.1% ripple under rated load. The 24-volt dc power supplies shall be sized to drive all connected loops at 30mA plus 30% spare overhead, minimum. The 24-volt dc power supplies shall be self-contained with output overvoltage and overcurrent protective devices. Provide an indicating fuse for each dc supply line to each individual loop. Fuses shall be mounted and located so that they can be easily seen and replaced.
2. Cabling Systems: Provide and install all cables required for normal, standby, communications, and programming modes of the PLC system. Each cable shall be of the appropriate length, unspliced, with factory connectors and/or terminations at both ends. All cables shall be manufactured and certified by the PLC manufacturer.
3. Connectors and Terminators: Connectors on cables shall be factory installed and shall mate with the connected equipment without the use of an adapter. Cables shall have factory terminators installed where required to ensure proper cable impedance at all connection points. All connectors and terminators shall be manufactured and certified by the PLC manufacturer.
4. PLC/Field Wiring Interface Hardware
 - a. Each analog and discrete input/output module shall be supplied with pre-wired cable and terminal block assembly (in lieu of independently wired I/O connectors and independently wired field terminal blocks).
 - b. Each assembly shall be designed to work with a specific I/O module.
 - c. Each assembly shall consist of an I/O connector/front panel adapter, with pigtail ends for wiring to field terminal blocks.
 - d. PLC/field wiring interface hardware shall be Weidmuller Cable Interface Modules, or equal.
5. PLC/PC Communications Card: PLC/PC communications card shall be a PCI plug-in card allowing a PC to interface with the PLC system communications network. The PLC/PC communications card shall be by the manufacturer of the PLC system or by a supplier approved by the PLC manufacturer. It shall be 100% Windows compatible, and shall provide a seamless interface with the SCADA software.
6. PLC Programming Software
 - a. PLC programming software shall be by the manufacturer of the PLC system, shall be IEC 1131-3 compliant, and shall include the following programming languages:
 - Ladder diagram
 - Sequential function chart
 - Function block diagram
 - Structured text
 - Instruction listPLC programming software shall support the simultaneous use of all five programming languages within one programming project.
 - b. PLC programming shall be performed to the best practices of the industry. All PLC programming shall adhere to standard programming protocols and shall be well-organized, annotated, and optimized. See Submittals for extensive programming requirements.
 - c. Programs written with non-IEC 1131-3 compliant software will not be accepted.
 - d. PLC programming software shall be Rockwell Studio 5000 Logix Designer, latest edition, and shall designate the District as the licensee.

7. Data Storage
 - a. Provide all necessary data structures. In addition, at a minimum, provide history archiving of each discrete and analog value collected to allow for cases of power or communications loss. Following restoration of power/communications, transmit archived data to the SCADA level. Provide for easy configuration of storage counts to allow for optimization.
8. System Restart
 - a. The PLC shall retain all operating values on power loss. On restoration of power, the PLC shall execute an orderly restart, which takes into account requirements arising from partially completed sequences and other applicable process conditions. The restart shall not require operator intervention to be successful. Additionally, the system shall monitor the integrity of the communications links, and on loss of communications shall continue operation in a safe mode. Should operation require real-time information from other PLCs, then the safe mode shall be configured to operate without this information.

2.9 PANEL UNINTERRUPTABLE POWER SUPPLY (UPS)

- A. Uninterruptable Power Supplies (UPSs) shall be furnished to provide a reliable source of uninterruptible power with no break in ac output power during a complete or partial interruption of incoming line power. Each UPS shall include audio, visual, and discrete output alarms.
- B. Operation: Each UPS shall be comprised of a static inverter, a hysteresis loop battery charger, batteries, a static switch, and a manual bypass of the static switch. The system shall also be of a modular design for ease of service in the field. Under normal operating conditions, the critical load shall be powered by normal ac line supply that has been filtered through a ferroresonant transformer. When ac line power is present and when the batteries are fully charged, the inverter and charger shall be normally off. When ac line power fails, the inverter shall supply ac power to the ferroresonant transformer from the battery source. There shall be no break in the output of the system during transfer from normal ac line supply to inverter battery supply. The electronics section shall be separate from the ferroresonant transformer. A manual bypass switch shall allow the electronics section to be removed while the ferroresonant transformer is left in place to continue to filter normal ac line. The batteries shall be hot-swappable.
- C. UPS Ratings:

Output Capacity:	Minimum 800-VA rating or greater as required to power all components of each control panel continuously for at least 30 minutes
Input Voltage:	120 volts ac, single-phase, plus 15%, minus 20%
Output Voltage:	120 volts ac, single-phase, plus or minus 3% for input voltage plus 15%, minus 20%
Efficiency:	85% or better
Wave Shape:	Sine wave with less than 5% total harmonic distortion

Frequency:	60 Hz plus or minus 0.5 Hz when running from inverter
Spike Attenuation:	2,000:1 per ANSI C62.41
Noise Rejection:	Common mode greater than 120 dB; normal mode greater than 60 dB
Operating Temperature:	-10 degrees to 40 degrees C

D. The UPS shall be Liebert, APC, Best, Ferrups FE Series, or equal.

2.10 OPERATOR INTERFACE PANEL

- A. The Operator Interface Panel (OIP) shall provide a complete view of pump station operation. Provide indication and alarm displays integrated with graphical representations of all the processes and equipment shown on the process instrumentation and control diagrams.
- B. OIP screens shall be organized in a hierarchical manner, with an overview screen and multiple equipment, mode, configuration, and subprocess screens. Include screens as required to meet all of the requirements of this Section and Section 13300, INSTRUMENTATION AND CONTROLS. Provide screens and displays which meet the requirements described in Article, SCADA System. Additional screens and features shall be provided, as needed, to create a complete system which meets best practices of the industry. If a given screen becomes crowded as configured by the Contractor, the screen shall be split into multiple screens.
- C. The OIP shall display discrete and analog values available within the PLC. With password protection, the OIP shall provide access to setpoints, registers, and other PLC internal variables and parameters. For alarms, the OIP shall provide displays and ACKNOWLEDGE and RESET functionality similar to that of a conventional annunciator.
- D. The OIP shall be panel mounted, shall operate on 24 volts dc, shall be rated NEMA 12, and shall be provided with a support kit (including security keyswitch, spare connectors, and transfer utility) and a PLC interface.
- E. The OIP shall be provided with all hardware and software required for programming the unit with an IBM-compatible computer. The software shall be suitable for online programming and shall include graphical software capable of generating custom characters and animated displays. The unit shall be provided completely programmed in accordance with Drawings and as specified herein. The program shall not be lost in the event of a power failure and shall restart automatically upon restoration of power.
- F. The Operation Interface Panel shall be Rockwell (Allen-Bradley) PanelView Plus 7 graphic terminal, sole source. The OIP shall be supplied with required programming software and programming cables.
- G. Provide and install all mounting and interconnection hardware and cables.

2.11 PANEL ETHERNET SWITCHES

- A. Provide Ethernet switches in control panels as shown on the Drawings.
- B. Switches shall include at least 16 RJ-45 10/100BaseTx ports (for Main Recorder Panel) and 8 RJ-45 10/100 Base TX ports (for Zone A Pump Stations), auto-sensing and auto-configuring. The link status, speed, and activity diagnostics shall be provided via LED's.
- C. Switches shall operate on 10- to 30-volt dc power.
- D. Operating temperature shall be -40 to 185 degrees Fahrenheit.
- E. Panel Ethernet switches shall be N-TRON 316TX-N (for Main Recorder Panel) and N-TRON 306TX-N (for Zone A Pump Station), or equal.

2.12 SERIAL DATA CABLE

- A. Serial data cable shall be 24-gauge stranded, 300-volt, 80 degrees C, multiconductor, twisted-pair cable, and shall have an overall aluminum-polyester shield with a 24-AWG stranded, tinned copper drain wire.

2.13 NETWORK CABLE AND CONNECTORS

- A. Network cable shall be four pair, twisted unshielded, riser rated, 24 AWG solid copper conductor, UL listed, CAT5e cable. Network cable shall be Belden, Coleman, or equal.

2.14 150 MHZ RADIOS

- A. Radio appliances shall operate over a frequency range of 130 to 174 MHz, with frequency programmability of 5kHz and 6.25 kHz increments, and channel spacing of 12.5 kHz and 15 kHz, selectable.
- B. Radios shall accept an operating voltage of 10.5 to 16 Vdc (13.8 Vdc nominal) over an operating temperature range of -30°C to 60° C.
- C. Radios shall conform to all requirements of Federal Communications Commission (FCC) Part 90.
- D. Radios shall be GE MDS-1710A, sole-sourced, no exceptions.

2.15 ANTENNA CABLE

- A. Antenna cable shall be manufactured with an inner conductor of solid bare copper-clad aluminum (BCCAI), a foam poly ethylene dielectric, an aluminum tape outer conductor, a tinned copper overall braid, with a polyethylene jacket.
- B. Cabling shall be designed for use in an outdoor environment (rated outdoor/watertight), with a UV rated outer jacket, capable of installed temperature range of -40°C to 85°C.

- C. Antenna cable shall be Times Microwave Systems LMR-4000DB, or equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Work shall be performed in a workmanlike manner by craftsmen skilled in the particular trade. Work shall be performed in accordance with the Drawings, the Specifications, the manufacturers' recommendations, and the best practice of the trade. Completed work shall present a neat and finished appearance.
- B. Coordinate the work covered in this Section with the Owner and the work of other trades to avoid conflicts, errors, delays, and unnecessary interference during construction.
- C. In addition to the requirements listed in this Section, the work covered in this Section hereby includes the applicable requirements of Section 13300, INSTRUMENTATION AND CONTROLS for the following work:
 - 1. Protection during construction
 - 2. Equipment installation, including seismic requirements
 - 3. Demolition
 - 4. Cutting and patching
 - 5. Cleaning and touchup painting

3.2 PROTECTION DURING CONSTRUCTION

- A. Throughout this Contract, provide protection for materials and equipment against loss, damage, and the effects of weather. Prior to installation, store items to be installed in indoor locations. Items subject to corrosion under damp conditions and items containing insulation, such as control panels and instruments, shall be stored in indoor, heated, dry locations.
- B. Following installation, protect materials and equipment from corrosion, physical damage, and the effects of moisture on insulation. Keep openings in boxes or equipment closed during construction.

3.3 MATERIAL AND EQUIPMENT INSTALLATION

- A. Follow the manufacturer's installation recommendations, unless otherwise indicated. Follow the Engineer's decision, at no additional cost to the Owner, wherever any conflict arises between the manufacturer's instructions, State, or other codes and regulations, and these Contract Documents. Keep a copy of the manufacturer's installation instructions available on the jobsite for review at all times.

3.4 SCADA SYSTEM, GENERAL

- A. The existing SCADA system consists of personal computers (PCs). The Contractor shall use SCADA development software furnished by the Contractor. SCADA development software shall be Wonderware.

- B. The Contractor shall perform all programming development with their own licensed software.
- C. Required functions include interrogating remote PLCs for discrete and analog operational data; displaying these data on the screen in a graphic and text format for operator use; printing automatic and operator-initiated reports; providing alarm annunciation and operator acknowledge and reset sequencing; performing automatic operations, as required by the database; allowing online modifications of the database; performing such recordkeeping as required; and transmitting discrete and analog operational data to the PLCs.
- D. Provide all functions required to implement process monitoring and control as specified in Section 13300, INSTRUMENTATION AND CONTROLS. In addition to those functions, provide the general functions specified herein.
- E. Communication Modes:
 - 1. The SCADA program shall have provisions for multiple modes of communication. The SCADA program shall support and control these modes of communication. In the event of a failure of a communications link, SCADA shall cause an alarm to be generated.
 - 2. The SCADA software shall control and process all communications data to and from the remote PLCs installed with this project. The communications portion of the SCADA software shall allow the communications with each PLC to be individually configured as to I/O content, polling cycles, online/offline selection, etc. The SCADA software shall communicate with the PLCs in the following ways:
 - a. PLC-Initiated Reporting: The PLC may initiate a transmission. Upon receipt of the PLC-initiated reporting, the SCADA computer system shall automatically transmit an acknowledge message back to the PLC to prevent additional, unnecessary PLC transmissions.
 - b. Polling: The SCADA system software shall be able to sequentially poll each PLC. Polling rates shall be as required to support the data collection intervals as specified below.

As part of each PLCs polling cycle, the SCADA system software shall transmit data as required to implement operator-initiated commands and control strategies as specified in the loop specifications.
 - 3. The SCADA program shall support communications as described elsewhere in this Specification. Communication shall include writing common alarms, process data, and all other alarms to the Allen-Bradley PLCs.
- F. Communications Monitoring and Optimizing:
 - 1. The SCADA program monitors the integrity of the communications systems and provides communications status displays. Communications status displays shall indicate communications data such as remote polling tries, failures, and normal conditions, performance/traffic on each communications link and cycle times for acquisition of data.
 - 2. This project shall match existing communications displays for Zone A
Pump Station additions.
- G. Data Collection: Using the polling feature, acquire data from each of the PLCs. Polling interval shall be set initially to 2 seconds per PLC. The data to be collected shall include the status of all discrete inputs and outputs, the value of all analog inputs and outputs, and the value or status of any internal PLC registers, as required.

- H. Data Storage: Provide all necessary data structures to support the operator interfaces described in the Specification. In addition, at a minimum, provide history archiving of each discrete and analog value collected, a minimum of the last 500,000 occurrences of each value. Provide for easy configuration of storage counts to allow for optimization.
- I. Calculations: The SCADA system shall calculate and display flow, flow since midnight, and totalized flow for each of the analog flow variables monitored by the PLCs.

3.5 SCADA SCREEN DISPLAYS

- A. Display standards and samples of each screen shall be submitted as described in Submittals.
- B. The existing SCADA system is fully developed for existing plant processes and existing remote sites. This project adds graphic screens to integrate Reservoir B improvements and the Zone A Pump Station into the existing SCADA system.
- C. Screen Requirements: This Article sets minimum requirements for screen displays. SCADA screens shall replicate all graphics and functions of the PLCs within the SCADA system. The SCADA screens shall provide larger system overview screens, which allow the operator to overview the entire SCADA process. Password protection shall be provided for all SCADA control functions. Additional screens and features shall be provided, as needed, to create a complete system which meets the best practices of the industry.
- D. If a given screen becomes crowded as configured by the Contractor, the screen shall be split into multiple screens. This Section is organized into general requirements, display requirements for representative components, and a listing of screens.
- E. General Requirements: Each screen shall have the following features in addition to those features described elsewhere:
 - 1. Display descriptive title.
 - 2. Display date and time.
 - 3. Function keys to access other related screens, get help, and acknowledge and reset alarms. Provide an on-screen function key legend. Provide a hardcopy "map" showing screen interrelationships and transitions available using function keys. Screens shall be sequenced in a "top down" arrangement.
 - 4. Any alarm condition shall cause an alarm, regardless of which screen is selected. Alarm acknowledge and reset sequencing shall match that of a conventional annunciator.
 - 5. Provide a status line for display of the following information, at a minimum:
 - a. Alarm description
 - b. SCADA master error descriptions
 - c. Communications error descriptions
 - d. Printer error descriptions
 - e. Screen print request acknowledge
 - f. Printing daily reports in progress message
 - g. Other statuses as applicable
 - 6. Alarms shall be individually suppressible, allowing for defeating of audible alarming only but continuing to log the event, or altogether suppressing the alarm.
 - 7. The SCADA software shall generate a COMMON ALARM for the Zone A Pump Station.
 - 8. Colors shall match standard colors used on devices in the field.
 - 9. Screen resolutions shall be coordinated with the resolution of the equipment provided.

F. Components:

1. For each component type below, screens showing these components shall display the information shown, if applicable. The component types listed are typical—provide similar displays for items not listed. Where a listed condition does not apply for a specific component (e.g., motor overtemperature is not sensed for each motor), that condition shall not be shown. Methods for displaying the information are indicated, such as text, use of color, and graphics.
2. Motor-Driven and Other Mechanical Equipment:
 - a. Graphic portraying the motor and equipment.
 - b. Statuses and alarms developed within the PLC system and received by the SCADA master.
 - ON (shown in text and with color).
 - OFF (shown in text and with color).
 - AUTO (shown in text and with color).
 - READY (shown in text and with color).
 - POSITION IN CALL SEQUENCE (shown in text).
 - CALLED TO RUN (shown in text and with color).
 - FAIL (shown in text and with color).
 - DISCHARGE PRESSURE.
 - DISCHARGE FLOW (shown in text and with color).
 - Other statuses and alarms as applicable, as monitored by the SCADA system or generated by the SCADA system.
 - c. Information derived by the SCADA computer.
 - Number of starts since midnight.
 - Run time since midnight.
3. Level and Flow-Monitoring Systems:
 - a. Graphic portraying the volume (TWST, Reservoir B, or other).
 - If the primary level monitoring is backed up by discrete level switches, the switches shall be shown graphically at their mounting heights.
 - Pumps connected to the volume shall be shown graphically.
 - b. Analog level, flow, statuses, and alarms.
 - Level (shown in text and graphically).
 - Flow (shown in text).
 - Flow since midnight (shown in text).
 - Totalized flow (shown in text).
 - LOW, LOW-LOW, HIGH and HIGH-HIGH alarms as received by SCADA and as derived within SCADA (shown in text).
 - LEVEL SENSOR FAIL (shown in text and with color).
 - ON/OFF/FAIL status of each pump connected to the volume (shown in text and with color).
 - c. Information derived by the SCADA system.
 - Level and flow trending shown graphically over the preceding 24 hours.
 - Level-monitoring discrepancy, alarm when discrete level alarms disagree with primary analog level monitoring. Show level graphically at discrete level alarm point, and indicate that level is unknown.
4. Process Analog and Discrete Monitoring Systems:
 - a. Graphic.
 - Provide applicable graphics depicting the analog or discrete process conditions monitored.
 - b. Analog values, statuses, and alarms.
 - Show values in text and graphically.

- Provide totalization, where applicable.
 - LOW, LOW-LOW, HIGH, and HIGH-HIGH alarms as received by SCADA and as derived within SCADA.
 - Sensor FAIL.
 - Statuses of related equipment.
 - c. Information derived by the SCADA system.
 - Trending of analog values.
5. Other Analog and Discrete Monitoring Systems:
- a. Graphic.
 - Provide applicable graphics depicting the systems and conditions being monitored. Where associated with other items, graphics shall be integrated. An example of an integrated display involving non-process items would be ventilation equipment and ventilation flow monitoring.
 - b. Analog values, statuses, and alarms.
 - Show values in text and graphically.
 - Provide totalization, where applicable.
 - LOW, LOW-LOW, HIGH, and HIGH-HIGH alarms as received by SCADA and as derived within SCADA.
 - Sensor FAIL.
 - Statuses of related equipment.
 - c. Information derived by the SCADA system.
 - Trending of analog values.
- G. Screen List:
1. Following is a list of screens and contents to be provided, at a minimum.
 2. System Overviews:
 - a. Provide overview screens as needed to provide overviews of all functions within each site. Lay out the screens geographically, with boundaries and transitions configured in a logical manner. Make use of graphics with 3-dimensional appearance at the higher levels, with 3-dimensional plan, elevation, or schematic type views at the more detailed levels. Graphics shall be arranged with the viewer's perspective in mind, to ensure that related displays and transitions provide continuity of perspective and are not confusing to the user.
 - b. For displays which are not schematic in nature, layouts shall account for relative sizes and arrangements of items. Illustrate the PLCs on applicable screens. PLCs shall be arranged geographically. Interconnection piping shall be shown. Color shall be used to show when any PLC has an alarm condition. Show landmarks such as roads and other facilities, as needed, to illustrate proximity and scale.
 - c. The Zone A Pump Station overview screen shall, as a minimum, show the following statuses and process information (where applicable):
 - Test mode
 - High TWST level
 - Flow
 - Interlocking
 - Pump failure
 - Communication status
 3. Process Screens:
 - a. Provide graphics screens which show each site, complete. All information on each screen shall be a logically grouped depiction of the inputs, outputs, and internal PLC variables associated with that part of the process.

4. Provide detailed screens for each system or subsystem, organized logically and accessible from the overview screen(s) which fully depict station operation. SCADA screens and OIP screens shall be organized comparable to one another to provide continuity. Refer to Section 13300, INSTRUMENTATION AND CONTROLS for requirements pertaining to PLC functions, which must be fully depicted at SCADA.
5. Non-Process Screens:
 - a. As described above for process-related screens, provide full SCADA depictions of non-process items.
6. Communication Screens:
 - a. Provide screens as required to implement the communications monitoring and optimizing functions described earlier in this Section.
7. SCADA System Screens:
 - a. Provide screens showing status and health of the interconnected components at the SCADA masters.
8. Mode Selection Screens:
 - a. Provide screens which enable the operator to select station and process operating modes as described in the loop specifications.
9. Configuration Screens:
 - a. Provide screens which enable the operator to view and change PLC and SCADA system setpoints and parameters. Edits made in these screens shall be password protected. The required level of access will be established during workshops.
 - b. The input/output configuration screens shall display all points. These screens, as a minimum, shall enable viewing and modification of the following (where applicable):
 - Instrument tag number
 - Description
 - Engineering range, units, alarm setpoints
 - Alarm state (open or closed contact)
 - State descriptions
 - Alarm enable/disableAll I/O configuration modifications shall be logged.
10. PLC Screens:
 - a. Each PLC in the system shall have a display, laid out on a module-by-module basis to resemble the physical arrangement, depicting everything known about the PLC at the supervisory level.
11. Alarm Summary:
 - a. This screen shall catalog alarms chronologically, one line per alarm. Alarm summary shall be configured so the most recent alarms appear first. The operator shall have the option of scrolling back as far as alarm history is available. Alarm history size shall be configurable and shall be initially set as recommended by the Contractor.
12. Trending (Multiple Screens):
 - a. For each measured or calculated analog process variable (such as flow, level, pressure), provide a full screen trend graph of the variable versus time. Each trend graph shall be accessible from any screen which shows the graphic associated with that trend. Provide no fewer than 250 points of horizontal resolution and 150 points of vertical resolution. Provide operator-selectable trend time intervals as follows:
 - hour
 - 1 day
 - 1 week

- 4 weeks
 - 1 year
- b. In addition to the trending screens, provide configurable averaging functions for each analog signal. Each signal shall have independently configurable averaging functions. For a configurable interval, set initially to 5 minutes, average the data, and store the average figures independent of the incoming signal data points. Provide displays and trending of raw data and averaged data.

3.6 PRINTED HARDCOPY

A. The operator shall have the option of printing any screen or any report.

B. Event Reports:

1. Event reports shall include any predefined or operator-selected events. Each event shall be logged on an equal, fixed number of lines in the event report. The event reports shall be printed at regular intervals, regardless of the number of events logged by the report. The operator may also manually print an event report at any time, with a selectable history length.
2. At the beginning of an event report, the printer shall print an opening header which reads as follows:

OWNER
EVENT LOGGING
PERIOD START <date> <time>

Each subsequent event log page shall have a page number, date, and time printed on the top of the page.

C. Daily Reports:

1. At midnight, automatically print a single-page report which summarizes run time and number of starts over the preceding 24 hours for all pieces of equipment – one line per piece of equipment. For each flow measured or calculated, print a one-page report which shows hourly flows, minima and maxima for the preceding 24 hours, and total flow for the preceding 24 hours. For the Zone A Pump Station, print a report which shows simultaneous pump run times for all combinations of pumps at that facility for the preceding 24 hours.

D. Monthly Reports:

1. At midnight, at the end of each month, print an equipment report similar to the daily report described above which shows run times and number of starts over the preceding month. Print the number of days in the month. Print a flow report, similar to the report described above, which shows minimum and maximum flows for each day in the preceding month and total flow at each pumping facility for the month. Print a simultaneous run time report, similar to the report described above, which shows simultaneous run times for each day in the preceding month and total simultaneous run times for the month.

E. Annual Reports:

1. At midnight, at the end of each year, print an equipment report having annual run times, number of starts, and total flow for the Zone A Pump Station. Print a simultaneous run time report, similar to the reports described above, which shows total simultaneous run times for the year.

F. Miscellaneous Reports:

1. The SCADA programmer shall coordinate with the Owner during workshops to generate additional process-oriented reports. The reports shall contain both current and archived values of process data and shall be set up and formatted in cooperation with the Owner. The reports shall be generated based on time, event, or operator-initiated action.

3.7 SUPERVISORY CONTROL

- A. It is the intent that the system be fully equipped to perform manual supervisory control of all PLC-controlled equipment. Supervisory manual control shall be fully implemented, documented, and tested as part of this project. Related training shall be provided.
- B. Supervisory manual control capability shall be implemented at the SCADA master.
- C. At project completion, all manual supervisory control functions shall be disabled, and detailed documentation shall be provided describing how to re-enable these functions, and recommended procedures for password protection, etc.

3.8 WORKSHOPS

- A. The Contractor's organization shall conduct four 6-hour workshops with the Owner's representatives at the Owner's offices for the purpose of reviewing programming standards and approaches, process control, screens and reports, and other aspects of the PLC and SCADA system.
- B. The Contractor shall prepare a detailed agenda for each workshop, and publish detailed minutes following each. Minutes shall include attachments illustrating the conclusions.
- C. These workshops shall not relieve the Contractor of the planning and submittal responsibilities associated with these systems.
- D. Workshop agenda topics shall include:
 1. PLC variable types: integers, floating point, etc.
 2. PLC programming layout.
 3. PLC program function blocks.
 4. General OIP screens layout
 5. General SCADA screens layout.
 6. Display and color of process streams, process equipment, and process values.
 7. Report formats.
 8. Variable trending.
 9. Security levels and password protection (e.g., View, Operator, Supervisor).
 10. Access level required to change process control and alarm setpoints, enable/disable alarms.
 11. Logging of events such as: Setpoint changes, alarm enabling and disabling, equipment start/stop, and other operator actions.
 12. Averaging and totalizer functions for analog variables: Time intervals required and applicable variables to be averaged.
 13. Equipment restart delays.

14. Historian configuration (existing) and setup: Establish data to be stored, cyclic vs. delta storage, and deadbands.
 15. Loss of communications/loss of variable.
- E. In advance of the workshop series, in addition to preparing detailed agendas for the workshops, the Contractor shall prepare and submit a list of all controlled variables on the project, their origins, and in which control loop(s) each are used. The workshops should address on a control loop by control loop basis the control system response on loss of variable (either as a result of instrument failure or communications failure). The control strategies in 13300A include selected cases where loss of certain variables are addressed, and the required control system responses in these cases should also be reviewed as part of the workshop.
- F. The workshops shall be attended by, at a minimum, all of the following from the Contractor's organization:
1. The control systems installation supervisor (see Section 13300).
 2. The specific programmers assigned to the project.
 3. A senior member of the Contractor's organization to track actions and cause other members of the Contractor's organization to effect workshop decisions.

3.9 TESTING

A. General

1. Testing, test plans, and test reports shall be provided by the Contractor as specified herein. The Contractor shall perform tests as required to demonstrate that the equipment and systems covered in this Section operate safely and meet the requirements of these Specifications. The Contractor shall provide labor, instruments, and other material to complete the tests.
2. Test plans and test reports shall be submitted as formal submittals and shall meet all applicable requirements of the Article, SUBMITTALS.
3. Tests and test plans shall be in the cause and effect format. The person conducting the test shall initiate an action (cause) and, upon the system's or subsystem's producing the correct result (effect), the specific test requirement will have been satisfied.
4. Tests and test plans shall be integrated across equipment and systems. The Contractor shall coordinate and integrate the documentation and efforts of suppliers and subcontractors to achieve unified tests and test plans.

B. Factory Testing, General

1. Factory testing of programmed systems shall fully test all system functions from the point of external connections (interface terminal strips or other points of connection) to operator monitoring and control devices such as operator interface panels, indicators, statuses, and alarms.
2. System inputs and outputs shall be simulated and monitored using hardware devices; observing only variable statuses internal to the program is not acceptable.
3. The testing requirements herein apply to all programmed systems.
4. Fully integrate the testing specified herein with that called for in Section 13300, INSTRUMENTATION AND CONTROLS. That section, among other things, includes a sample format for test procedures (Attachment E) and the level of detail required for the integrated testing.

C. Unwitnessed Factory Test (UFT)

1. UFT's shall be performed on all programmed systems. The UFT's shall consist of execution of the Factory Demonstration Test (FDT), unwitnessed. Following successful completion of the UFT, submit the following certification:
 "The UFT has been successfully completed on the following systems: (The Contractor shall list here the tested systems.)
 All functions were verified, with the following exceptions: (The Contractor shall list here unresolved failures and functions which were not tested.)
 All of the deficiencies above will be corrected and retested prior to the FDT."
 2. This certification shall be signed by the Contractor and by representatives of all firm(s) contractually responsible for the items tested.
 3. Any functions not successfully completed shall be described in detail in the certification above. Should the exceptions be significant in the Engineer's opinion, retesting and resubmission of the certification will be required prior to execution of the FDT.

D. Factory Demonstration Test (FDT)

1. The Contractor shall prepare and submit a test plan for each FDT.
2. The FDT plan shall demonstrate that each component and system within the pump station and reservoir control systems, including integration with SCADA fully functions and meets the requirements of the Drawings and Specifications. Paragraph-by-paragraph, loop-by-loop testing is required. General approaches to testing are not acceptable--the test plan shall lay out comprehensive testing on an activity-by-activity, point-by-point basis.
3. The test plan shall demonstrate the PLC, OIP, and SCADA programs, and proper operation of hardwired systems. The procedures shall test all PLC OIP and panel components and systems and the SCADA system, including but not limited to the following:
 - a. PLC-related systems
 - Demonstrate proper operation of each PLC module, including each I/O point.
 - Operation with failed power supplies.
 - Operation with failed communications.
 - Demonstrate proper function of OIP
 - Demonstration that all communications devices function properly.
 - Demonstration that all programs function properly over all normal (and abnormal) operating ranges and conditions.
 - b. Hardwired systems
 - Prove out all panel wiring and analog and discrete devices.
 - c. SCADA system
 - Demonstrate that all features for displays, operator inputs, reports, and all other specified functions operate properly.
 - Demonstrate proper communications with the PLCs. Demonstrate that all communications devices function properly.
 - Demonstrate that all programs function properly over all normal (and abnormal) operating ranges and conditions.
 - Failure of a SCADA master and assumption of functions by the remaining machine.
 - Operation with failed communications.
 - Loss of power and orderly restart.
 - Where the actual cables to be used in the field can be factory tested,

demonstrate that interconnecting cabling functions properly.

4. The test plan shall include testing of the interconnected SCADA system, including all of the components specified in this Section.
5. Communications links and components shall be included in the factory testing. Test all interconnected SCADA computers (simulated) and PLC panels in the final configuration, complete.
6. The test plan shall include tag numbers for equipment, instruments, alarms, displays, operator interfaces, etc.; input/output addresses and ranges; display ranges; and setpoints. The test plan shall be self-contained and shall be in sufficient detail to require little or no referencing to Contract Documents and/or other submitted documents during testing. All values, including ranges and setpoints, shall be included in submitted test plans so that the expected cause-and-effect relationship can be verified prior to the FDT. It is acceptable that early submittals of the FDT test plan include blanks for these values; if so, the blanks shall be completed prior to or during the UFT. These values shall be submitted prior to execution of the FDT.
7. The Owner's representative will witness the tests.
8. If any component or subsystem fails the FDT, the Contractor shall correct the problem and shall repeat the test until it is successful.
9. After completion of the FDT, the Contractor shall prepare a test report and shall submit it for review. The listed components and subsystems shall not be shipped until the test has been successfully completed and the test report has been favorably reviewed by the Engineer.
10. Refer to Section 13300, INSTRUMENTATION AND CONTROLS for grouping items to be included in each FDT.

E. Other Testing

1. Programmed systems shall be tested as part of the Operational Readiness Test (ORT) and the Functional Acceptance Test (FAT), specified in Section 13300, INSTRUMENTATION AND CONTROLS.
2. The Contractor shall coordinate testing and documentation requirements for programmed systems among subcontractors, suppliers, and communication service providers, and shall ensure that the parties contractually responsible for programmed systems fully support testing, including participating in the development and execution of integrated test procedures.

3.10 FIELD SUPPORT

- A. Provide the services of experienced, factory-trained service engineers or technicians to assist with installation, checkout, startup, and testing of each installation.
- B. Timing and length of site visits shall be coordinated with the Contractor, but minimum effort shall be 2 man-days on the site. This time does not include training of Owner's personnel.

END OF SECTION

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**FIGURE 1
POINT LISTING (SAMPLE)
SECTION 13350**

TAG NUMBER	ENGLISH DESCRIPTION	RECORD TYPE	SIGNAL LEVEL	ADDRESS	DISCRETE		ANALOG			SETPOINT			COMMENTS
					SET	RESET	FUNCTION	RANGE	UNITS	DESCRIPTION	VALUE	UNITS	
01LSH05	Wetwell Level High	DI	120 volts, 60 Hz	*	HIGH	NORMAL	-	-	-	Mounting Height	9.0	feet	
01LSHH05	Wetwell Level High High	DI	120 volts, 60 Hz	*	HIGH HIGH	(none)	-	-	-	Mounting Height	9.5	feet	
01LAH05	Wetwell Level High Alarm	DO	120 volts, 60 Hz	*	HIGH	NORMAL	-	-	-	-	-	-	See 01LSH05
01LAHH05	Wetwell Level High High Alarm	DO	120 volts, 60 Hz	*	HIGH HIGH	(none)	-	-	-	-	-	-	See 01LSHH05 and 01L1T05
01LIT05	Wetwell Level	AI	4-20 mA	*	-	-	Level	1-11	feet	-	-	-	Used for proportional- only pump control.
01LIT05	(As above)	-	-	*	-	-	-	-	-	Low Alarm	1.5	feet	
01LIT05	(As above)	-	-	*	-	-	-	-	-	High High Alarm	9.5	feet	Redundant with 01LSHH05
01LIR05	Wetwell Level Indicator/ Recorder	AO	4-20 mA	*	-	-	Level	0-10	feet	-	-	-	Note that output calibration differs from input
-	Pump 1 Runtime	IV**	-	*	-	-	Runtime	0- 100,000	hours	-	-	-	

* Address entries shall use formatting consistent with manufacturer's standard.

**IV = Internal Variable

SECTION 15010
PIPING SUPPORT SYSTEMS

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Shop Drawings:
 - 1. Details of each pipe support type used.

PART 2 - PRODUCTS

2.1 SUPPORT SYSTEMS:

- A. Channel-type support systems
 - 1. 304 Stainless Steel
 - a. Unistrut
 - b. B-Line
 - c. Or Equal.
 - 2. Non-metallic
 - a. Aikenstrut
 - b. CLIC
 - c. Or Equal.
- B. Hanger- and Clevis-type support systems
 - 1. B-line
 - 2. Anvil
 - 3. Or Equal
- C. Stanchion-type support systems
 - 1. B-Line
 - 2. Anvil
 - 3. Or Equal
- D. Adjustable Pipe Saddle Support
 - 1. B-Line, Figure B-3092
 - 2. Or Equal
- E. Wall Bracket (14-inch to 24-inch pipe)
 - 1. B-Line Figure B-3067 Heavy Duty Angle Bracket
 - 2. Or Equal
- F. Wall Bracket (8-inch to 12-inch pipe)
 - 1. B-Line Figure B-3066 Medium Duty Angle Bracket
 - 2. Or Equal
- G. Wall Bracket (4-inch to 6-inch pipe)
 - 1. B-Line Figure B-3068 Light Duty Angle Bracket
 - 2. Or Equal

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PART 3 - EXECUTION

3.1 INSTALLATION

- A. In addition to the pipe supports specifically called for on the drawings, CONTRACTOR shall provide pipe supports as required to fully support all piping systems.
- B. CONTRACTOR shall design, supply and install pipe support system using manufacturer's standard available pipe support hardware.
- C. Pipe supports shall, at a minimum, be installed at the following locations:
 - 1. On both sides of each valve, piece of equipment or other appurtenance, such that allowance is made for removal of the valve, piece of equipment, or other appurtenance while leaving the pipe system fully supported. Support piping connections to equipment by pipe support and not by the equipment.
 - 2. Along straight runs of pipe, the maximum distance between supports shall be as listed below:

Pipe Diameter	Maximum Distance Between Supports	Minimum Hanger Rod Diameter (if Hanger Rods are used)
2" and smaller	6-feet	1/2"
2-1/2" to 6"	8-feet	3/4"
8" to 12"	10-feet	2 @ 3/4"
14" to 18"	10-feet	2 @ 1"
Over 18"	Custom Design	

- 3. Directly supporting valves 8-inch in diameter and larger.
 - 4. At least two supports on each side of flexible couplings or flanged coupling adapters to provide that no load is applied to the flexible coupling.
 - 5. On the pipe within two pipe diameters of each side of elbows and each branch of tees and crosses.
 - 6. Where piping passes through walls, such that no load is transferred to the wall.
- D. Install support systems in accordance with MSS SP 69, Pipe Hangers and Supports-Selection and Application and MSS SP 89, Pipe Hangers and Supports-Fabrication and Installation, unless shown otherwise.
 - 1. Support no pipe from the pipe above it.
 - 2. Do not install pipe supports and hangers in equipment access areas or bridge crane runs.
- E. Bracing and lateral support:
 - 1. Provide lateral sway bracing on 10-foot maximum centers
 - a. Brace hanging pipes against horizontal movement by both longitudinal and lateral sway bracing.
 - 2. Install lateral supports for seismic loads at all changes in direction.
- F. Thermal expansion and thrust restraint
 - 1. Install pipe anchors where required to withstand expansion thrust loads and to direct and control thermal expansion.
- G. Support types:
 - 1. Horizontal Suspended Piping:
 - a. Single Pipes: Adjustable swivel-ring, splint-ring or clevis hangers.

- b. Grouped Pipes: Trapeze hanger systems.
 - c. For insulated piping, furnish galvanized steel protection shields, welding insulation saddles, or precut sections of rigid insulation (with vapor barrier) at all hanger locations.
 - 2. Horizontal Piping Supported From Walls:
 - a. Single Pipes: Wall brackets or wall clips attached to wall with anchors. Clips attached to wall-mounted framing also acceptable.
 - b. Stacked Piping:
 - 1) Wall-mounted framing system and clips acceptable for piping smaller than 3-inch minimal diameter.
 - 2) Piping clamps that resist axial movement of pipe through support not acceptable.
 - c. Insulated piping shall have the insulation removed in the vicinity of wall brackets and piping clips to allow only direct pipe wall contact with the support system.
 - 3. Horizontal Piping Supported From Floors:
 - a. Stanchion Type:
 - 1) Pedestal type; adjustable with stanchion, saddle, and anchoring flange.
 - 2) Use yoked saddles for piping whose centerline elevation is 18 inches or greater above the floor and for all exterior installations.
 - 3) Provide neoprene waffle isolation pad under anchoring flanges, adjacent to equipment or where otherwise required to provide vibration isolation.
 - b. Floor-Mounted Channel Supports:
 - 1) Use for piping smaller than 3-inch nominal diameter running along floors and in trenches at piping elevations lower than can be accommodated using pedestal pipe supports.
 - 2) Attach channel framing to floors with anchor bolts.
 - 3) Attach pipe to channel with clips or pipe clamps.
 - c. Concrete Cradles:
 - 1) Use for piping larger than 3-inch along floor and in trenches at piping elevations lower than can be accommodated using stanchion type.
 - 4. Vertical Pipe:
 - a. Support with wall brackets and base elbow or riser clamps on floor penetrations.
 - b. Insulated piping shall have the insulation removed in the vicinity of wall brackets and riser clamps, to allow only direct wall contact with the support system.
- H. Standard Attachments:
- 1. To Concrete Ceilings: Concrete inserts.
 - 2. To Steel Beams: I-beam clamp or welded attachments.
 - 3. To Wooden Beams: Lag screws and angle clips to members not less than 2-1/2 inches thick.
 - 4. To Concrete Walls: Concrete inserts or brackets or clip angles with anchor bolts.
 - 5. Existing Walls and Ceilings: Install as specified for new construction, unless shown otherwise.
 - 6. Repair mounting surfaces to original condition after attachments are made.
- I. Isolation:
- 1. Install elastomeric inserts designed to isolate piping from pipe supports where copper pipe is run in stainless steel supports, or where other dissimilar metals are in contact with pipe supports.
- J. Materials:

1. Channel-type, hanger-type and trapeze-type support systems and pipe racks constructed of channel systems:
 - a. Provide non-metallic support systems in all chemical storage and feed areas. Provide type 316 stainless steel fasteners.
 - b. Provide type 304 stainless steel support systems and fasteners in all other areas.
2. Stanchion-type support systems
 - a. Provide steel and ductile iron stanchion components
 - b. Coat stanchions after assembly per specification Section 09900, Painting.

+ + END OF SECTION + +

SECTION 15100
PIPE AND FITTINGS

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Shop Drawings:
 - 1. Product data sheets for each piping system.
 - a. Include information on pipe, fittings and joint systems.
 - 2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
 - 3. Complete descriptions and data for all coatings and linings.
 - 4. Tests and inspection data for pipe and coatings/linings.
 - 5. Qualifications for welders and/or technicians performing joining processes that requires specialized equipment to perform the work or as specifically identified herein.
- B. Operation and Maintenance Data as specified in Section 01330, SUBMITTAL PROCEDURES.

1.2 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. In accordance with manufacturer's directions.

PART 2 - PRODUCTS

2.1 PIPING SYSTEM DATA SHEETS

- A. Piping system data sheets (PSDS) have been attached to this Specification and are incorporated herein by reference. Provide piping systems in accordance with piping system data sheets.

2.2 THRUST RESTRAINT

- A. Provide rigid or restrained joints and fittings for all piping systems specified with a test pressure in the Pipe Schedule.
- B. Unless otherwise specified in the Pipe Schedule or shown on the Drawings, and without written approval from the Engineer thrust blocks shall not be used.

PART 3 - EXECUTION

3.1 PIPE SCHEDULE

- A. A Pipe Schedule has been attached to this Specification and is incorporated herein by reference. Install piping systems in accordance with Pipe Schedule.

- B. For pipe which is shown on the Drawings, but not referenced in the Pipe Schedule, CONTRACTOR to provide pipe material and fittings which are appropriate for the intended service and acceptable to the ENGINEER.

3.2 PREPARATION

- A. Inspect pipe and fittings before installation, clean ends thoroughly, and remove foreign matter and dirt from inside.
- B. Repair any coatings or linings which were damaged during shipping and handling using manufacturer-approved coating and lining repair materials in accordance with manufacturer's instructions.

3.3 INSTALLATION

- A. General:
 - 1. Join pipe and fittings in accordance with manufacturer's instructions, unless otherwise shown or specified.
- B. Joint Assembly:
 - 1. Flanged Joints (FLG):
 - a. Bolt Holes: Straddle vertical centerlines, aligned with connecting equipment flanges or as shown.
 - b. Follow a bolt tightening pattern which produces uniform bearing pressure.
 - c. Do not over-tighten bolts. Follow manufacturer's recommendation for bolt torque.
 - d. Provide gasket at every flanged joint.
 - e. Provide insulating flange kit where indicated on Drawings and required in this Specification.
 - 2. Threaded and Coupled Joints (THR):
 - a. Conform to ANSI B1.20.1.
 - b. Produce sufficient thread length to ensure full engagement when screwed home in fittings.
 - c. Ream pipe ends and clean chips and burrs after threading.
 - d. Make connections with not more than three threads exposed.
 - e. Lubricate male threads only with thread lubricant or tape as specified on Piping Data Sheets.
 - f. PVC Threaded Joints:
 - 1) Provide Schedule 80 threaded nipple where necessary to connect to threaded valve or fitting.
 - 2) Use strap wrench for tightening threaded plastic joints. Do not overtighten fittings.
 - g. Provide dielectric union or insulating coupling where indicated on Drawings and required in this Specification.
 - 3. Grooved-End Joints (GRV):
 - a. Type: Rigid, except where joints are used to correct misalignment, to provide flexibility, and where shown otherwise, in which case provide flexible type.
 - b. Grooved end joints are not allowed for plastic pipes unless approved by the ENGINEER.
 - 4. Soldered Joints (SLD):
 - a. Before soldering, remove stems and washers from solder joint valves.
 - b. Use only solder specified for particular service.
 - c. Cut pipe ends square and remove fins and burrs.

- d. Protect adjacent surfaces from damage during soldering.
 - 1) Protect from high temperatures due to flame
 - 2) Protect from damage due to dripping flux or solder
- e. After thoroughly cleaning pipe and fitting of oil and grease using solvent and emery cloth, apply noncorrosive flux to the male end only.
- f. Solder Joint
- g. Wipe excess solder from exterior of joint before hardened.
- 5. Solvent Welded Joints (SLV):
 - a. Use only solvent cement which is rated for use in the service intended. Check compatibility of solvent cement with service, especially in pipelines which carry chemicals.
 - b. Observe all manufacturer's requirements for environmental conditions for use of solvent cement.
 - c. Cut pipe ends square and remove fins and burrs.
 - d. Apply appropriate primer.
 - e. Apply solvent cement and assemble joint.
 - 1) Hold in place long enough for solvent cement to set-up and hold joint, as assembled, until solvent cement has cured.
 - f. Wipe excess solvent cement from exterior of joint before hardened.
- 6. Proprietary Restrained Mechanical Joints (PRJ):
 - a. PRJ piping shall be furnished with factory-fabricated retainer weldment on spigot end.
 - b. If PRJ piping is field cut, the pipe joint shall be restrained using Restrained Mechanical Joint (RMJ) Glands as specified in Section 15120, Piping Specialties. Field welding of retainer weldment will not be allowed.
- 7. Welded Steel and Stainless Steel Joints (WLD)
 - a. Field welded joints shall be in accordance with AWWA C206
 - b. Welder Qualifications:
 - 1) All welding shall be done by skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used.
 - 2) Welders shall be qualified by the CONTRACTOR under the provisions of ASME BPVC for shop welds and ANSI/AWS D1.1 for field welds.
 - 3) Furnish all material and bear the expense of qualifying welders.
 - c. Backing rings will not be permitted for 30-inch and smaller pipe. Single field-welded butt joints with outside backing rings may be used for pipe larger than 30 inches in diameter.
 - d. Where exterior welds are performed, adequate space shall be provided for welding and inspection of the joints.
 - e. Butt Straps
 - 1) Butt straps shall be used as closure pieces and where shown on the Drawings.
 - 2) Where used or required, shall be as shown on the Contract Drawings or as approved during shop drawing review.
 - 3) When fitting up the ends of pipe to be welded or fitting butt-strap pieces, minor jacking or clamping will be allowed. Cold working the metal and sledges or localized application of heat and working the metal and sledges will not be allowed. If field displacement of joints, where butt strap joints are indicated, does not allow proper fit-up with the tolerances indicated, special closure butt straps or mitered pieces shall be shop fabricated and installed.
 - 4) Butt straps shall be welded on both the inside and outside of the pipe and at each end of the pipe and strap to avoid stress multiplication.
 - f. Prior to the backfilling or beginning the welding procedure, any tack welds or joint stops used to position the pipe during laying shall be removed. Any annular space

between the faying surfaces of the bell and spigot shall be equally distributed around the circumference of the joint by shimming, jacking, or other suitable means. The weld shall then be made in accordance with ANSI/AWWA C206. Where more than one pass is required, all dirt, slag, and flux shall be removed before the succeeding bead is applied.

- g. Repair of Welds: All welds that are defective shall be repaired by the CONTRACTOR to meet the requirements of this section at no additional cost to the OWNER. Defects in welds or defective welds shall be removed, and that section of the joint shall then be re-welded. Only sufficient removal of defective material that is necessary to correct the defect is required. After the repair is made, the joint shall be checked by repeating the original test procedure. Welds deficient in size shall be repaired by adding weld metal.
- 8. Insulating Flanges, Couplings, and Dielectric Unions:
 - a. Applications: Provide insulating flange, coupling or di-electric union for all joints at the following locations:
 - 1) Dissimilar metal piping connections.
 - 2) Cathodically protected piping penetration to buildings.
 - 3) Submerged to unsubmerged metallic piping connections.
 - 4) Where required for electrically insulated connection.
 - b. Installation:
 - 1) Insulating joints connecting immersed piping to non-immersed piping shall be installed above maximum water surface elevation.
 - 2) Align and install insulating joints according to manufacturer's recommendations to avoid damaging insulating materials.

C. Exposed Piping Installation:

- 1. Piping Runs:
 - a. Parallel to building or column lines and perpendicular to floor, unless shown otherwise.
 - b. Piping upstream and downstream of flow measuring devices shall provide straight lengths as required for accurate flow measurement.
- 2. Supports: As specified in Section 15010, PIPING SUPPORT SYSTEMS.
- 3. Group piping wherever practical at common elevations; install to conserve building space and not interfere with use of space and other work.
- 4. Provide unions or flanges at each piping connection to equipment or instrumentation on equipment side of each block valve to facilitate installation and removal.
- 5. Install piping so that no load or movement in excess of that stipulated by equipment manufacturer will be imposed upon equipment connection;
- 6. Install piping to allow for contraction and expansion without stressing pipe, joints, or connected equipment.
- 7. Piping clearance, unless otherwise shown:
 - a. Over Walkway and Stairs: Minimum of 7 feet 6 inches, measured from walking surface or stair tread to lowest extremity of piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.
 - b. Between Equipment or Equipment Piping and Adjacent Piping: Minimum 3 feet 0 inch, measured from equipment extremity and extremity of piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.
 - c. From Adjacent Work: Minimum 1 inch from nearest extremity of completed piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.

- d. Do not route piping in front of or to interfere with access ways, ladders, stairs, platforms, walkways, openings, doors, or windows.
- e. Headroom in front of openings, doors, and windows shall not be less than the top of the opening.
- f. Do not install piping containing liquids or liquid vapors in transformer vaults or electrical equipment rooms.
- g. Do not route piping over, around, in front of, in back of, or below electrical equipment including controls, panels, switches, terminals, boxes, or other similar electrical work.

D. Buried Pipe Installation:

1. Pipe Placement:

- a. Keep trench dry until pipe laying and joining are completed.
- b. Exercise care when lowering pipe into trench to prevent twisting or damage to pipe.
- c. Prevent foreign material from entering pipe during placement.
 - 1) Close and block open end of last laid pipe section when placement operations are not in progress and at close of day's work.
- d. Lay pipe upgrade with bell ends pointing in direction of laying.
- e. Deflect pipe at joints for pipelines laid on a curve using unsymmetrical closure of spigot into bell. Utilize a maximum of 75 percent of manufacturer's recommended allowable joint deflection.
 - 1) If joint deflection of standard pipe lengths will not accommodate horizontal or vertical curves in alignment, provide:
 - a) Shorter pipe lengths.
 - b) Fittings/bends.
- f. Secure pipe which has been placed from movement or damage while placing the next section of pipe.
- g. Prevent uplift and floating of pipe prior to backfilling.

E. Cleaning:

- 1. Following assembly and testing, and prior to disinfection and final acceptance, flush pipelines with water at 2.5 fps minimum flushing velocity until foreign matter is removed. At a minimum, flush for a period of time which will flush the entire pipeline volume three times.
 - a. If impractical to flush large diameter pipe at 2.5 fps, clean in-place from inside by brushing and sweeping, then flush line at lower velocity. If lower velocity is used, flush the entire pipeline volume five times.
- 2. Provide temporary means of removing flushing water from pipeline during flushing.
- 3. Provide means for removal/screening of debris from the flushing water, disposal of debris and disposal of flushing water.

3.4 TESTING

- A. Pressure test piping in accordance with the Pipe Schedule, and Section 15990, Pressure Testing of Piping Systems.

3.5 SUPPLEMENTS

- A. The following supplements are attached to this Specification section and incorporated herein by reference:
 - 1. 15100 PS – Pipe Schedule

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2. 15100 PSDS COP – Copper Pipe
3. 15100 PSDS DIP – Ductile Iron Pipe
4. 15100 PSDS PVC2 – PVC Pressure Pipe
5. 15100 PSDS PVC3 – Polyvinyl Chloride Drain, Waste and Vent Pipe
6. 15100 PSDS PVC6 – PVC Storm Drain Pipe
7. 15100 PSDS WSP – Welded Steel Pipe
8. 15100 PSDS WSSTP – Welded Stainless Steel Pipe

+ + END OF SECTION + +

15100-6

SECTION 15100 PS

PIPE SCHEDULE

1.1 DESCRIPTION

A. General:

1. This schedule is provided for the convenience of the CONTRACTOR. Some flow streams may be shown on the drawings, but not listed here.

B. Flow Stream IDs:

1. DR – Drain
2. FW – Finished Water
3. W1 – Potable Water
4. ZATM – Zone A Transmission Main

C. Pipe Materials:

1. COP – Copper Pipe
2. DIP – Ductile Iron Pipe
3. PVC2 – PVC Pressure Pipe
4. PVC3 – Polyvinyl Chloride Drain, Waste, and Vent Pipe
5. PVC6 –PVC Storm Drain Pipe
6. WSP – Welded Steel Pipe
7. WSST – Welded Stainless Steel Pipe

D. Joint Types:

1. FLG – Flanged
2. GRV – Grooved End
3. MJ – Mechanical Joint
4. PO – Push On
5. PRJ – Proprietary Restrained Mechanical Joint
6. RMJ – Restrained Mechanical Joint
7. S – Swagelok stainless steel compression type
8. SLV – Solvent Welded Socket
9. SLD – Soldered Socket
10. THR – Threaded
11. WLD – Butt Welded

E. Lining Systems:

1. CM – Cement Mortar

F. Coating Systems: As described in Section 09900

1.2 PIPE SCHEDULE

A. Contractor shall install piping systems in accordance with the following pipe schedule:

FLOW STREAM I.D.	DESCRIPTION	SERVICE	EXPOSURE	SIZE RANGE	MATERIAL	JOINT TYPE	TEST PRESSURE	LINING	COATING SYSTEM/ COLOR	NOTES
DR	Drain	Water	Buried	4"	PVC3	SLV	None	None	None	None
FW	Finished Water	Water	Buried	>3"	DIP/PVC2	RMJ	165 psi	CM (DIP) /None (PVC)	Asphaltic + Poly Wrap (DIP) /Blue (PVC)	Class 250 (DIP) / DR 25 (PVC)
			Exposed	Note 1	WSP	WLD	165 psi	Fusion Bonded Epoxy	300/Blue	NSF 61
			Exposed	Note 1	DIP	FLG	165 psi	CM	300/Blue	Class 250
			Submerged	All	WSSTP	WLD	None	None	None	None
			Buried and Exposed	3" and smaller	COP	SLD	None	None	None	Lead Free
W1	Potable Water	Water	Exposed	6"	DIP	FLG	165 psi	CM	300/Blue	Class 250
			Buried	6"	DIP/PVC2	RMJ	165 psi	CM (DIP) /None (PVC)	Asphaltic + Poly Wrap (DIP) /Blue (PVC)	Class 250 (DIP) / DR 25 (PVC)
ZATM	Potable Water	Water	Buried	All	PVC2	RMJ	165 psi	None	Blue	DR 25 Note 2

Note 1: Supply pipe material as indicated on drawings.

Note 2: OWNER-Furnished Equipment

SECTION 15100 PSDS COP

PIPING SYSTEM DATA SHEET – COPPER PIPE

ITEM	DESCRIPTION
Tubing	Seamless, conforming to ASTM B88 as follows: Potable water (buried)Type K, soft or hard temper Potable water (exposed)Type L, hard drawn Compressed air serviceType L, hard drawn P-Trap priming serviceType L, soft temper
Fittings	Commercially pure wrought copper, socket joint, conforming to ASTM B75, dimensions conforming to ANSI B16.22.
Flanges	Commercially pure wrought copper, socket joint, conforming to ASTM B75, faced and drilled 150-pound ANSI B16.24 standard.
Bolting	ASTM A307, carbon steel, Grade A hex head bolts, and ASTM A563 Grade A hex head nuts.
Gaskets	1/16-inch thick nonasbestos compression type, full face, Cranite, John Manville.
Solder	Joints 2-1/2 Inch and Smaller: Wire solder (95 percent tin), conforming to ASTM B32 Alloy Grade Sn95. Do not use cored solder. Joints Larger Than 2-1/2 Inch: Wire solder, melt range approximately 440 degrees F to 660 degrees F, conforming to ASTM B32 Alloy Grade HB or HN. Do not use cored solder.

15100 PSDS COP-1

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SECTION 15100 PSDS DIP

PIPING SYSTEM DATA SHEET – DUCTILE IRON PIPE

ITEM	DESCRIPTION
Pipe	<p>Buried Piping: Pressure class as indicated in the pipe schedule. If not indicated:</p> <ul style="list-style-type: none"> • All pipe 12" diameter and smaller shall be pressure class 350. • All pipe 14" through 20" shall be pressure class 250. • All pipe larger than 24" shall be pressure class 200. <p>Flanged Piping: Special Thickness Class 53 Pressure class shall be per AWWA C150/A21.50 and AWWA C151/A21.51</p>
Lining	Water: Cement-Mortar: AWWA C104/A21.4.
Coating	<p>Unless otherwise specified in the Pipe Schedule, piping shall be coated as follows:</p> <p>Buried Piping:</p> <ul style="list-style-type: none"> • AWWA C151/A21.51: Minimum 1-mil asphaltic coating; and • AWWA C105/A21.5: Polyethylene encasement, 4-mil high-density cross laminated or 8-mil linear-low density, color as required by local/state regulations. <p>Exposed/Immersed Piping:</p> <ul style="list-style-type: none"> • Primer Coating: Where shop primer is applied to protect pipe during shipping, storage and handling, primer shall be compatible with pipe coating requirements of Section 09900, Painting.
Fittings	<p>Lined and coated same as pipe.</p> <p>Push-On (PO): AWWA C110/A21.10 and C111/A21.11, gray or ductile iron, 250 psi minimum working pressure. American Cast Iron Pipe Co., Fastite Joint; U.S. Pipe and Foundry, Tyton Joint.</p> <p>Mechanical (MJ): AWWA C110/A21.10, C111/A21.11, and C153/A21.53 gray or ductile iron, 250 psi minimum working pressure. Follower glands shall be ductile iron.</p> <p>Restrained Mechanical Joint (RMJ): Standard MJ Fittings with RMJ Gland conforming to requirements of Section 15120, PIPING SPECIALTIES.</p> <p>Proprietary Restrained (PRJ): AWWA C111/A21.11 and C153/A21.53, ductile iron, 250 psi minimum working pressure. Clow Corp., Super-Lock Joint; American Cast Iron Pipe Co., Flex-Ring or Lok-Ring Joint; U.S. Pipe, TR Flex.</p> <p>Grooved End (GRV): AWWA C606 and C110/A21.10, ductile iron, 250 psi minimum working pressure. Victaulic.</p> <p>Flange (FLG): AWWA C110/A21.10 ductile iron, faced and drilled, 125-pound flat face. Gray cast iron will not be allowed.</p>
Joints	Push-On (PO): 250 psi minimum working pressure, AWWA C110/A21.10 and C111/A21.11. American Cast Iron Pipe Co.,

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ITEM	DESCRIPTION
	<p>Fastite Joint; U.S. Pipe and Foundry, Tyton Joint.</p> <p>Mechanical (MJ): 250 psi minimum working pressure.</p> <p>Restrained Mechanical Joint (RMJ): Standard MJ Joint with RMJ gland conforming to requirements of Section 15120, PIPING SPECIALTIES.</p> <p>Proprietary Restrained (PRJ): 150 psi minimum working pressure. Clow Corp., Super-Lock; American Cast Iron Pipe Co., Flex-Ring or Lok-Ring; U.S. Pipe, TR Flex.</p> <p>Grooved End (GRV): Rigid type radius cut conforming to AWWA C606, 250 psi minimum working pressure. Victaulic.</p> <p>Flange (FLG): 125-pound flat face, ductile iron, threaded conforming to AWWA C115/A21.15. Gray cast iron will not be allowed.</p> <p>Branch connections 3 inches and smaller, shall be made with service saddles, unless otherwise noted, as specified in Section 15120, PIPING SPECIALTIES.</p>
Couplings	<p>Grooved End: 250 psi minimum working pressure, malleable iron per ASTM A47 or ductile iron per ASTM A536. Victaulic.</p> <p>Grooved End Adapter Flanges: 250 psi minimum working pressure, malleable iron per ASTM A47 or ductile iron per ASTM A536. Victaulic.</p>
Bolting	<p>T-Bolts and other specialty bolts: Manufacturer's standard.</p> <p>Hex Bolts: ASTM A307, Grade B carbon steel hex head bolts</p> <p>Nuts: ASTM A563, Grade A carbon steel hex head nuts.</p>
Gaskets	<p>Push-On, Mechanical, and Proprietary Restrained Joints: Red Rubber (SBR) conforming to ANSI/AWWA C111/A21.11.</p> <p>Grooved End Joints: Halogenated butyl conforming to ASTM D2000 and AWWA C606.</p>
Joint Lubricant	Manufacturer's standard.

SECTION 15100 PSDS PVC2

PIPING SYSTEM DATA SHEET – POLYVINYL CHLORIDE PRESSURE PIPE

ITEM	DESCRIPTION
Pipe	Conform to the requirements of AWWA C900-16 (4-inch to 60-inch) for PVC water transmission pipe, pressure class as shown in pipe schedule. If no pressure class is shown in pipe schedule, provide pressure class adequate to accommodate test pressure shown in pipe schedule. JMEagle products may not be provided.
Fittings	Ductile Iron per 15100 PSDS DIP – Ductile Iron Pipe. Transition fittings necessary for the proper connection shall be the standard of, and provided by, the manufacturer of the fittings.
Joints	Rubber-gasketed bell and spigot or rubber-gasketed couplings. No restrained joint PVC piping shall be allowed. In sections where joint restraint is required, transition piping to Ductile Iron Pipe with restrained joint fittings or as shown on the drawings.
Gaskets	Conforming to the requirements of ASTM F477.
Joint Lubricant	Manufacturer's standard.

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SECTION 15100 PSDS PVC3

PIPING SYSTEM DATA SHEET – POLYVINYL CHLORIDE DRAIN, WASTE AND VENT PIPE

ITEM	DESCRIPTION
Pipe	PVC Drain Waste and Vent type, ASTM D1785, Type 2110, Schedule 40. JMEagle products may not be provided.
Fittings	Schedule to match pipe above, ASTM D2665 Drain, Waste and Vent Type
Joints	Solvent socket weld except where connection to threaded valves and equipment may require future disassembly.
Solvent Cement	As recommended by the pipe and fitting manufacturer conforming to ASTM D2564.
Thread Sealant	Teflon Tape.
Special Installation Instructions for DWV Piping	<ol style="list-style-type: none">1. Approximate routing as shown on drawings. Provide drain waste and vent piping to produce a complete, code-compliant drain, waste and vent system.2. Provide and install all required fittings, adapters, etc. to produce a complete system.3. Set piping above floor slab true and plumb.4. Set risers in CMU walls where possible, set exposed risers as close to walls as possible.5. Where vent stacks pass through roof, fit with flashing sleeve secured to roof.6. Extend vents minimum 1 foot above roof.

15100 PSDS PVC3-1

15100 PSDS PVC3-2

SECTION 15100 PSDS WSP

PIPING SYSTEM DATA SHEET – WELDED STEEL PIPE

ITEM	DESCRIPTION
Pipe	Carbon steel ASTM A283/A283M Rev A Grade C or ASTM A285/A285M Grade C, sheet or coil, fabricated in accordance with AWWA C200, straight or spiral seam, thickness designed for 66 percent of minimum yield stress at hydrostatic test pressure, minimum thickness 1/4-inch, sizes are to be nominal outside diameters conforming to ASME B36.10M.
Linings/Coatings	Factory Applied Lining and Coating: Fusion Bonded Epoxy per AWWA C-213, 16 mil thickness, NSF-61 certified. 3M Scotchkote 206N, or equal.
Joints	Full penetration butt-welded, flanged, rolled grooved end where shown and/or required.
Fittings	<p>All fittings 6" and smaller shall be forged. Fittings 8" to 24 inches may be forged or fabricated, unless shown otherwise on the Drawings.</p> <p>Fabricated: Carbon steel fabricated from pipe in accordance with AWWA C208; elbows to have a 22.5-degree maximum miter section angle and a radius of 2.5 times the diameter, unless shown otherwise; wyes, tees, crosses, and outlets to be reinforced in accordance with AWWA M-11.</p> <p>Forged: Butt-welding fittings, ASTM A234/A234M, Grade WPB meeting the requirements of ANSI B16.9. Fitting wall thickness to match adjoining pipe. Elbows to be long radius unless shown otherwise.</p>
Flanges	AWWA C207, Class D (150 psi), Class E (250 psi), or Class F (275 psi) hub or ring type. Pressure class to match pipe.
Bolting	<p>Carbon steel ASTM A307, Grade A hex head bolts and ASTM A563, Grade A hex head nuts.</p> <p>Bolts for rolled grooved ends shall be manufacturer's standard.</p>

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ITEM	DESCRIPTION
Gaskets	<p><u>Potable Water and Sewage Service:</u> 1/8-inch thick, cloth-inserted rubber, corrosive acid and alkali free conforming to ANSI B16.21 and AWWA C207.</p> <p><u>Digester Gas Service:</u> Microcellular Teflon outer layers with rigid center layer. Sealability in accordance with ASTM F37 less than 0.55 mm per hour leakage of iso-octane at 1000 psi gasket load and 9.8 psi fluid pressure. Garlock Style 3545 or equal.</p> <p>Provide full-face gaskets for flat-face flanges; flat ring gaskets for raised-face flanges.</p> <p>Gaskets for rolled grooved ends shall be as recommended by manufacturer for sewage service.</p>

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SECTION 15100 PSDS WSSTP

PIPING SYSTEM DATA SHEET – WELDED STAINLESS STEEL PIPE

ITEM	DESCRIPTION
Pipe	ANSI/AWWA C220, Standard for Stainless Steel Pipe, 1/2-inch diameter and larger, latest revision. Pressure class to accommodate test pressure listed in Pipe Schedule. Type as indicated in the Piping Schedule. Minimum Schedule 10.
Linings/Coatings	None
Joints	Full penetration butt-welded, flanged, rolled grooved end, or threaded where shown and/or required.
Fittings	Fabricated: Type 304 stainless steel fabricated in accordance with AWWA C208; elbows to have a 22.5-degree maximum miter section angle, minimum of three sections; wyes, tees, crosses, and outlets to be reinforced in accordance with AWWA M-11. Forged: Butt-welding fittings, ASTM A403M, type 304 stainless steel. Fitting wall thickness to match adjoining pipe. Threaded: Piping 4" and less, threaded per ANSI B1.20.1, pressure class to accommodate test pressure, stainless grade to match pipe grade (ASTM A351 CF8 for grade 304 pipe and CF8M for grade 316 pipe).
Flanges	AWWA C207, Class D (150 psi), Class E (250 psi), or Class F (275 psi) hub or ring type. Type 304 stainless steel, pressure class to match pipe.
Bolting	Hex Bolts: ASTM A320/A320M, Type 304 stainless steel, grade 5 Nuts: ASTM F594, Type 304 stainless steel, grade 5
Gaskets	1/8-inch thick, cloth-inserted rubber, corrosive acid and alkali free for intended service conforming to ANSI B16.21 and AWWA C207; full-face gaskets for flat-face flanges; flat ring gaskets for raised-face flanges. Gaskets for rolled grooved ends shall be as recommended by manufacturer for intended service.
Thread Lubricant	Nonseizing, industrial grade thread sealing compound that is insoluble in water

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15100 PSDS WSSTP -2

SECTION 15120
PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Shop Drawings:
 - 1. Manufacturer's data on materials, construction, end connections, ratings, overall lengths, etc.

PART 2 - PRODUCTS

2.1 SERVICE SADDLES

- A. Double-Strap Iron:
 - 1. Pressure Rating: Capable of withstanding 150 psi internal pressure without leakage or over stressing.
 - 2. Run Diameter: Compatible with outside diameter of pipe on which saddle is installed.
 - 3. Taps: Iron pipe threads.
 - 4. Materials:
 - a. Body: Malleable or ductile iron.
 - b. Straps: Stainless steel.
 - c. Hex Nuts and Washers: Stainless Steel.
 - d. Seal: Rubber.
 - 5. Manufacturers and Products:
 - a. Romac 202S
 - b. Or Equal

2.2 FLEXIBLE COUPLINGS

- A. Flexible Couplings (FC)
 - 1. Features:
 - a. Description: Sleeve-type flexible couplings
 - b. Pressure and Service: Same as connected piping.
 - c. Sleeve material: Carbon steel for carbon steel and ductile iron piping systems, or stainless steel for stainless steel piping systems.
 - d. Coating and Lining: All cast and carbon steel components shall be epoxy lined and coated, minimum 16 mils thickness. For potable water service, lining shall be NSF-61 certified.
 - e. Gasket: EPDM
 - f. Bolts and Nuts: Alloy steel, corrosion-resistant, prime coated. Buried couplings shall have Type 316 stainless steel bolts and nuts.
 - 2. Manufacturers and Products:
 - a. Ductile Iron Pipe:
 - 1) Dresser Piping Specialties; Style 153.
 - 2) Smith-Blair, Inc.; Style 411.
 - 3) Or Equal.

B. Flanged Coupling Adapters (FCA)

1. Features:
 - a. Description: One end of adapter shall be flanged and the other end shall have a sleeve type flexible coupling.
 - b. Pressure and Service: Same as connected piping.
 - c. Adapter body material: Cast iron or steel.
 - d. Gasket: EPDM
 - e. Bolts and Nuts: Alloy steel, corrosion-resistant, prime coated. Buried couplings shall have Type 316 stainless steel bolts and nuts.
2. Manufacturers and Products:
 - a. Ductile Iron Pipe:
 - 1) Dresser Piping Specialties; Style 227.
 - 2) Smith-Blair, Inc.; Style 127.
 - 3) Or Equal.

C. Restrained Flanged Coupling Adapters (RFCA)

1. Features:
 - a. Description: One end of adapter shall be flanged and the other end shall have a sleeve type flexible coupling.
 - b. Pressure and Service: Same as connected piping.
 - c. Adapter body material: Cast iron or steel.
 - d. Gasket: EPDM
 - e. Bolts and Nuts: Alloy steel, corrosion-resistant, prime coated. Buried couplings shall have Type 316 stainless steel bolts and nuts.
 - f. Restraining lug.
2. Manufacturers and Products:
 - a. Ductile Iron Pipe:
 - 1) Type 1: Romac Industries; RFCA
 - 2) Type 2 (short lay length): EBAA; Series 2100 Megaflange
 - 3) Or Equal.

D. Restraint Rods for Flexible Couplings: As shown on the Drawings

2.3 RESTRAINED COUPLINGS

A. Restrained Mechanical Joint Glands (RMJ)

1. Pressure Rating:
 - a. Minimum Working Pressure Rating: Not less than 150 psi.
 - b. Safety Factor: Not less than two times working pressure and shall be supported by manufacturer's proof testing.
2. RMJ gland shall be designed for use with standard mechanical joint pipe. Pipe restraint products designed for use with push-on joints will not be acceptable.
3. Thrust Restraint:
 - a. Provide hardened steel wedges that bear against and engage outer pipe surface, and allow articulation of pipe joint after assembly while wedges remain in their original setting position on pipe surface.
 - b. Products employing set screws that bear directly on pipe will not be acceptable.
4. Manufacturer and Product:
 - a. Ductile Iron Pipe Only
 - 1) EBAA Iron Sales Co.; Megalug.
 - 2) Romac Industries Inc.: RomaGrip
 - 3) Or Equal.

- B. Dismantling Joint
 - 1. Pressure Rating
 - a. Minimum Working Pressure Rating: Not less than 150 psi
 - b. Pressure rating to be no less than test pressure for piping system in which the Restrained Dismantling Joint is used.
 - c. Safety Factor: Not less than two times working pressure and shall be supported by manufacturer's proof testing.
 - 2. Thrust Restraint
 - a. Provide steel tie rods, ASTM A 193 GR B7
 - b. Number and arrangement of tie rods to provide dismantling joint assembly which meets pressure rating requirement.
 - 3. Materials of Construction
 - a. Flanged Adapter Body: Steel
 - b. Follower Flange: Ductile Iron
 - c. Gasket: Buna-N, NSF-61 approved
 - d. Flange: Steel, per AWWA C207
 - e. Spigot: Steel
 - f. Studs: Type 304 stainless steel
 - g. Coating: NSF-61 approved epoxy
 - 4. Manufacturer and Product
 - a. Smith-Blair, Model 975 or 972, as required for pressure rating
 - b. Romac Industries, Style DJ400
 - c. Or Equal.

2.4 MODULAR MECHANICAL SEAL

- A. Type: Interconnecting synthetic rubber links shaped and sized to continuously fill annular space between pipe and sleeve, blackout, or core-drilled opening in concrete slabs or walls.
- B. Features:
 - 1. Links: EPDM
 - 2. Bolts and nuts: Type 316 stainless steel
 - 3. Pressure plates: composite
 - 4. Temperature range: -40 to 250 degrees Fahrenheit
 - 5. Pressure rating: guaranteed by the manufacturer to provide a water-tight seal with a differential hydrostatic head of 40-feet of water
- C. Manufacturers and Products:
 - 1. PSI-Thunderline; Link-seal, Type S-316
 - 2. Or equal

2.5 PIPE TO MANHOLE CONNECTORS

- A. Type: Resilient rubber male-to-female wedge-style flexible connector between a circular gravity pipe and a circular opening core-drilled into a precast or cast-in-place concrete structure.
- B. Performance Requirements:
 - 1. Able to hold 10 psi head pressure for 10 minutes with no leakage
 - 2. Load Rating: 150 lbs per inch pipe diameter

- C. Materials:
 - 1. Body: resilient rubber material conforming to ASTM C923
 - 2. Hardware: 300 Series Stainless Steel conforming to ASTM C923, ASTM A666 and ASTM A240
- D. Manufacturer and Products
 - 1. Trelleborg Pipe Seals Milford, Inc., Model Kor-N-Seal I – 106 Series for pipes up to 18" diameter and Kor-N-Seal II – 206 Series for pipes from 20" to 54" in diameter.
 - 2. Or Equal

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General
 - 1. Follow all manufacturer's directions
- B. Flexible Couplings (FC)
 - 1. Follow all manufacturer's directions
 - 2. No more than 1-inch gap between pipe ends
 - 3. Center flexible coupling in joint
 - 4. Tighten bolts in an alternating pattern to provide even tension around the coupling
 - 5. Tighten bolts to specified torque
 - 6. In buried installations, wrap coupling with plastic fastened to pipe to protect bolts and coupling from backfill material
- C. Flanged Coupling Adapters (FCA)
 - 1. Follow all manufacturer's directions
 - 2. No more than 1-inch gap between pipe plain end and flange face
 - 3. Tighten flange bolts prior to tightening coupling bolts
 - 4. Tighten bolts in an alternating pattern to provide even tension around the coupling
 - 5. Tighten bolts to specified torque
 - 6. In buried installations, wrap coupling with plastic fastened to pipe to protect bolts and coupling from backfill material
- D. Restrained Mechanical Joint Glands (RMJ)
 - 1. Follow all manufacturer's directions
 - 2. Tighten mechanical joint gland bolts before tightening restraint lugs
 - 3. Tighten restraint lugs until torque head breaks off
 - 4. In buried installations, wrap joint with plastic fastened to pipe to protect bolts and coupling from backfill material
- E. Pressure Gages
 - 1. Follow all manufacturer's directions
 - 2. Install diaphragm seals where process liquid would be detrimental to gage life (wastewater, chemical service, etc.)
 - 3. Check gage accuracy

+++ END OF SECTION +++

15120-4

SECTION 15200
VALVES AND OPERATORS

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Shop Drawings:
 - 1. Product data sheets for make and model.
 - 2. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
 - 3. Certificate of Compliance for: Butterfly valves; full compliance with AWWA C504.
- B. Tests and inspection data.
- C. Operation and Maintenance Data as specified in Section 01330, SUBMITTAL PROCEDURES.

1.2 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. In accordance with manufacturer's directions.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All valves shall be the same size as the pipe in which they are installed, unless specifically noted otherwise on the Drawings.
- B. All valves shall include all appurtenant parts (operators, chainwheels, handwheels, valve stems, floor stands, gear boxes, operating nut, etc.) for a complete operating valve.
 - 1. Valve shall be, as much as practical, fully factory assembled.
- C. All valves shall open by turning counter-clockwise. Maximum force required for operation shall be 40 lbs.
- D. Where Lead-Free Bronze or Brass is specified, materials shall be in compliance with California Health & Safety Code Section 116875. Not more than a weighted average of 0.25 percent of the wetted surface of the valve shall be lead. Valve shall be provided with a "hang tag" or other marking that easily identifies the valve as Lead-Free.
- E. Coatings and Linings:
 - 1. Provide factory-applied coatings as described herein.
 - 2. Where liquid epoxy coatings are specified, coatings shall conform to AWWA C550.
 - 3. Field coat the exterior of all valve bodies with the same coating as is required for the adjacent pipe in Section 09900, PAINTING and Section 15100, PIPE AND FITTINGS, unless otherwise specified.
- F. Nuts, Bolts and Washers

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1. Hex Bolts: ASTM A320/A320M, Type 304 stainless steel, [Grade B8, Class 2](#)
2. Nuts: ASTM F594, Type 304 stainless steel, [Grade B8, Class 2](#)
3. Washers: Type 304 stainless steel

2.2 BALL VALVES

A. **BAV-01LF:** Lead-Free Ball Valve, 3 inches and smaller:

1. Service: Potable Water
2. Features:
 - a. Two-piece, end-entry type
 - b. Lead-Free Brass & Bronze Materials in compliance with California Health & Safety Code Section 116875. Not more than a weighted average of 0.25 percent of the wetted surface of the valve shall be lead. Valve shall be provided with a "hang tag" or other marking that easily identifies the valve as Lead-Free.
 - c. Lead-Free Bronze (Alloy C89836, C89833 or C69300) body
 - d. Chrome-plated lead-free brass (Alloy C27450 or C69300) ball
 - e. RTFE or PTFE seats and packing
 - f. Zinc-coated steel hand lever operator with vinyl grip
 - g. Rated 600-psig WOG, 150-psig SWP.
3. Manufacturer and Products:
 - a. Threaded:
 - 1) Apollo 70LF100 Series
 - 2) Milwaukee; UPBA100
 - 3) Nibco T-685-80-LF
 - 4) Or Equal
 - b. Soldered:
 - 1) Apollo 70LF200 Series
 - 2) Milwaukee; UPBA150
 - 3) Nibco S-685-80-LF
 - 4) Or Equal

B. **BAV-03:** Stainless Steel Ball Valve, 3 Inches and Smaller

1. Service: Water, air.
2. Features:
 - a. Threaded ends
 - b. Rated minimum 800 psig WOG (Water-Oil-Gas)
 - c. Stainless steel body
 - d. Polished stainless steel ball
 - e. Teflon seat
 - f. Stainless steel lever-type handle
3. Manufacturers and Products:
 - a. Apollo, Type 76
 - b. Watts Type S-FBV-1
 - c. Or Equal

2.3 BUTTERFLY VALVES

A. **BFV-10:** Butterfly Valve 3 Inches to 72 Inches:

1. Service: Water.
2. Features:
 - a. Flanged end, short body type.
 - b. AWWA C504, Class 150B.

- c. Features:
 - 1) Body:
 - a) Cast iron
 - 2) Disc:
 - a) Cast or ductile iron disc
 - b) On valves 24-inch and larger, provide non-hollow discs
 - 3) Shaft:
 - a) Type 304 stainless steel shaft,
 - b) Self-adjusting V-type or O-ring shaft seals.
 - 4) Seat:
 - a) Valves 3- to 20- inch:
 - 1. Buna N or NBR rubber seat bonded or molded in body only.
 - 2. Elastomer seats which are bonded or vulcanized to the body shall have adhesive integrity of bond between seat and body assured by testing, with minimum 75-pound pull in accordance with ASTM D429, Method B.
 - b) Valves 24-inch and larger:
 - 1. Buna N or NBR rubber seat retained within a dovetail groove in the valve body and mechanically locked in place by use of an epoxy filler.
 - 2. Valve to be adjustable from either side
 - 3. Valves using seat fasteners or retaining rings are not allowed
 - c) Provide stainless steel seating surface.
 - 5) Coatings and Linings:
 - a) Liquid epoxy, 12 mil minimum, for valve interior and exterior.
 - b) For potable water applications, epoxy lining shall be NSF 61 approved.
- d. Valve shall be suitable for throttling operations and infrequent operation after periods of inactivity.
- e. Valve shall be bubble-tight with rated pressure applied from either side.
- f. Smooth flow stream on valve body interior
 - 1) No travel stops for disc on interior of body.
 - 2) Isolate metal-to-metal thrust bearing surfaces from flowstream.
- 3. Manufacturers and Products:
 - a. DeZurik Water Controls; Model BAW.
 - b. Henry Pratt Company
 - 1) 3" to 20": Model 2FII
 - 2) 24" to 72": Model Triton XR-70
 - c. Or Equal.

2.4 CHECK VALVES

- A. **CKV-10:** Swing Check Valve (2" to 24")
 - 1. Service: Water, Sewage, Sludge and General Service.
 - 2. Style: Swing Check, Outside lever and weight type, Flanged-End Connections
 - 3. General: Valves shall comply with AWWA C508.
 - 4. Body: Valve body and cover shall be fabricated with cast iron conforming to ASTM A 126 with flanged ends conforming to ANSI B16.1.
 - 5. Disc: The valve disc shall be fabricated of cast iron or ductile iron and rubber faced.
 - 6. Seat and Rings: The valve seat and rings shall be fabricated of bronze conforming to ASTM B62 or B148 or of Buna-N.
 - 7. Disc Bolt: A307 Steel
 - 8. Hinge: Ductile Iron
 - 9. Hinge Pin: The hinge pin shall be fabricated of stainless steel.

10. Coatings and Linings:
 - a. Liquid epoxy, 12 mil minimum, for valve interior and exterior.
 - b. For potable water applications, epoxy lining shall be NSF 61 approved.
11. Manufacturer:
 - a. M&H; Style 159, Lever and Weight
 - b. Milliken; Figure 8001, Lever and Weight
 - c. Or equal.

2.5 GATE VALVES

- A. **GAV-10:** Resilient-Seated Gate Valve, 3 Inches to 24 Inches:
 1. Service: Water.
 2. Features:
 - a. Conforms to AWWA C509 (<12") or AWWA C515 (14" to 24")
 - b. Iron body
 - c. Resilient seat, bronze mounted
 - d. Full port
 - e. Valve Ends:
 - 1) Mechanical joint ends for buried service, unless shown otherwise on drawings or valve schedule
 - 2) Flanged ends for exposed service
 - f. Non-rising stem
 - g. Actuator for Buried Service:
 - 1) Stem extension, as required, to bring operating nut to within 12" of ground surface.
 - 2) 2-inch operating nut
 - h. Actuator for Exposed Service:
 - 1) Handwheel
 - i. Design working water pressure: 250 psig
 - j. Coatings and Linings:
 - 1) Liquid epoxy, 12 mil minimum, for valve interior and exterior.
 - 2) For potable water applications, epoxy lining shall be NSF 61 approved.
 3. Manufacturers and Products:
 - a. Mueller 2360 (2" to 12") or 2361 (14" to 24")
 - b. M&H Valve; AWWA C509 (2" to 12") or AWWA C515 (14" to 24").
 - c. Or Equal.

2.6 HOSE VALVES

- A. **HSV-01:** ¾" Angle-Pattern Hose Valve, non frost-proof
 1. Service: Water.
 2. Features:
 - a. 3/4-inch NPT female inlet,
 - b. 3/4-inch male hose thread outlet,
 - c. Heavy rough brass body rated 125 psi,
 - d. Removable handle,
 - e. Atmospheric vacuum breaker conforming to ASSE Standard 1011 and IAPMO code
 3. Manufacturers and Products:
 - a. Acorn; 8131
 - b. Or Equal.

2.7 FIRE HYDRANTS

A. **HYD-30:** WET-BARREL FIRE HYDRANT - COMMERCIAL

1. Service: Water.
2. Features:
 - a. Hydrant shall be manufactured in accordance with AWWA Standard C-503
 - b. Hydrant head shall be made of gray cast iron, meeting ASTM A126 Class B specifications. It shall be capable of withstanding a hydrostatic test pressure of 4 (four) times the working water pressure without stressing the material beyond its yield point per Section 4.6.3.2 of AWWA C503.
 - c. Valved Ports:
 - 1) Wet-barrel fire hydrants shall feature independently-valved ports. The working parts shall be engineered to function as a unit and to give trouble-free service over 200 pounds working pressure and tested to 400 pounds hydrostatic pressure.
 - 2) Fire hydrants shall be provided with three outlet ports: two outlet ports of 2.5" in diameter, and one 4.5" diameter outlet port.
 - d. A positive break-off check valve is required in the assembly.
 - e. All hydrants shall be permanently marked to identify the model number of the hydrant, the manufacturer and the year in which the hydrant was manufactured.
 - f. Hose and pumper nozzle threads shall be in conformance with the standard for fire hose connections, NFPA 1963, unless otherwise specified.
 - g. Protector caps shall be grey cast iron unless otherwise specified by the purchaser. They shall be securely chained to the hydrant barrel and furnished an inner gasket.
 - h. Standard nut size of valve/stem and protector caps shall be of pentagonal shape and furnished with a nut of 1 1/8" measured from point to flat of the pentagon.
 - i. Coatings and Linings:
 - 1) Liquid epoxy lining, 12 mil minimum, for fire hydrant interior.
 - 2) For potable water applications, epoxy lining shall be NSF 61 approved.
 - 3) Exterior of hydrants shall receive a primer coat and be furnished with a traffic yellow enamel finish coat for potable water, or a purple enamel finish coat for recycled water.
3. Manufacturers and Products
 - a. Clow Valve Company, Model 860

2.8 CONTROL VALVES

A. **PRV-40:** Pressure Relief Valve and Surge Anticipator Valve, Water Service:

1. Service: Water.
2. Features:
 - a. Hydraulically operated, pilot controlled modulating valve
 - b. Designed to provide pressure relief from high pressure surges
 - c. Globe Pattern
 - d. ANSI B16.42 150-lb flanged ends
 - e. Y-strainer on the pilot control line
 - f. Valve rated pressure: 250 psi
 - g. Adjustable Pressure Relief Range: 100 to 300 psi
 - h. Adjustable Pressure Reducing Range: 30 to 300 psi
 - i. Provide sensing line(s) and route per manufacturer's recommendations.
3. Materials:
 - a. ASTM A536 ductile iron body

- b. Bronze or stainless steel trim
- c. Buna-N Rubber Disc
- d. Nylon reinforced Buna-N Rubber Diaphragm
- e. Stainless steel stem
- 4. Coatings and Linings:
 - a. Liquid epoxy, 12 mil minimum, for valve interior and exterior.
 - b. For potable water applications, epoxy lining shall be NSF 61 approved.
- 5. Manufacturers and Products:
 - a. Cla-Val; Model 52-01
 - b. Or Equal

2.9 AIR RELIEF AND VACUUM VALVES

A. **ARV-03:** Air Release Valve, ½" to 1"

- 1. Service: Water.
- 2. Features:
 - a. Simple lever type
 - b. Automatically exhausts small amounts of entrained air that accumulates in a system
 - c. Once air has been exhausted, uses water pressure to close valve. In CLOSED position, seat against resilient seat to prevent water leakage.
 - d. Rated 150 psi working pressure, orifice size by manufacturer (minimum orifice size 1/16-inch).
 - e. Cast iron, ductile iron, or semi-steel body, cover with stainless steel float and trim.
 - f. Provide No. 16 Mesh 316SS screen on inlets and outlets.
 - g. Coatings and Linings:
 - 1) Liquid epoxy, 12 mil minimum, for valve interior and exterior.
 - 2) For potable water applications, epoxy lining shall be NSF 61 approved.
- 3. Manufacturers and Products:
 - a. APCO Valve and Primer Corp.; Model 50
 - b. Val-Matic Valve; Model 15A.
 - c. Or equal.

B. **AVV-02:** Air/Vacuum Valve for Vertical Turbine Pumps, ½" to 3"

- 1. Service: Potable, Raw or Reclaimed Water.
- 2. Features:
 - a. Automatically exhausts large amounts of air when pump starts, and allows large quantities of air to re-enter the pump column when pump stops to break vacuum.
 - b. Once air has been exhausted, uses water pressure to close valve. In CLOSED position, seat against resilient seat to prevent water leakage.
 - c. Discharge orifice shall be fitted with a double-acting throttling device to automatically regulate and restrict air venting and to establish pressure loading on rising suction column of water to minimize air surging. On pump stop, throttling device shall automatically open to allow full line unrestricted air re-entry to prevent vacuum from forming in the pump column.
 - d. Rated 200 psi working pressure
 - e. Cast iron, ductile iron, or semi-steel body and cover with stainless steel float and trim.
 - f. Model determined by size as indicated in Valve Schedule or on Drawings.
 - g. Provide vent hose or piping and route discharge line to nearest drain/structure.
- 3. Manufacturers and Products:

- a. APCO Valve and Primer Corp.; Series 140DAT
 - b. Val-Matic Valve; 100ST Series.
 - 4. Or equal.
- C. **CARV-01:** Combination Air Release and Vacuum Valve, Water Service up to 150 psi:
- 1. Service: Water.
 - 2. Features:
 - a. Combines the operating features of both an air vacuum valve and air release valve, allowing to vent or re-enter system freely in either direction.
 - b. Once air has been exhausted, uses water pressure to close valve. In CLOSED position, seat against resilient seat to prevent water leakage.
 - c. Single-body type
 - d. Rated 150 psi working pressure, orifice size by manufacturer (minimum orifice size 3/32-inch).
 - e. Cast iron, ductile iron, or semi-steel body, cover with stainless steel float and trim.
 - f. 2-inch inlet, 2-inch outlet.
 - g. Provide No. 16 Mesh 316SS screen on inlets and outlets.
 - h.
 - i. Provide vent hose or piping and route discharge line to nearest drain/structure.
 - j. Coatings and Linings:
 - 1) Liquid epoxy, 12 mil minimum, for valve interior and exterior.
 - 2) For potable water applications, epoxy lining shall be NSF 61 approved.
 - 3. Manufacturers:
 - a. APCO Valve and Primer Corp., Model 145C
 - b. Val-Matic Valve; Model VM-202C.2
 - c. Or equal.
- D. **CARV-02:** Combination Air Release and Vacuum Anti-Surge Valve, Water Service:
- 1. Service: Water.
 - 2. Features:
 - a. Combines functions of uninterrupted discharge of air during filling, continuous discharge of dis-entrained pressurized air, unrestricted vacuum break, and pipeline surge protection in a single chamber. Valves shall be anti-surge and anti-shock air release and vacuum break valves.
 - b. Once air has been exhausted, uses water pressure to close valve. In CLOSED position, seat against resilient seat to prevent water leakage.
 - c. Single-body type
 - d. Rated 276 psi max operating pressure.
 - e. Stainless Steel or Fusion Bonded Epoxy Power Coated Ductile Iron body, flanges, cover and stainless steel fasteners.
 - f. HPDE floats with EPDM O-ring seals.
 - g. 3-inch.
 - h. Suitable for use with water.
 - i. Maximum Valve Height: 13.65-inches
 - 3. Manufacturers:
 - a. Vent-O-Mat; Model: RBXc
 - b. Vent-Tech; Model: WTR-C
 - c. Or equal.

2.10 BACKFLOW PREVENTERS

A. **BFP-01:** Reduced-Pressure Principle Backflow Prevention Assembly:

1. Service: Potable Water.
2. Materials:
 - a. Body: lead-free bronze materials or epoxy-coated cast/ductile iron.
 - b. Test cocks: lead-free bronze
 - c. Ball valves: lead-free bronze
 - d. Valve Seats: stainless steel or Noryl
3. Features:
 - a. Two check valves with an independent relief valve between the valves,
 - b. Two resilient-seated isolation gate valves or ball valves
 - c. Test cocks, in accordance with AWWA C511
 - d. Rated 175 psi maximum working pressure,
 - e. Meets requirements of USC Foundation For Cross-Connection Control and Hydraulic Research.
 - f. Ends: as required for installation as shown on Drawings
 - g. Coatings and Linings (steel and cast iron):
 - 1) Liquid epoxy, 12 mil minimum, for valve interior and exterior.
 - 2) For potable water applications, epoxy lining shall be NSF 61 approved.
4. Manufacturers and Products:
 - a. Zurn Wilkins 375 (2.5" to 10")
 - b. Or Equal.

2.11 OPERATORS:

A. General:

1. Operator force not to exceed 40 pounds under any operating condition, including initial breakaway. Gear reduction operator when force exceeds 40 pounds.
2. Operator self-locking type or equipped with self-locking device.
3. Provide position indicator on all valves.
4. Worm and gear operators one-piece design worm-gears of gear bronze material. Worm hardened alloy steel with thread ground and polished. Traveling nut type operators threaded steel reach rods with internally threaded bronze or ductile iron nut.
5. Valve handles, wheels, etc. to be designed to accommodate a padlock.

B. Manual Operator:

1. Galvanized and painted handwheels.
2. Lever operators allowed on quarter-turn valves 8 inches and smaller.
3. Cranks on gear type operators.
4. For all valves above 5'-0" above adjacent working surface (finished floor or finished grade), provide chain wheel operator with tiebacks
5. For all exposed valves below adjacent working surface (finished floor or walkway), provide extension stem, floor stands, and other accessories to permit operation from 2'-6" above adjacent working surface.
6. For all buried valves 3" and larger, provide stem extension, valve bonnet, valve box and 2" AWWA operating nut such that operating nut is within 12" of adjacent finished grade.
 - a. For small-diameter buried valves, provide cross-shaped handle for operating with forked key.

2.12 ACCESSORIES

- A. T-Handled Operating Wrench:
 - 1. One each galvanized operating wrench, 4 feet long.
 - 2. Manufacturers and Products:
 - a. Mueller; No. A-24610.
 - b. Clow No.; F-2520.
 - c. Or Equal.
- B. Cast Iron Valve Box: Designed for traffic loads, sliding type, with minimum of 6-inch ID shaft.
 - 1. Box: Cast iron with minimum depth of 9 inches.
 - 2. Lid: Cast iron, minimum depth 3 inches, marked WATER.
 - 3. Extensions: Cast iron.

PART 3 - EXECUTION

3.1 VALVE SCHEDULE

- A. A Valve Schedule has been attached to this Specification and is incorporated herein by reference. Provide valves in accordance with Valve Schedule.
- B. For valves that are not referenced in Valve Schedule, provide the valve type called for on the Drawings.

3.2 PREPARATION

- A. Cleaning:
 - 1. Clean all mating faces of valve (threads, flange faces, etc.) prior to assembly.
 - 2. Remove all debris from valve body prior to assembly.
 - 3. Take extra care to clean mating faces of existing pipe and fittings which may have corrosion, dirt, debris and mineral build-up which should be removed for a proper fit.
- B. Apply joint compound, lubricant, etc. as recommended by valve manufacturer for proper installation prior to installation.
- C. Install valves in accordance with the following schedule and as noted on the Drawings:

3.3 INSTALLATION

- A. Install valves per manufacturer's recommendations.
- B. Install valves so handles operate from fully open to fully closed without encountering obstructions.
- C. Install valves in location and orientation for easy access for routine operation and maintenance. Access should be such that an operator can operate the valve by reaching a handle, chain, etc. at a height between 2'-6" and 5'-0" above adjacent work surface (for buried valves, this is accomplished with a t-handle wrench and the operating nut being within 12" of finished grade).

- D. Install plug valves with the seat side as indicated on the drawings. If manufacturer's recommendations differ from indicated seat direction on the drawings, or if no seat side is indicated, install plug valves with seat side as recommended by the manufacturer after obtaining approval from the ENGINEER.

3.4 TESTS AND INSPECTION

- A. Valve may be either tested while testing pipelines, or as a separate step.
- B. Test that valves open and close smoothly under operating pressure conditions. Test that two-way valves open and close smoothly under operating pressure conditions from both directions.
- C. Inspect air release and vacuum valves as pipe is being filled to verify venting and seating is fully functional.
- D. Count and record number of turns to open and close valve; account for any discrepancies with manufacturer's data.
- E. Set, verify, and record set pressures for all relief and regulating valves.
- F. Automatic valves to be tested in conjunction with control system testing. Set all opening and closing speeds, limit switches, as required or recommended by the ENGINEER.

3.5 SUPPLEMENTS

- A. The following supplements are attached to this Specification section and incorporated herein by reference:
 - 1. 15200 VS – Valve Schedule

+ + END OF SECTION + +

SECTION 15200 VS

VALVE SCHEDULE

1.1 DESCRIPTION

A. General:

1. This schedule is provided for the convenience of the CONTRACTOR. Some valves may be shown on the drawings, but not listed here.
2. Valve specifications are given in Section 15200, Valves and Operators.

B. Valve Tag Number:

1. Tag numbers are as noted in the Drawings.

C. Valve Type:

1. Valve types are as described in 15200, Valves and Operators

D. Valve Ends:

1. FLG – Flanged
2. GRV – Grooved End
3. LUG – Lugged
4. MJ – Mechanical Joint
 - a. Where the surrounding piping system is installed with restrained joints, MJ valves shall be installed using RMJ (restrained mechanical joint) glands per 15120, Piping Specialties.
5. SLV – Solvent Welded Socket
6. SLD – Soldered Socket
7. THR – Threaded
8. W – Wafer

E. Installation Codes

1. Ex – Exposed
2. Un – Underground

F. Valve Actuators, as described in 15200, Valves and Operators

1. HW – Handwheel
2. L – Lever
3. N – 2" Nut
4. N/A – Not Applicable

1.2 VALVE SCHEDULE

VALVE TAG NUMBER	VALVE TYPE	ENDS	DIAMETER	INSTALLATION	ACTUATOR
ZONE A PUMP STATION					
V101	AVV-02	THR	2"	EX	N/A
V102	CKV-10	FLG	8"	EX	N/A
V103	BFV-10	W	8"	EX	HW
V104	GAV-10	MJ	12"	UN	N
V201	AVV-02	THR	2"	EX	N/A
V202	CKV-10	FLG	8"	EX	N/A
V203	BFV-10	W	8"	EX	HW
V204	GAV-10	MJ	12"	UN	N
V301	AVV-02	THR	2"	EX	N/A
V302	CKV-10	FLG	8"	EX	N/A
V303	BFV-10	W	8"	EX	HW
V304	GAV-10	MJ	12"	UN	N
V401	AVV-02	THR	2"	EX	N/A
V402	CKV-10	FLG	8"	EX	N/A
V403	BFV-10	W	8"	EX	HW
V404	GAV-10	MJ	12"	UN	N
V500	PRV-40	FLG	6"	EX	N/A
V502	BFV-10	W	12"	EX	HW
V503	CARV-01	THR	3"	EX	N/A
V504	BFP-01	FLG	6"	EX	HW
ZONE A TRANSMISSION MAIN – Note 1					
V601	GAV-10	FLG	3"	UN	N
V602	CARV-02	FLG	3"	EX	N/A
V603	GAV-10	FLG	3"	UN	N
V604	CARV-02	FLG	3"	EX	N/A
V605	GAV-10	FLG	3"	UN	N
V606	CARV-02	FLG	3"	EX	N/A
V607	GAV-10	FLG	3"	UN	N
V608	CARV-02	FLG	3"	EX	N/A
V609	GAV-10	FLG	3"	UN	N
V610	CARV-02	FLG	3"	UN	N/A
V611	GAV-10	FLG	3"	UN	N
V612	CARV-02	FLG	3"	UN	N/A
V613	GAV-10	FLG	3"	UN	N
V614	CARV-02	FLG	3"	UN	N/A
V620	GAV-10	MJ	6"	UN	N
V621	GAV-10	MJ	6"	UN	N
V622	GAV-10	MJ	6"	UN	N
V623	GAV-10	MJ	6"	UN	N

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VALVE TAG NUMBER	VALVE TYPE	ENDS	DIAMETER	INSTALLATION	ACTUATOR
V624	GAV-10	MJ	6"	UN	N
V625	GAV-10	MJ	6"	UN	N
V626	GAV-10	MJ	6"	UN	N
V630	GAV-10	MJ	16"	UN	N
V631	GAV-10	MJ	16"	UN	N
V632	GAV-10	MJ	16"	UN	N
V633	GAV-10	MJ	16"	UN	N
V634	GAV-10	MJ	16"	UN	N
V635	GAV-10	MJ	16"	UN	N
V636	GAV-10	MJ	16"	UN	N
V640	GAV-10	MJ	16"	UN	N
V641	GAV-10	MJ	16"	UN	N
V642	GAV-10	MJ	16"	UN	N
V643	GAV-10	MJ	12"	UN	N
V650	GAV-10	MJ	6"	UN	N
V651	HYD-30	FLG	6"	EX	N/A
V652	GAV-10	MJ	6"	UN	N
V653	HYD-30	FLG	6"	EX	N/A
V654	GAV-10	MJ	6"	UN	N
V655	HYD-30	FLG	6"	EX	N/A
V660	BAV-03	THR	3"	UN	L
V661	BAV-03	THR	3"	UN	L
V662	BAV-03	THR	3"	UN	L
PUMP STATION #2					
V701	BFV-10	LUG	8"	EX	L
V702	BFV-10	LUG	8"	EX	L
V703	BFV-10	LUG	6"	EX	L
V705	BFV-10	LUG	6"	EX	L
V706	BFV-10	LUG	8"	EX	L
V707	PRV-50	LUG	8"	EX	N/A
V708	BFV-10	LUG	8"	EX	L
V709	ARV-03	THD	1"	EX	N/A

Note 1: OWNER-Furnished Equipment

15200 VS-3

+ + END OF SECTION + +

15200 VS-4

SECTION 15400
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Shop Drawings:
 - 1. Catalog information and rough-in dimensions for plumbing fixtures, products, and specialties.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

- A. Hose Reel
 - 1. Steel wall-mounted hose reel
 - 2. Spring driven
 - 3. Swiveling wall-mount for hose reel to allow up to 180 degrees of rotation
 - 4. Stainless steel full-flow shaft and swivel
 - 5. ¾" hose thread connection
 - 6. For use with ½" ID hose with ¾" hose thread connections.
 - a. Provide 35-feet of hose installed in hose reel
 - b. Provide 5-feet of hose to connect hose reel to HSV-01 at hose reel location
 - c. Provide 360 degree swivel head and spray nozzle with hose
 - 7. NSF-61 certified
 - 8. Manufacturers and Products
 - a. Reelcraft; Model 5835 OLBSW23 potable water hose reel
 - b. Or Equal.

2.2 DRAINAGE PRODUCTS

- A. Roof and Overflow Drains:
 - 1. Features:
 - a. Dura-coated cast iron body and dome.
 - b. 8-1/2" diameter, less than 5" high dome.
 - c. Female NPT outlet (size per Drawings).
 - d. Provide combined flashing clamp for use with membrane roofing and gravel stop.
 - e. Provide underdeck mount and accessories for mounting to metal deck.
 - f. For overflow drains, provide extensions as shown on the Drawings.
 - g. Free area of 41.5 square inches.
 - 2. Manufacturer and Product:
 - a. Jay R. Smith Manufacturing Co., Figure 1330.
 - b. Zurn, Figure Z125.
 - c. Or Equal.
- B. Roof Drain Leaders:
 - 1. Schedule 40 galvanized steel threaded pipe, size as shown on Drawings.

C. Floor Drain with Funnel (**FD-02**)

1. Features:
 - a. Cast Iron body and grate
 - b. Funnel top, 4 inch diameter and 4-1/4 inch tall, attached to grate with concealed screws
 - c. Trap primer connection
 - d. Threaded outlet designed for use with PVC drain waste and vent pipe
2. Manufacturers:
 - a. Jay R. Smith Manufacturing Co.; Model 3510T
 - b. Or equal.

D. Floor Cleanout (**FCO-01**):

1. Material: Tapered thread, bronze plug with round adjustable scoriated secured cast iron top. Designed for use on finished concrete floors with heavy industrial traffic loads.
2. Outlet designed for use with PVC drain waste and vent pipe
3. Manufacturers and Products:
 - a. Jay R. Smith Mfg. Co.; Model 4111 with Speedi-Set outlet.
 - b. Zurn; Model Z1400-HD with Neo-Loc outlet
 - c. Or equal.

E. Trap Priming Valves:

1. Electrical Actuated Trap Primer
 - a. Features:
 - 1) Surface mounted metal cabinet with cover plate
 - 2) 1/2" NPT inlet
 - 3) 1/2" NPT outlet
 - 4) Electrical Components
 - a) Circuit breaker
 - b) Switch
 - c) Timer solenoid valve (UL listed)
 - b. Accessories:
 - 1) Trap primer distribution Unit (Required for trap primer serving 2-4 drains)
 - c. Manufacturer and Product:
 - 1) Precision Plumbing Products, Inc. Model Mini-Prime Electronic (Serves 1 drain) with surface mounted cabinet, Model MPB-500-115V
 - 2) Precision Plumbing Products, Inc. Model Mini-Prime Electronic (Serves 1-4 drains) with surface mounted cabinet, Model MPB-500-115V with Distribution Unit (DU-U).

PART 3 - EXECUTION

3.1 DETAILING

- A. Contract Drawings and specifications do not detail all requirements for installation of plumbing fixtures. CONTRACTOR shall provide all required materials to provide a complete installation of all plumbing fixtures which is fully functional and compliant with all applicable codes and regulations.

3.2 PLUMBING FIXTURE INSTALLATION

- A. General:
 - 1. Install all plumbing fixtures plumb, level and per the manufacturer's instructions.
- B. Plumbing Fixtures, Mounting Heights:
 - 1. Standard rough-in catalogued heights, unless shown otherwise on Drawings.
 - 2. Caulk fixtures in contact with finished walls with waterproof, white, non-hardening sealant which will not crack, shrink, or change color with age.
- C. Drains and Cleanouts:
 - 1. Install top flush with finished floor elevation.
 - 2. Install PVC p-traps at each floor drain.
 - 3. Provide cleanouts where shown and where required by code.
- D. Trap Priming Valves:
 - 1. Provide one trap priming valve for each floor drain. Trap priming valves and associated piping are not shown on the Drawings, but are required.
 - 2. Connect each trap priming valve to W1 system.
 - 3. Connect trap priming valve to floor drain using ½" Type K soft copper tubing. Install copper tubing at the time of floor drain installation (before concrete for floor is placed). Route tubing to final location of trap priming valve.
 - 4. Locate trap priming valves as required, however, group trap priming valves for floor drains in the same area.
 - 5. Provide shut-off valve (1/2" ball valve) between trap priming valve and W1 line feeding trap priming valve directly adjacent to trap priming valve.
 - 6. Label trap priming valve indicating which floor drain is served.
- E. Roof Drain Leaders:
 - 1. Slope horizontal leaders ¼-inch per foot in the downstream direction.

+ + END OF SECTION + +

15400-4

SECTION 15500

HEATING, VENTILATION AND AIR CONDITIONING EQUIPMENT

PART 1 - GENERAL

1.1 SUBMITTALS:

- A. Complete specifications, descriptive drawings, catalog cuts, and descriptive literature that include make, model, dimensions, weight of equipment, horsepower, and electrical schematics for products and control system components specified.
- B. Complete performance data that indicates full compliance with the Specifications.
- C. Recommended procedures for protection and handling of equipment and materials prior to installation.
- D. Manufacturer's standard finish color selection for cabinet finishes.
- E. Operation and maintenance manuals.
 - 1. List of recommended spare parts for equipment and materials specified.
 - 2. Manufacturer's Certificate of Conformance for the heat pumps.

1.2 QUALITY CONTROL

- A. Furnish 2-year warranty for all equipment.
- B. Furnish special warranty of 5 years for refrigeration section compressor(s).

PART 2 - PRODUCTS

2.1 SUPPLY FAN

- A. General: Provide heavy-duty steel wall-mounted fixed pitch propeller fan with thermostat control and thermostat bypass switch for on/off only control.
- B. Construction:
 - 1. All structural components shall be aluminum, steel or galvanized steel
 - 2. Gravity damper, standard duty
 - 3. Wall box with bolted guard factory assembled
- C. Motor:
 - 1. Variable Speed V-Belt Drive 1.2 SF
- D. Supply fan Information:

SUPPLY FAN SF-01	
Location	Zone A Pump Station
Unit Type	Interior, wall-mounted exhaust fan
Minimum Air Flow	6,500 cfm, 1376 RPM
Electrical Requirements	1.5 HP, 1800 RPM, 230/460V, 3ph, 60Hz, TEFC
Manufacturer/Model	Twin City TCWP 24BTC, or equal

2.2 FIXED LOUVERS

- A. Furnish storm class fixed blade louvers where shown and with the dimensions and shapes shown on Drawings. Louvers shall be designed for exhaust while providing maximum resistance to water penetration due to wind-driven rain.
- B. Fixed Louver Construction:
 - 1. Louver shall be constructed from extruded aluminum, alloy 6063-T5.
 - 2. Louver shall be 7 inches thick.
 - 3. Frame and blades shall be 0.081" thick.
 - 4. Louver shall be shaped and dimensioned as shown on the drawings.
 - 5. Install aluminum louver screen on interior side of the louver.
 - 6. Finish: Kynar 500 fluorocarbon coating, dark brown color, or equal.
- C. Fixed Louver Design:
 - 1. Louver ID: L-201
 - 2. Dimensions: 4' W x 4' L
 - 3. Free Area: Minimum 45% net free area. Provide AMCA test data to show a 4'x 4' unit with a minimum of 7.3-square feet free area.
 - 4. Pressure Loss: AMCA certified rating of no greater than 0.30-inch WC at 750 fpm.
 - 5. Provide louver supports designed to carry 30 psf wind load.
 - 6. Louvers to be designed for air flow in either direction.
 - 7. Louvers to provide protection from water penetration due to wind-driven rain. Provide test results, per AMCA standard 500L, which show that the louver being provided has the following performance characteristics:
 - a. 99% effectiveness at preventing water penetration of 3 inches per hour of wind driven rain at a wind speed of 29.1 miles per hour directed to the face of the louver
- D. Manufacturers and Products:
 - 1. Construction Specialties; Model RS-7315.
 - 2. Airolite; Model SCH7.
 - 3. Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install equipment and systems in accordance with manufacturers' instructions.

+ + END OF SECTION + +

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SECTION 15990

TESTING OF PRESSURE PIPING SYSTEMS

PART 1 - SUBMITTALS

1.1 TESTING PLAN

- A. Testing Plan: Submit prior to testing and include at least the information that follows.
 - a. Testing dates.
 - b. Piping systems and section(s) to be tested.
 - c. Test type.
 - d. Method of isolation.
 - e. Calculation of maximum allowable leakage for piping section(s) to be tested.
2. Certifications of Calibration: Testing equipment.
3. Certified Test Report.

1.2 REFERENCE

- A. Reference Section 15100 PS for test pressure.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 NOTIFICATION

- A. Notify ENGINEER in writing 5 days in advance of testing. Perform testing in presence of ENGINEER.

3.2 PRESSURE TESTING

- A. General:
 1. Complete installation of piping system, including all thrust restraint, prior to pressure testing.
 - a. If thrust blocking is specified, wait 5 days minimum after concrete thrust blocking is installed to perform pressure tests. If high-early strength cement is used for thrust blocking, wait may be reduced to 2 days.
 2. Prior to test, remove and replace with pipe spools or suitably isolate appurtenant instruments or devices that could be damaged by pressure testing.
 3. New Piping Connected to Existing Piping: Isolate new piping with grooved-end pipe caps, spectacle blinds, blind flanges, or as acceptable to ENGINEER.
 4. Piping to be Pressure Tested and Test Pressure: as indicated on Piping Schedule.
- B. Testing with Water (non-HDPE2 pipe):
 1. Fluid: Clean, potable water.
 2. Pipeline Protection:
 - a. Maximum Filling Velocity: 0.25 foot per second, applied over full area of pipe.
 - b. Vent piping during filling. Open vents at high points of piping system or loosen flanges, using at least four bolts, or use equipment vents to purge air pockets.

3. Exposed Piping:
 - a. Perform testing on insulated piping prior to application of insulation
 - b. Maintain hydrostatic test pressure continuously for 60 minutes, minimum, and for such additional time as necessary to conduct examinations for leakage.
 - c. Examine joints and connections for leakage.
 - 1) Correct visible leakage and retest as specified.
 - 2) Empty pipe of water prior to final cleaning or disinfection.
4. Buried Piping:
 - a. Test after backfilling has been completed.
 - b. Expel air from piping system during filling.
 - c. Apply and maintain specified test pressure with hydraulic force pump. Valve off piping system when test pressure is reached.
 - d. Maintain hydrostatic test pressure continuously for 2 hours minimum, reopening isolation valve only as necessary to restore test pressure.
 - e. Determine actual leakage by measuring quantity of water necessary to maintain specified test pressure for duration of test.
 - f. Maximum Allowable Leakage:

$$L = \frac{SD(P)^{1/2}}{133,200}$$

where:

- L = Allowable leakage, in gallons per hour.
 S = Length of pipe tested, in feet.
 D = Nominal diameter of pipe, in inches.
 P = Test pressure during leakage test, in pounds per square inch.

- g. Correct leakage greater than allowable, and retest as specified.

3.3 PIPE PRESSURE TESTING LOG

- A. All pressure tests shall be witnessed by ENGINEER. CONTRACTOR shall keep a pipe pressure testing log to document the pressure testing and ENGINEER's approval of such.
 1. Specific details of the contents and format pipe pressure testing log shall be determined by the CONTRACTOR and approved by the ENGINEER.
 2. At a minimum, pipe pressure testing log shall record, on a daily basis for any day when pipe pressure testing is performed:
 - a. Test Report Documentation:
 - 1) Test date.
 - 2) Description and identification of piping tested.
 - 3) Test fluid.
 - 4) Test pressure.
 - 5) Remarks, including:
 - a) Leaks (type, location).
 - b) Repair/replacement performed to remedy excessive leakage.
 3. Pipe pressure testing log shall be kept on-site. Pipe pressure testing log shall be signed on a daily basis, for any day when pipe pressure testing log work is performed, by the supervisor of the CONTRACTOR's field crew and by the ENGINEER.
 4. Any piping system which was pressure testing, but which was not recorded in the pipe pressure testing log shall be re-tested at the ENGINEER's discretion.

+ + END OF SECTION + +

SECTION 15995

DISINFECTION OF POTABLE WATER SYSTEMS

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Informational Submittals:
 - 1. Plan describing and illustrating conformance to appropriate AWWA standards and this Specification.
 - 2. Procedure and plan for cleaning system.
 - 3. Procedures and plans for disinfection and testing.
 - 4. Proposed locations within system where Samples will be taken.
 - 5. Type of disinfecting solution and method of preparation.
 - 6. Certification that employees working with concentrated chlorine solutions or gas have received appropriate safety training.
 - 7. Method of disposal for highly chlorinated disinfecting water.
 - 8. Independent Testing Agency: Certification that testing agency is qualified to perform bacteriological testing in accordance with AWWA standards, agency requirements, and this Specification.
 - 9. Certified Bacteriological Test Results:
 - a. Facility tested is free from coliform bacteria contamination.
 - b. Forward results directly to ENGINEER.

1.2 QUALIFICATIONS

- A. Independent Testing Agency: Certified in the State of California with 10 years' experience in field of water sampling and testing. Agency shall use calibrated testing instruments and equipment, and documented standard procedures for performing specified testing.

PART 2 - PRODUCTS

2.1 WATER FOR DISINFECTION

- A. Clean, uncontaminated, and potable.
- B. CONTRACTOR shall make arrangements for water supply and convey water in disinfected pipelines or containers.

2.2 CONTRACTOR'S EQUIPMENT

- A. Furnish chemicals and equipment, such as pumps and hoses, to accomplish disinfection.
- B. Water used to fill pipeline may be supplied using a temporary connection to existing distribution system. Provide protection against cross-connections as required by AWWA C651.

PART 3 - EXECUTION

3.1 GENERAL

- A. Conform to AWWA C651 for pipes and pipelines, C653 for water treatment plants and filters, and C654 for wells, except as modified in these Specifications.
- B. Disinfect the following items installed or modified under this Project, intended to hold, transport, or otherwise contact potable water:
 - 1. Pumps.
 - 2. Treated Water Storage Tank
 - 3. Pipelines: Disinfect new pipelines that connect to existing pipelines up to point of connection.
- C. Disinfect surfaces of materials that will contact finished water, both during and following construction, using one of the methods described in AWWA C652 and C653. Disinfect prior to contact with finished water. Take care to avoid recontamination following disinfection.
- D. Prior to application of disinfectants, clean pump, tank, filters, and pipelines of loose and suspended material.
- E. Allow freshwater and disinfectant solution to flow into pipe or vessel at a measured rate so chlorine-water solution is at specified strength. Do not place concentrated liquid commercial disinfectant in pipeline or other facilities to be disinfected before it is filled with water.

3.2 PIPING

- A. Cleaning:
 - 1. Before disinfecting, clean all foreign matter from pipe in accordance with AWWA C651.
- B. If the continuous feed method or the slug method of disinfection, as described in AWWA C651 are used, flush pipelines with potable water until clear of suspended solids and color. Provide hoses, temporary pipes, ditches, and other conduits as needed to dispose of flushing water without damage to adjacent properties.
- C. Flush service connections and hydrants. Flush distribution lines prior to flushing hydrants and service connections. Operate valves during flushing process at least twice during each flush.
- D. Flush pipe through flushing branches and remove branches after flushing is completed.
- E. Disinfecting Procedure: In accordance with AWWA C651, unless herein modified.

3.3 PUMPS

- A. Disinfecting Solutions: Minimum free chlorine concentration of 100 ppm.
- B. Application:

1. Inject disinfecting solution into pump and associated piping and circulate for a minimum 3-hour period of time. At end of 3-hour period, solution shall have a strength of at least 50 ppm free chlorine.
2. Operate valves and pump appurtenances during disinfection to ensure that disinfecting solution is dispersed into all parts of pump and lines.
3. If disinfecting solution contained in pump has a residual free chlorine concentration less than 50 ppm after the 3-hour retention period, reclean pump, reapply disinfecting solution, and retest until a satisfactory test result is obtained.
4. After chlorination, flush water from pump until water through the unit is chemically and bacteriologically equal to permanent source of supply.

3.4 DISPOSAL OF HEAVILY CHLORINATED WATER

- A. Do not allow flow into a waterway without neutralizing disinfectant residual.
- B. See the appendix of AWWA C651, C652, C653, and C654 for acceptable neutralization methods.

+ + END OF SECTION + +

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SECTION 16050

ELECTRICAL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This Section, supplemented by Attachment A, ELECTRICAL COMPONENTS, Section 16150, POWER DISTRIBUTION EQUIPMENT, and Section 16200, ELECTRIC MOTORS, covers electrical work. Furnish material, labor, and equipment in accordance with these Specifications, the accompanying Drawings, and the directions of the Engineer. The work includes calibrating, adjusting, testing, documenting, and starting up the electrical system, as well as training of the Owner's personnel.
- B. Intent of Drawings: Exact conduit locations are not shown unless so indicated or specifically dimensioned.
- C. Departures from Drawings: Submit to the Engineer, in writing for review, details of any necessary proposed departures from these Contract Documents, and the reasons therefore, as soon as practicable and within 30 days after the award of the Contract. Make no such departures without the prior written approval of the Engineer.
- D. The Contractor shall be responsible for complete systems in accordance with the intent of these Contract Documents. The Contractor shall refer to all of the Drawings, Specifications, and submittals of other trades for details of equipment and construction which affect the work covered under this Section.
- E. Clearances: Coordinate the layout, fabrication, and installation of equipment and meet all applicable clearance requirements in front of and around equipment. Meet the requirements of the National Electrical Code, these Specifications, and the Authorities Having Jurisdiction. Obtain approvals from Authorities Having Jurisdiction, including the power company.

1.2 CODES, PERMITS, AND REGULATIONS

- A. Do all work and install materials and equipment in accordance with the requirements of the National Electrical Code (NEC), applicable State and local laws and ordinances, and the power company.
- B. Conflicts, if any, that may exist among the above items will be resolved at the discretion of the Engineer.
- C. Wherever the requirements of the Specifications or Drawings exceed those of the items above, the requirements of the Specifications or Drawings shall govern.

1.3 SUBMITTALS

A. General:

1. Provide complete submittals as specified herein and as required to completely describe the equipment and systems being provided.
2. In addition to the schedule requirements herein, the Contractor is responsible for providing submittals in a timely manner as required to meet the overall project schedule.
3. Should any item which deviates from these Specifications be included, the deviation shall be clearly indicated and explained at the time of submittal.
4. Submittals shall be complete, neat, orderly, and indexed. The Contractor shall check submittals for number of copies, adequate identification, correctness, and compliance with the Drawings and Specifications, and shall initial all copies.
5. Revise and resubmit all submittal information until favorably reviewed by the Engineer.
6. Review of submittal information by the Engineer shall not relieve the Contractor of responsibility for meeting the requirements of the Drawings and Specifications or for errors and omissions in submittals.

B. Product Submittals:

1. Product submittals shall be submitted within 45 days after the Notice to Proceed, except for the list of motor protective devices. In addition, no products shall be fabricated or shipped until the applicable submittals have been favorably reviewed by the Engineer.
2. As-built copies of product submittals shall be included in the O&M manuals.
3. Before any material is fabricated or shipped, furnish to the Engineer full details, shop drawings, dimensions, catalog cuts, schematic (elementary) diagrams, wiring diagrams, and other descriptive matter as required to fully describe the equipment specified under this Section.
4. Submittals shall show that the products furnished meet the applicable UL standards for its intended use.
5. Provide submittals as called out in Section 01610, GENERAL PRODUCT REQUIREMENTS, which demonstrate that design, fabrication, and installation of products meet the seismic requirements of that Section.
6. Electrical Drawing Requirements:
 - a. Electrical drawings and data shall be complete and shall represent the equipment proposed for this project. Drawings and data shall be adequate to demonstrate that the equipment meets the requirements of the Contract Drawings and Specifications, and also to be used by the Owner for operation, maintenance, and troubleshooting of the facility.
 - b. Provide electrical schematic diagrams and connection (wiring) diagrams which show locations and wiring for items specified in this Section, and also show interface wiring between items specified in this Section and other items on this project.
 - c. Electrical schematic diagrams, sometimes referred to as elementary diagrams or control diagrams, shall show complete control logic and interfaces for all systems furnished under this Section. Electrical schematic diagrams shall show circuits and device elements in ladder-diagram form without regard to physical location. "Typical" schematic diagrams are not acceptable; provide separate diagrams for multiple pieces of equipment.
 - d. Wiring diagrams shall show wire-by-wire, device-by-device, terminal-to-terminal, connections between devices within enclosures. Devices are

arranged not by their schematic relationship, but instead by their physical relationships. Wiring diagrams shall show each device within an enclosure, with each connection, annotated with wire numbers and terminal numbers throughout. Provide wiring diagrams for each enclosure, control panel, and unique item of equipment.

For all external connections, provide explicit references to interconnection diagrams, such that the user of the drawings can navigate from the enclosure to field wiring.

- e. For electrical schematic and wiring diagrams, manufacturer's standard drawings may be used, provided that they show the information described and are annotated to reflect the configuration for this project. For example, equipment numbers and descriptions unique to this project should be used, options not included should be stricken, signal interfaces with systems outside this package should be marked up to depict the actual interfaces on this project, information and detail should be added to meet the requirements above, and other standard and optional provisions should be annotated to match this project.
 - f. Interconnection diagrams shall show interconnection between devices and enclosures. Provide complete project-specific interconnection diagrams, which show the following for all power, control, signal, and communications interconnection:
 - 1) Terminal identification
 - 2) Wire numbers
 - 3) Conductor size, quantity
 - 4) Intermediate terminations
 - 5) Conduit/raceway designations
 - 6) References to corresponding enclosure wiring diagrams
 - 7) Pullboxes, handholes, manholes and enclosuresInclude terminal numbers and wire numbers which match terminal numbers and wire numbers on wiring diagrams, and on schematic diagrams. Include references to corresponding wiring diagrams.
 - g. Provide complete drawings and descriptive data, both mechanical and electrical, for motor control centers, control panels and any other power or control enclosure.
7. Motor Protective Devices: After installation but prior to energization, the Contractor shall compile, by visual inspection of equipment installed for each motor, the following data in neatly tabulated form:
- a. Equipment driven
 - b. Motor horsepower
 - c. Nameplate amperes
 - d. Service factor
 - e. Temperature rating
 - f. Overload catalog number
 - g. Overload current range and setting
 - h. Circuit breaker or fuse rating for combination starters
 - i. Circuit breaker trip setting and adjustable ranges for magnetic-only circuit breakers

This information shall be submitted to, and favorably reviewed by, the Engineer prior to the startup of any equipment and shall be included in the Operation and Maintenance Manual.

C. Layout Submittals:

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1. The Contractor shall inspect the locations of the conduit work. The Contractor shall observe conditions at the site, including any ongoing construction, verify location of equipment and field devices, confirm location of required excavation and trenches including location and depth of pipe taps, and resolve any potential interferences. Before beginning construction, inform the Owner of any conflicts or interferences.
 2. For trenching, the Contractor shall determine the specific routes of conduits, pullbox locations, possible underground interferences, planned depth, and other related work. For joint trenches, the Contractor shall plan the physical orientation of the conduits/piping, respecting minimum spacing shown on the plans. For conduits, the Contractor shall determine the routing, pullbox locations, terminations, and other design details, inspect for condition and suitability of any existing conduits that are to be reused, and inspect existing wiring to which a new connection is required.
 3. Prepare and submit dimensioned equipment layouts, room layouts, and area plans for indoor and outdoor electrical installations. Show all conduit penetrations. Show conduit entry/exit, required vertical and horizontal clearances, and other information as required. Include number, size, type, and identification of all conduits, including underground and embedded conduits. Show how conduits interface with ductbanks and or manholes/handholes, and identify routing around conflicts and obstructions. Show locations of conduits stubbed up for future use. Provide plan views, and provide elevations where vertical arrangement or headroom is an issue.
 4. Provide submittal drawings showing ductbanks, handholes, vaults, and other underground utilities. Make minor location adjustments as required. Coordinate with all trades and disciplines associated with underground construction.
 5. Coordinate these submittals with other submittals to ensure that dimensional information pertaining to this specific project is used.
- D. Butterfly Drawings:
1. Prior to installing conductors and cables, prepare and submit butterfly drawings for each manhole, handhole, or below grade pullbox.
 2. Following installation and plant startup, open each manhole, handhole, or below grade pullbox and perform a verification against the butterfly drawings. Update and resubmit the drawings, and include with the project record drawings (O&M manuals).
- E. Testing Submittals:
1. Submittal requirements for testing, test plans, and test reports are covered under the Article, TESTING.
- F. Field Wiring Interconnection Diagram:
1. Prior to the Functional Acceptance Test (FAT) and within 15 days after completion of installation of field interconnection wiring, the Contractor shall submit a complete interconnection wiring diagram.
 2. An as-built interconnection diagram shall be included in the O&M manual.
 3. The interconnection diagram shall show all electrical connections between equipment, consoles, panels, and field-mounted components; all component and panel terminal board identification numbers; and external wire and cable numbers. This diagram shall include all intermediate terminations between field elements and panels, such as terminal junction boxes and pull boxes. Diagrams, device designations, and symbols shall be in accordance with NEMA ICS 1-101.

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4. The Contractor shall determine which member or members of the Contractor's team shall provide this drawing(s).
5. The supplier(s) and/or subcontractor(s) supplying the equipment and systems covered under this and other Sections of this Specification shall provide to the Contractor complete information required by the Contractor for installation of field interconnection wiring and for preparation of field interconnection wiring diagrams. As a minimum, this information shall include the following items for all equipment and systems covered under this and other Sections of this Specification:
 - a. Tabulation of interconnection wiring, with recommended wire and conduit sizes
 - b. Equipment terminal points
 - c. Internal wire identifications

1.4 POWER OUTAGES

- A. If power outages are planned or required for the Contractor to perform work, the following procedures shall be followed:
 1. The Contractor shall prepare an outage plan for each planned outage. The outage plan shall be included in a System Outage Request which shall be submitted to the Owner or the Owner's representative at least 2 weeks before the planned outage.
 2. Outages shall be performed only after approval of the System Outage Request by the Owner or the Owner's representative.
 3. Where cutover activities will interrupt commercial power, onsite standby power, including fuel cost, shall be provided by the Contractor. Standby generator shall be suitably rated to supply full facility loads.
 4. Shutdown of existing facilities will be performed by Owner personnel or by the Contractor only under Owner personnel's supervision and with prior approval by the Owner or the Owner's representative.

1.5 POWER SYSTEM STUDIES

- A. General: Perform the following studies for the Water Treatment Plant electrical system, complete.
 1. Perform a short-circuit study, a coordination study, and an arc-flash study as described below. Perform field investigations as required.
 2. When reference is made to a fault or short circuit, the intent is to include both line faults and ground faults.
 3. The studies shall include the entire power distribution system, from the utility power source down to the level of panelboard, motor controllers, and any branch circuit disconnects (at the 480-volt level).
 4. The studies shall be performed from both normal power and standby power sources.
 5. The studies shall be made from complete one-line diagrams prepared by the Contractor, and which represent the as-built condition of the power distribution system. (Refer to the Article, "Field Investigation.")
 6. Include applicable information on all circuit breakers which have ground fault protection. Relay and breaker settings shall provide coordination among all trip settings, both with line faults and ground faults.
 7. Studies shall be performed at three separate loads:
 - a. All loads connected.
 - b. Approximately half of the loads connected.
 - c. Under very light-load conditions (5% to 10% of loads connected).
 8. Study results shall include:

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- a. Three phase and ground fault currents.
 - b. Operation on normal and on standby power.
 - c. All load conditions.
- B. Short-Circuit Study:
1. Perform a short-circuit study which calculates fault currents throughout the power distribution system.
 2. Proposed protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs.
 3. Include on each TCC graph, a complete title and one-line diagram with legend identifying the specific portion of the system covered.
 4. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
 5. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
 6. Plot the following characteristics on the TCC graphs, where applicable:
 - a. Electric utility's overcurrent protective device.
 - b. Low-voltage fuses, including manufacturers' minimum melt, total clearing, tolerance, and damage bands.
 - c. Low-voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands.
 - d. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
 - e. Conductor damage curves.
 - f. Ground fault protective devices, as applicable.
 - g. Pertinent motor starting characteristics and motor damage points, where applicable.
 - h. Pertinent generator short-circuit decrement curve and generator damage point.
 - i. The largest feeder circuit breaker in each motor control center and applicable panelboard.
 7. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.
 8. The study shall include both line-to-line faults and line-to-ground faults, both when the system is supplied by the utility, and when supplied by the standby generator. Tabulate fault currents on a one-line diagram (or diagrams) prepared by the Contractor.
 9. The study shall incorporate equipment ratings determined during the field investigation and available fault current which the Contractor shall obtain from the serving utility and the standby generator manufacturer. Provide coordination curves, settings, and calculations as required for a comprehensive study.
- C. Coordination Study:
1. Perform a coordination study, resulting in recommended settings for system protective devices.
 2. Recommended settings for protective devices shall ensure that normal motor starting shall not result in tripping of circuit breakers.
 3. Include calculations for coordination with ground fault protection on the upstream breakers. Protective device settings shall prevent a ground fault on the load side of any downstream breaker from tripping an upstream circuit breaker.
 4. The coordination study shall incorporate instantaneous blocking, such that in the event of a fault downstream of a breaker, the upstream breaker will delay tripping until the downstream breaker has time to trip.

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5. Provide recommended settings for protective devices.
6. Submit the results of the short-circuit study and coordination study for review.
7. Following favorable review by the Engineer, protective devices shall be adjusted by the Contractor to the recommended settings.
8. Setting of protective devices, including all programming and configuration of protective devices, shall be performed by the manufacturer(s) of the protective devices or a qualified technical representative certified by the manufacturer.

D. Arc-Flash Study:

1. Perform an arc-flash study as described in NFPA 70E, IEEE Standard 1584, and as specified herein.
2. The study shall calculate the hazard/risk category at each point in the power distribution system.
3. The arc-flash hazard analysis shall include all significant locations in 240-volt and 208-volt systems fed from transformers equal to or greater than 125kVA where work could be performed on energized parts.
4. The study shall identify the personal protective equipment (PPE) required for each hazard/risk category.
5. Submit the draft arc-flash study for review. Include recommendations.
6. Following favorable review by the Engineer, furnish and install hazard labeling tags on each equipment item identifying the hazard risk category and the required PPE to work on energized equipment.

E. Field Investigation For Power System Studies

1. Perform a field investigation, and record information in order to perform the power system studies described herein.
2. The field investigation shall cover the entire existing power distribution system, from the utility feed down to the level of panelboard, motor controllers, and any branch circuit and motor feeder disconnects (at the 480-volt level).
3. The investigation shall include size, length, and type of feeders and branch circuits. The results of the investigation shall confirm, correct, and supplement the information shown on the Contract one-line diagrams.
4. Results of the investigation shall be submitted for review. Results shall include a complete set of one-line diagrams prepared by the Contractor and a tabulation of current settings of protective devices (breakers, motor protective devices, protective relays, etc.).

1.6 FIELD INVESTIGATIONS AND PREPARATION OF DRAWINGS

- A. This project includes field investigation, demolition, and rehabilitation of existing equipment. Downtime at operating facilities will be required, with extensive planning requirements.
- B. Before submitting a bid, visit the site and determine conditions at the sites and at all existing structures in order to become familiar with existing conditions and electrical systems which will affect the work required under this Contract. No subsequent increase in Contract cost will be allowed for additional work required because of the Contractor's failure to fulfill this requirement.
- C. Prior to preparing any submittals associated with site installations and prior to performing any construction work at a site, perform a field investigation of that site and prepare related drawings as described below.

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- D. The electrical drawings were developed utilizing information from past record drawings. Verify all scaled dimensions.
- E. Using detailed information ascertained during the field investigation, prepare and submit the following drawings as specified in this Section.
 - 1. Elementary diagrams
 - 2. Wiring diagrams
 - 3. Layout submittals
- F. Control Wiring Modifications:
 - 1. The control schematics included in the Contract Documents are schematic in nature and do not represent all of the physical wiring details required for the work. Further, the control schematics are based on the best available information at the time of design, but will require field verification prior to construction.
Prior to preparing wiring submittals, the Contractor shall carefully inspect each control circuit to be modified and verify the exact field conditions, review the control diagrams (elementary diagrams) in the Contract Documents, and then verify that the circuits shown will operate in a reasonable and logical fashion and in accordance with the applicable Control Strategies. The Contractor shall then prepare and submit elementary diagrams and wiring diagrams.
- G. Enclosures and Panels:
 - 1. Prior to submitting panel construction drawings for a new enclosure, or for modifications to an existing enclosure, the Contractor shall inspect the field conditions to determine all site-specific requirements, including the size, layout, and details of existing panels and enclosures as required to perform the work. The Contractor shall verify available space and review surrounding conditions for suitability of installing new enclosures, and verify that existing wiring to be reused is long enough to reach its intended new termination point without damage during construction. After thorough field inspection, the Contractor shall then submit panel drawings.

1.7 OPERATION AND MAINTENANCE MANUALS

- A. Provide operation and maintenance manuals within 20 days after the start of the Functional Acceptance Test (FAT). Include the following (both hardcopies and electronic copies on CD):
 - 1. Corrected submittals as required herein.
 - 2. Record (as-built) wiring diagrams, control schematic (elementary) diagrams, interconnection diagrams, and equipment drawings.
 - 3. For all equipment suppliers, list of current names, addresses, and telephone numbers of those who should be contacted for service, information, and assistance.
 - 4. Record (as-built) Contract Drawings marked with red pencil to show revisions to the electrical work and the underground raceway and cable when different from the original Contract Drawings. Prepare by obtaining new, clean sets of Contract Drawings from the Engineer, and pay all costs for same.
 - 5. Test results.
- B. The O&M manuals shall include operating and maintenance information for all subsystems and components covered in this Section. The O&M information shall be in sufficient detail to allow the operation, removal, installation, adjustment, calibration,

and maintenance of each component provided under this Section down to the printed circuit board level.

- C. Each set of manuals shall be assembled in one or more three-ring binders, each with a title page, table of contents, and heavy section dividers with labeled index tabs. When more than one binder is required, the binders shall be labeled "Volume 1," "Volume 2," etc. The table of contents shall encompass the entire set of O&M manuals, shall list the contents of each volume, and shall appear in each binder.
- D. Additional O&M requirements are described in Section 01330, SUBMITTAL PROCEDURES.

1.8 WARRANTY

- A. The work and materials covered in this Section shall be guaranteed for a period of 1 year from the date of acceptance thereof against defective materials, design, and workmanship.
- B. Warranty coverage shall include any and all costs for labor, travel, lodging, and parts.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Unless otherwise indicated, provide all first-quality new materials, free from any defects, and suitable for the intended use and the space provided. Provide materials that are UL listed, recognized, classified, or verified wherever standards have been established.
- B. Furnish and install all incidental items not specifically shown or specified which are required by good practice to provide the complete systems specified herein. This requirement includes installation and termination items for all field interconnection wiring, including that which terminates in equipment, motor controllers, instruments, and package systems.
- C. Where two or more units of the same class of material or equipment are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer.

2.2 SEISMIC REQUIREMENTS

- A. Products shall be designed and fabricated to meet the applicable requirements of Section 01610, GENERAL PRODUCT REQUIREMENTS. Product submittals shall confirm that product seismic requirements are satisfied.
- B. This Article covers the following items:
 - 1. Conduit/raceways
 - 2. Boxes/enclosures greater than 12 inches in any dimension (other than buried boxes, handholes, and pullboxes)
 - 3. Light fixtures
 - 4. Fans (12-inch diameter or greater)

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5. MCC's
6. Wall-mounted equipment (motor starters, disconnects, etc.)
7. Control panels
8. Other items of weight 40 pounds or greater

2.3 STANDARD PRODUCTS

- A. Unless otherwise indicated, provide materials and equipment which are products of manufacturers regularly engaged in the production of such materials and equipment. Provide the manufacturer's latest design that conforms to these Specifications.

2.4 SUPPLY VOLTAGE DISTORTION

- A. Electrical (60-Hz) power supplied to equipment furnished under this Section may contain up to 10% harmonic distortion in voltage. All systems and equipment covered in this Section shall operate properly under this condition of supply voltage distortion.

2.5 EQUIPMENT FINISH

- A. Unless otherwise indicated, finish for electrical equipment and enclosures shall be manufacturer's standard gray or ANSI 61 gray over a primer and rust inhibitor.

2.6 ENCLOSURES

- A. Unless indicated otherwise, provide suitable NEMA-rated enclosures for all devices and equipment. Enclosures shall meet the recommendations of the device or equipment manufacturer and shall be safely and securely mounted.
- B. All pullboxes, junction boxes, switchgear, motor control centers (including individual motor starter buckets), and enclosures provided or modified under this Section shall be provided with permanently mounted nameplates bearing the entire tag number of the enclosure and/or equipment contained within, as identified on the Drawings.
- C. Nameplates shall be engraved, rigid, laminated phenolic adhesive back. Unless noted otherwise, color shall be black with white letters with 1/2-inch-high characters.
- D. Components or equipment (including terminal blocks) contained and mounted within enclosures shall also have laminated phenolic nameplates with 3/16-inch-high characters.

2.7 CONDUIT

- A. Galvanized Rigid Steel Conduit (GRS): Rigid steel conduit including couplings, elbows, nipples, and other fittings shall be galvanized after fabrication by hot-dipping, electroplating, or a metallizing process, and shall meet the requirements of ANSI C80.1 and ANSI C80.4, NEMA FB 1, UL-6, and the NEC. Conduit bodies and covers shall be of cast malleable galvanized ferrous materials. Provide covers with gaskets.
- B. Electrical Metallic Tubing (EMT): Electrical metallic tubing, including couplings and elbows, shall meet the requirements of ANSI C80.3, UL-797, and the NEC. Compression-type couplings shall be used. Do not use set screw-type couplings, set screw-type bushings, or set screw-type fittings.

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- C. Rigid PVC Conduit (PVC): Rigid polyvinyl chloride (PVC) conduit shall be schedule 40, suitable for concrete-encased usage, direct burial underground, and exposed use. Rigid PVC conduit including couplings, elbows, nipples, and other fittings shall conform to the requirements of the latest edition of NEMA TC 2 and NEMA TC 3, UL, NEC, Federal Specification WC-1094, and shall meet applicable ASTM test requirements for the intended use. PVC conduit shall be rated 90 degrees C.
- D. Flexible Conduit (flex): Flexible conduit shall be moisture-proof flexible steel, polyvinyl chloride jacketed, and shall be Anaconda Sealtite conduit, Electrifix, or equal. Flexible conduit used in dry, concealed areas for lighting fixtures may be non-moistureproof flexible steel conduit, Anaconda Type CN, Triangle Tristeel, or equal.

2.8 BOXES

- A. General:
 - 1. Boxes shall not be smaller than required to meet the minimum requirements of the National Electrical Code (NEC).
 - 2. Use special boxes as shown on the Drawings.
- B. Sheet Steel Boxes, Small:
 - 1. These boxes shall include sizes up to 4-11/16 inches square and ganged switch boxes.
 - 2. Sheet steel boxes shall be zinc- or cadmium-plated, and shall be of the one-piece stamped or drawn type, or welded, except when not available in the size required.
 - 3. Provide boxes of adequate size without using box extensions. Boxes shall have a minimum depth of 2 inches, except where shallower boxes are required by structural conditions and where specifically approved by the Engineer. Switch and receptacle boxes shall be 2 inches wide by 4 inches high, minimum size. Other boxes shall be 4 inches wide by 4 inches high, minimum size.
 - 4. For hollow masonry construction, provide boxes of sufficient depth so that conduit knockouts or hubs are in the masonry void space.
 - 5. Provide covers and device plates as called out under RACEWAY SYSTEM, Type to be used, in the Part, EXECUTION.
 - 6. Small sheet steel boxes shall be Appleton OB/SB Series, Steel City, Bowers, or equal.
- C. Sheet Steel Boxes, Large:
 - 1. Boxes shall be 16-gauge sheet steel, minimum, with welded seams.
 - 2. Boxes shall be NEMA 12, minimum, in dry locations and NEMA 3R, minimum, in damp and wet locations.
 - 3. Unless shown otherwise on the Drawings, provide hinged covers on boxes with length or width greater than 24 inches. Smaller NEMA 12 boxes may have screw covers. Hinges shall be full length, with stainless steel hinge pins. Hinged covers shall have secure closing provisions. Provide draw-pull catches (two minimum), three-point latch with a single handle, or clamps on three sides to clamp the cover.
 - 4. Finish shall be ANSI 61 gray over a primer and rust inhibitor.
 - 5. Boxes shall be Hoffman, Tanco, Keystone, Electromate, or equal.
- D. Cast Boxes:
 - 1. Cast boxes shall be galvanized malleable ferrous metal, gasketed and watertight, with threaded conduit hubs and mounting lugs. Boxes shall have a minimum (inside) depth of 2 inches.

2. Provide stamped steel covers with gaskets and stainless steel or galvanized steel screws; except provide weatherproof cast covers for switches and receptacles outdoors and in other wet or damp locations.
3. Cast boxes shall be Crouse Hinds FD, Appleton FD, or equal.

2.9 COVERS AND DEVICE PLATES

- A. Device plates shall be stamped stainless steel, one-piece, satin finish with matching screws with oval heads. Stainless steel metal device plates shall be Hubbell S-Series, Leviton 84000 Series, or equal.
- B. Stamped steel covers and device plates shall be one-piece, and shall fit closely and tightly to the box on which they are installed. Covers shall be zinc- or cadmium-plated, with galvanized or stainless steel screws, and shall have gaskets in wet and damp locations. On surface-mounted boxes, device plates shall be raised with rounded edges and shall not extend beyond the sides of the box.
- C. Cast covers and plates shall be galvanized malleable ferrous metal with gaskets and stainless steel screws; except cast receptacle plates shall be die-cast, copper-free aluminum.
 1. Cast switch plates in wet and damp locations shall have integral external operators for each switch. Plates shall be Crouse Hinds "Feralog" DS Series, Appleton malleable iron FSK Series, or equal.
 2. Cast receptacle plates in wet and damp locations shall have spring-loaded, gasketed, weatherproof covers for each receptacle. These plates shall be weatherproof when in use (with attachment plug cap inserted), as described in NEC 406.8(B)(1). Plates shall be Thomas & Betts Red Dot Code Keeper, Carlon Weatherproof, Appleton Weatherproof, or equal.

2.10 HANDHOLES

- A. Handholes (HH):
 1. Handholes shall be concrete traffic-rated boxes and covers, suitable for H-20 traffic loading, unless noted otherwise, as shown on the Drawings and as specified herein. Minimum size shall be 24 inches by 15 inches by 12 inches deep or as shown on the Drawings. Provide galvanized steel covers with hold-down bolts. Provide extensions as required.
 2. Covers shall be permanently identified (not painted) with the words ELECTRICAL or CONTROLS, as appropriate.
 3. Handholes shall be Christy Electrical Box, Cook Electric Pull Box, or equal.

2.11 CONDUCTORS

- A. This Article covers insulated wire and cable, not buses.
- B. Conductors shall be copper. Conductors, including insulation, cabling, jacket, filler, shielding, covering, and testing, shall meet applicable requirements of ICEA S-19-81 and S-61-402, the NEC, and UL.
- C. Conductors shall have 600-volt type THWN insulation.

- D. Conductors identified on the Drawings as TSP shall be twisted, shielded pairs, shall be Type PLTC/ITC for use in industrial instrumentation circuits, and shall be AWG 18, 19-strand copper, with PVC insulation rated 300 volts. The shield shall be aluminum polyester with copper drain wire. The outer jacket shall be PVC. The cable shall be rated 90 degrees C, minimum. Maximum diameter of No. 18 TSP shall be 0.25 inch. The cable shall be Belden 9318 Type PLTC and ITC, or equal.

2.12 RACEWAY TAGS

- A. Provide permanent, nonferrous metal markers with raceway designations pressure stamped, embossed, or engraved onto the tag. Tags relying on adhesives or taped-on markers are not acceptable. Attach tags to raceways with No. 16 AWG, stainless steel wire at each end and at least once in every 50 feet near the midpoint of exposed conduit in ceiling spaces and surface mounted.

2.13 WARNING TAPE

- A. Where trenches are required, provide heavy-gauge, yellow plastic tape of 6-inch minimum width for trenches containing electric circuits. Utilize tape made of material resistant to corrosive soil. Use tape with printed warning that an electric circuit is located below the tape. Manufacturers and types: ITT Blackburn Type YT or RT; Griffolyn Co. Terra-Tape; or equal.

2.14 SPARE PARTS, CONSUMABLE ITEMS, AND TOOLS

- A. Spare parts, consumable items, and tools shall meet the requirements specified elsewhere in these Contract Documents.
- B. Fuses: Provide 20% of each size and type used rounded to the next whole number, but not less than five of each size and type.
- C. Indicating Light Bulbs: Provide 20% of each size and type used rounded to the next whole number, but no less than 10 of each type. This requirement applies to annunciator light bulbs as well, if any are supplied under this Section.

PART 3 - EXECUTION

3.1 GENERAL

- A. Work shall be performed in a workmanlike manner by craftsmen skilled in the particular trade. Work shall be performed in accordance with the Drawings, Specifications, manufacturer's recommendations, and the best practice of the trade. Completed work shall present a neat and finished appearance.
- B. Coordinate electrical work with the Owner and the work of other trades to avoid conflicts, errors, delays, and unnecessary interference during construction.

3.2 PROTECTION DURING CONSTRUCTION

- A. Throughout this Contract, provide protection for materials and equipment against loss or damage and from the effects of weather. Prior to installation, store items to be

installed in indoor locations. Items subject to corrosion under damp conditions and items containing insulation, such as transformers, motors, and controls, shall be stored in indoor, heated, dry locations.

- B. Following installation, protect materials, equipment, and insulation from corrosion, physical damage, and moisture. Cap conduit runs during construction with manufactured seals. Keep openings in boxes or equipment closed during construction. Provide temporary heating source for electrical equipment in damp locations or locations subject to condensation, including transformers, motors, and controls, until construction is complete and equipment is energized.

3.3 EQUIPMENT INSTALLATION

- A. Follow the manufacturer's installation recommendations unless otherwise indicated. Follow the Engineer's decision, at no additional cost to the Owner, wherever any conflict arises between the manufacturer's instructions, State or other codes and regulations, and these Contract Documents. Keep copy of the manufacturer's installation instructions available on the jobsite for review at all times.
- B. Install freestanding equipment in accordance with the manufacturer's recommendations. Unless noted otherwise, mount freestanding equipment on a 4-inch concrete pad. Secure motor control centers (MCC's) and other freestanding equipment rigidly to floors or mounting pads with anchor bolts, expansion shields, or other approved means. Grout mounting channels provided with MCC's into the floor or mounting pads, unless the MCC's are firmly anchored with the specified concrete anchors, in which case the channels are not required.
- C. Seismic Requirements
 - 1. Installation of products provided under this Section shall meet the applicable requirements of Section 01610, GENERAL PRODUCT REQUIREMENTS.
 - 2. Provide calculations signed by a registered civil or structural engineer registered in the state where the project is located. Product installation shall meet the requirements of the calculations.

D. Clearances

Coordinate the layout, fabrication, and installation of equipment and meet all applicable clearance requirements in front of and around equipment. Meet the requirements of the National Electrical Code, these Specifications, and the Authorities Having Jurisdiction. Obtain approvals from Authorities Having Jurisdiction, including the power company.

- E. Unless noted otherwise, pieces of freestanding equipment located adjacent to one another shall be installed such that the fronts line up.

3.4 DEMOLITION

- A. This is a rehabilitation project which includes demolition, as described in the Drawings and Specifications. Required demolition of electrical equipment, wire and conduit, and other equipment is covered under this Section. Demolition work includes disconnecting, removing, capping, patching, painting, and cleanup.

- B. Where existing materials and equipment are removed or relocated, remove all materials no longer used, such as studs, straps, conduits, and wires. Remove or cut off concealed or embedded conduit, boxes, or other materials and equipment to a point at least 3/4 inch below the final finished surface.
- C. Repair affected surfaces to conform to the type, quality, and finish of the surrounding surface in a neat and workmanlike manner. Follow any specific instructions in other sections of these Specifications. Utilize skilled craftsmen of the trades involved.

3.5 CUTTING AND PATCHING

- A. Do not cut or notch any structural member or building surface without specific approval of the Engineer. Carefully carry out any cutting, channeling, chasing, or drilling of floors, walls, ceilings, paving, or other surfaces required for the installation, support, or anchorage of conduit, raceways, or other electrical materials and equipment. Following such work, restore surfaces neatly to new condition using skilled craftsmen of the trades involved, at no additional cost to the Owner.

3.6 CLEANING AND TOUCHUP PAINTING

- A. Keep the premises free from accumulation of waste material or rubbish. Upon completion of work, remove materials, scraps, and debris from the premises and from the interior and exterior of all devices and equipment. Refinish damaged surfaces to new condition using skilled craftsmen of the trades involved, at no additional cost to the Owner.

3.7 RACEWAY SYSTEM

- A. General: Unless otherwise specified or indicated, wiring shall consist of insulated conductors installed in raceways of the types indicated.
- B. Table 1 identifies the types of conduit and boxes to be used in various locations.

TABLE 1 – CONDUIT AND BOX APPLICATIONS

Line No.	Location	Conduit (Notes 3, 4)	Small Boxes (Up to 4-11/16 + Ganged Switch Boxes)	Large Boxes and Terminal Junction Boxes (TJBs)
1	Indoor dry locations with concealed conduit:			
1.1	In block walls and poured concrete walls	PVC	Sheet steel	NEMA 1 sheet steel
2	Indoor dry locations with exposed conduit:			
2.1	Up to 10 feet above floor	GRS (Note 5)	Cast	NEMA 1 sheet steel
2.2	Above 10 feet above floor	EMT	Sheet steel	NEMA 1 sheet steel
3	Outdoor and wet and damp locations	GRS	Cast	NEMA 3R
4	Underground conduit	PVC/Taped GRS (Note 1)	- -	- -

Notes for Table 1:

1.	Use rigid polyvinyl chloride (PVC) conduit for buried and embedded conduit; except use tape-wrapped galvanized rigid steel (GRS) through expansion joints, for at least 5 feet on both sides of the ends of ductbanks, of penetrations through footings and outside walls, for all buried and embedded 90-degree bends (ells), under equipment mounting pads, where embedded in exterior light pole foundations, and where conduit changes from underground to exposed or from embedded to exposed.
2.	Not used.
3.	EMT may be used in place of PVC in dry, concealed locations, and GRS may be used as a substitute for EMT or PVC in any location.
4.	Use liquidtight flexible metal conduit (flex) for the last 18 to 36 inches of conduit run to a piece of equipment where required to isolate vibration or to facilitate maintenance or adjustment. Flexible metal conduit (non-moistureproof) may be used in dry, concealed areas for lighting fixtures.
5.	EMT may be used in dry locations where dropping from above to electrical equipment more than 6 feet above the floor.

- C. Minimum size conduit shall be 1/2 inch; except 3/4-inch minimum shall be used for underground and embedded conduit, unless indicated otherwise on the Drawings.

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- D. Use stamped steel covers and device plates in dry locations, and use cast weatherproof covers and device plates with gaskets in wet and damp locations.
- E. Boxes:
1. Provide each outlet in the wiring or raceway systems with a box to suit the conditions encountered. Each box shall have sufficient volume to accommodate the number of conductors entering the box in accordance with the requirements of the NEC. Provide flush or recessed fixtures with separate junction boxes when required by the fixture terminal temperature requirements. Boxes used with concealed conduits shall be flush mounted, unless otherwise indicated on the Drawings.
 2. Install boxes in a rigid and satisfactory manner, and support boxes independently of the conduit. For frame construction, use bar hangers; on concrete or brick, fasten directly to the surface using bolts or expansion shields; on hollow masonry units, use toggle bolts or expansion shields; and on steelwork, use machine screws. Threaded studs driven in by a powder charge and provided with lock washers and nuts are acceptable in lieu of expansion shields. Set flush-mounted sheet steel boxes flush with the finished surface. Boxes shall be of adequate size without box extensions, but provide suitable extension rings as required. Mounting hardware shall be galvanized, unless noted otherwise.
 3. Where shown on the Drawings, use traffic-rated concrete boxes with galvanized steel covers for outdoor boxes at grade.
- F. Installation:
1. Conduit system installation shall meet or exceed the requirements of the NEC. Raceways shall be concealed or exposed, as indicated, and shall be at least 12 inches away from parallel runs of flues and steam or hot water pipes. Group raceways in same area together. Raceways shall be supported at intervals required by the NEC and shall have exposed runs installed parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Do not install crushed or deformed raceways. Avoid traps in raceways where possible. Take care to prevent the lodgment of plaster, dirt, or trash in raceways, boxes, fittings, and equipment during the course of construction. Raceways shall be entirely free of obstructions or shall be replaced. All conduit shall be reamed, deburred, and cleaned for proper introduction of wires and cables. Immediately after installation, plug or cap all conduit ends with watertight and dusttight conduit seals until the time for pulling wires. In block walls, do not run conduit in the same horizontal course with reinforcing steel.
 2. Avoid field-made bends and offsets where possible, but where necessary make with an approved hickey or conduit bending machine. Heating of conduit to facilitate bending shall not be acceptable, except as noted hereinafter. Changes in direction of runs shall be made with symmetrical bends or cast metal fittings. The total sum of all bends and offsets in a continuous run shall not exceed 270 degrees. In addition, for conduit runs greater than 100 feet, all bends and offsets shall not exceed 180 degrees.
 3. Install insulated bushings on the ends of all conduits, except where conduits terminate in threaded hubs on cast boxes or cabinets. Threadless fittings for electrical metallic tubing shall be of the type approved for the conditions encountered. Use insulating throat connectors where tubing terminates in boxes or cabinets. Provide suitable expansion fittings for raceways crossing expansion joints in structures or concrete slabs, or provide other suitable means to compensate for expansion and contraction.

4. Wooden plugs inserted in concrete or masonry are not acceptable as a base for raceway fastenings, nor shall raceways or pipe straps be welded to steel structures. Support multiple raceways adjacent to each other by ceiling trapeze. Support individual raceways by wall brackets, strap hangers, or ceiling trapeze fastened by toggle bolts or expansion shields on hollow masonry units, expansion shields on concrete or brick, and clamp-type fasteners approved for the type of installation on steelwork. Threaded studs driven in by a powder charge and provided with lock washers and nuts are acceptable in lieu of expansion shields.
5. Conduit shall be of the greatest practicable single length between joints. Joints shall be made up with approved jointing compound. Do not use red lead as a joint compound. Do not use nails to fasten conduit. Do not use wire in lieu of straps or hangers, and do not notch structural members for the passage of raceways except with prior approval of the Engineer.
6. Install and equip conduit, boxes, and fittings installed outdoors or in other wet locations so as to prevent water from entering the conduit. Do not run conduit through equipment foundation pads.
7. Provide a seal inside each conduit or raceway entering buildings and structures, in raceways entering boxes and enclosures in wet locations. Seal inside the conduit with duct seal putty, or suitable plastic expansible compound to prevent passage of rodents, gasses, and liquids. Duct seal shall be as manufactured by Q-Pak, Rainbow, or equal.
8. Empty ducts and conduits shall be identified at both ends and shall be capped and provided with a copper pull wire, No. 14 AWG minimum, or 1/8-inch-minimum non-nylon cord, unless noted otherwise.
9. For PVC conduit, use factory-made ells where applicable. Use approved heating methods for forming all other bends. Provide expansion joints as required by the NEC and as recommended by the manufacturer. When joining PVC conduit to metallic fittings, use approved PVC terminal adapters. When joining PVC conduit to rigid steel conduit, use an approved PVC female adapter. PVC conduit joints shall be solvent-welded with solvent recommended by the conduit manufacturer. Where PVC conduit is used, a separate grounding conductor shall be run with the conductors.
10. Concealed, embedded, and buried conduits shall emerge at right angles and shall have none of the curved portion of a bend exposed, unless otherwise approved by the Engineer. Embedded and underground ells shall be galvanized rigid steel conduit.
11. Final connection to motors, motor heaters, wall- or ceiling-mounted fans, dry transformers, and to other equipment where flexible connection is desired or required to minimize vibration or to facilitate maintenance or removal of equipment, shall be made with flexible conduit. Length shall be 18 inches to 36 inches, unless otherwise approved by the Engineer.
12. Flexible conduit shall not be used as a ground. Where flexible conduit is used, a separate grounding conductor shall be run with the conductors. Flexible conduit shall be secured with conduit clamps or equivalent means except where the flexible conduit is fished and where sections less than 4 feet in length are used in concealed areas for lighting fixtures.

G. Underground and Embedded Conduit

1. Arrangement and Routing:
 - a. Arrange multiple conduit runs substantially in accordance with details shown on the Drawings. Locate underground conduits where indicated on the Drawings.
 - b. Make minor changes in location or cross section as necessary to avoid obstructions or conflicts. Where raceway runs cannot be installed substantially as shown because of conditions not discoverable prior to digging of trenches, refer the conflict to the ENGINEER for instructions before further work is done.
 - c. Where piping or other utility systems are encountered or being installed along a raceway route, maintain a 12-inch-minimum vertical separation between raceways and other systems at crossings. Maintain a 12-inch minimum vertical and 12-inch-minimum horizontal separation between raceways and other systems in parallel runs. Do not place raceways over valves or couplings in other piping systems which may restrict access. Refer conflicts with these requirements to the ENGINEER for instructions before further work is performed.
2. Except as otherwise indicated, cover for underground and embedded conduit shall be as tabulated in Table 2, except conduit under building slabs may be just below the slab. Do not embed conduit in slabs. Conduit installation shall meet the requirements of the NEC.

TABLE 2
COVER REQUIREMENTS FOR BURIED RACEWAYS

Type of Buried Raceway	Areas of Vehicle Access (Roads, Parking Areas, etc.)	Other Areas
Direct-Buried Conduit	36 inches, with warning tape 12 inches above conduit	18 inches, with warning tape 12 inches above conduit

3. On steel conduit installed underground, wrap the entire length with tape using 1/2-inch overlap. Use PVC-based pressure-sensitive all-weather tape, 20-mil minimum thickness, as recommended by the manufacturer for corrosion protection of underground conduits. Tape shall be Scotchwrap 51 or equal.
4. Separate parallel runs of four or more conduits in a single trench with preformed, nonmetallic spacers designed for the purpose. Install spacers at 6 feet or at intervals not greater than that specified in the NEC for support of the type of conduit used. Support conduits installed in fill areas suitably to prevent accidental bending until backfilling is complete.
5. Minor changes in location or cross sectional arrangement of conduits shall be made as necessary to avoid obstructions, etc. Where conduit runs cannot be installed substantially as shown because of conditions not discoverable prior to digging of trenches, the condition shall be referred to the Engineer for instructions before further work is done. Underground conduit work shall be coordinated with other construction work.
6. Existing outside services shall be maintained in operation unless otherwise directed by the Engineer.

H. Trenching and Backfill

1. Unless otherwise noted, conduit and direct-buried cable shall have a minimum cover as shown in Table 2 of these Specifications. Trench bottoms shall be free of rocks and other hard objects. Bedding material shall be used for a depth of 3 inches below the conduit or cable, and bedding material shall be used for the zone 6 inches above the conduit or cable.
2. Bedding material shall contain no rocks larger than 3/4 inch in diameter and shall be free from roots and debris.
3. Unless otherwise shown on the Drawings, that zone from 6 inches above the conduit to the top of the trench shall be the material removed from the trench; except that it shall contain no rocks larger than 6 inches and shall be free of roots and debris.
4. Where conduit trenches are located in roads or in structural backfill, the compaction requirements shall be as required for those areas. Where conduit trenches are located in an area where backfill material specifications are more rigid than those of this section, the trench backfill shall meet the more rigid specification. In any event, trench backfill compaction shall be at least equal to that of the material adjacent to the trench.
5. Conduits shall be placed parallel in the bottom of the trench. Where conduits are required to cross, they shall be separated by a minimum of 3 inches of bedding material. Where more than one level of conduit are placed in the same trench, they shall be separated by a minimum of 3 inches of bedding material.
6. Backfill shall include warning tape over the entire length of the run.
7. Conduit trenches in areas to be paved or improved under this project shall be installed and backfilled before the area is paved or improved.
8. For trenches through existing paving, the paving shall be saw cut in order to obtain a neat vertical edge for repaving. Saw cuts shall be parallel and shall be a minimum of 6 inches outside of the trench area. Paving shall meet the requirements of other Sections of this Specification.
9. All existing improvements damaged as a result of the Contractor's operation shall be reconstructed by the Contractor at no cost to the Owner.

I. Penetrations

1. Penetrations may be cast in place or run through blockouts or holes, except where waterproof penetrations are required. Dry pack with non-shrink grout around conduits run through blockouts or holes.
2. Where a waterproof penetration through a concrete structure is shown on the Drawings or called out elsewhere in the Specifications, an approved malleable-iron watertight entrance sealing device shall be provided. Each end of the device shall have a gland-type sealing assembly with pressure bushings which may be tightened at any time, except where a concrete envelope is specified or shown on the Drawings. Where there is a concrete envelope specified or shown on the Drawings, a sealing gland assembly may be on the more accessible side only. The device shall be securely anchored into the concrete with one or more integral flanges. The sealing device shall be OZ/Gedney Type WSK, Spring City Type WDP, or equal.
3. As an alternative, where a waterproof penetration is required the seal may be of the modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the raceway and wall opening. Links shall be loosely assembled with stainless steel bolts to form a continuous rubber belt around the raceway with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tightening of the

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bolts shall cause the rubber sealing elements to expand and provide a waterproof seal between the raceway and wall opening. The seal shall be constructed so as to provide electrical insulation between the raceway and wall, thus reducing chances of cathodic reaction between these two members. Inside diameter of wall openings or sleeves and other details of installation shall be in accordance with the manufacturer's recommendations. The seal shall be Thunderline Link-Seal, or equal.

3.8 CONDUCTORS AND TERMINATIONS

A. General

1. Wire shall be continuous from outlet to outlet of the raceway system. Conductors shall not be smaller than No. 12 AWG for lighting and power circuits, No. 14 AWG for control circuits, and No. 18 AWG for twisted shielded cables, unless otherwise indicated.
2. Conductors shall be stranded; except solid conductors No. 10 AWG and No. 12 AWG may be used for branch circuit power wiring and for lighting and receptacle circuits.
3. Provide adequate length pigtails for conductors connected by others.
4. Arrange wiring in enclosures neatly cut to proper length. Apply terminals to control wiring, including spares, for connection to terminals, and bridle and secure in an approved manner. List all circuits emanating from power, distribution, and lighting panelboards by function on a typed directory card.
5. Identify conductors at all splices and terminations using sleeve-type wire markers permanently marked with the same wire number as shown on the submitted control schematics (elementary diagrams) and wiring diagrams.

B. Conductor Identification

1. Provide a complete Contractor-developed conductor identification system so that after installation, circuits can be easily traced from origin to final destination. The Contractor shall submit a proposed identification system format tailored to match existing system(s) in use and the Owner's preferences. The Owner will mark up the sample, and the resulting format shall be carried throughout the project.
2. Identify conductors at all splices and terminations using sleeve-type wire markers permanently marked with the same wire number as shown on the submitted control schematics (elementary diagrams) and wiring diagrams.
3. Identify conductors and multiconductor cables at all pullboxes using a portable printer using shrink tube labels. The labels shall wrap entirely around the conductor or cable. Handwritten labels are not acceptable.
4. Cables No. 8 AWG and smaller shall be factory color coded with a separate color for each phase and neutral. No. 6 AWG and larger may be black with colored 3/4-inch vinyl plastic tape for 6 inches at each end and at all terminations and in pullboxes.
 - a. All 120/208-volt system feeder cables and branch circuit conductors shall be color coded as follows: Phase A-black; Phase B-red; Phase C-blue; and Neutral-white.
 - b. The 480/277-volt system conductors shall be color coded as follows: Phase A-brown; Phase B-orange; Phase C-yellow. Insulated ground wire shall be green. Color coding and phasing shall be consistent throughout the site. Bus bars at panelboards, switchboards, and motor control centers shall be arranged phase A-B-C, top to bottom or left to right, facing the connecting lugs. The cables shall be labeled at terminations and in pullboxes, handholes, and manholes.

5. General purpose 60-Hz control conductors shall be color coded violet, except neutrals shall be white.
6. General purpose dc control conductors shall be color coded blue.

C. Lacing of Wires and Cables

1. All wires and cables shall be tagged and laced in pullboxes or junction boxes, and at each termination. Wires and cables shall be laced so that the wires of the individual circuits are laced together by circuit, and the laced-together circuit or cable shall be tagged with the circuit number and equipment served. All wiring entering and exiting the control panels shall be bundled into groups and clearly labeled as to the field destination of the wiring. Power, lighting, control, alarm, and instrumentation wiring shall be bundled, laced, and tagged, as specified herein.

D. Splices and Terminations

1. Preferably, conductors shall be run between pieces of equipment without splices. Splices, where required, shall be made in accessible boxes only. Splices shall not be made below finish grade unless indicated on the Drawings or approved by the Engineer.
2. Where splices are used below grade or in wet locations, including vaults, approved splice kits shall be used. The splice kits shall be suitable for use underground, shall be rated 1,000 volts minimum, and shall make use of a two-part, low-viscosity polyurethane. Splice kits shall be 3-M 72-N Series, 3-M 85 Series, or equal.
3. Soldering shall not be used, except where required by the type of device terminals.
4. Make splices and terminations of stranded conductors using crimp-type or mechanical devices suitable for the type and size of conductor used. Provide termination devices for all field interconnection wiring among all equipment, products, and instruments on the project.
5. For control wiring, use pre-insulated ring-tongue crimp-type devices, except where terminals of factory-supplied equipment do not so allow. Use terminals, connectors, and installation tools as recommended by the manufacturer. Crimp-type lugs shall be applied with a tool so designed that once the crimping action is started, the tool cannot be removed until the crimping action is completed.
6. Do not use wire nuts or solder for splices or terminations; except wire nuts may be used with solid wires as indicated below.
7. For solid conductors No. 12 AWG and smaller and for terminations at individual lighting fixtures, make splices and terminations using wire nuts or threaded mechanical devices suitable for the type and size of the conductor used. Wire nuts shall be the coiled, spring-loaded type. Do not use wire nuts constructed of one solid piece (not spring loaded).
8. For solid conductors No. 10 AWG and larger, make splices and terminations using threaded mechanical devices suitable for the type and size of conductor used.

E. Shielded Wire and Cable

1. Maintaining the integrity of shielding is essential. Shield grounding shall occur at one point, and at one point only. Take special care in cable installation to ensure that unwanted grounds do not occur because of careless terminations or damage to the jacket over the shield. Take special care to ensure that random contact of shields of adjacent cables does not occur.

2. Provide crimp-type (solderless) lugs, connectors, and ferrule-ring assemblies of the proper size for the conductor used. Crimp devices using the tool recommended by the device manufacturer. The tool shall be designed such that once the crimping action is started, the tool cannot be removed until its jaws "bottom." Leave no shields bare. Where shields have been stripped, re-insulate with shrink tubing. Where a shield branches off from a parent conductor, leave no bare wire or shield exposed. To dead end shields, strip back outer jacket and shield. Insulate shield end with shrink tubing.
3. To ground shields, strip outer jacket back and unwrap shield. Splice shield to a length of green insulated conductor or cover with shrink tubing. In either case, insulate with shrink tubing the length of conductor near where the shield branches off. As an alternate shield grounding method, use manufactured crimp-type ferrules and rings to splice a length of ground conductor to the shield. Use devices manufactured by Burndy, Amp, or equal. Device size, type, and installation procedure shall be in accordance with the device manufacturer's recommendations for the type of conductor used. Do not loop ground conductors from one shield to another. Ground each shield separately.

3.9 REHABILITATION OF EXISTING EQUIPMENT

- A. This Article covers work associated with the following existing enclosures which are part of this project:
 - Switchgear SWGR-101A and SWGR-101B
 - Manhole MH-1
 - Main Recorder Panel (MRP)
 - Radio Panel (in WTP Control Room)
- B. On all enclosures that are part of this project, perform the following work items:
 1. Cover and seal all holes existing and/or those created by demolition work under this project.
 2. Sand and etch chips and rust spots, prime, touch up paint. Repaint enclosures in entirety which are marred.
 3. Oil hinges.
 4. Replace worn, dry, or failed gaskets.
 5. Tighten each termination within the enclosure.
 6. Tie and dress all wiring within the enclosure.
 7. Vacuum.
 8. Type new branch circuit schedules for panelboards.
 9. Install a phenolic nameplate on each enclosure, black with 1/4-inch white letters, fastened with stainless steel hardware. Designations will be provided by the Owner.

3.10 GROUNDING

- A. Unless otherwise indicated, ground all exposed non-current-carrying metallic parts of electrical equipment, raceway systems, and the neutral of all wiring systems in accordance with the NEC, State, and other applicable laws and regulations. Where metallic conduit is not grounded at its termination, it shall be separately grounded with a ground clamp and ground wire.

- B. Provide grounding points (foundation ground points) at each building and structure. Grounding electrode shall be No. 4 minimum-size, 20-foot-minimum-length piece of reinforcing steel located near the bottom of the concrete foundation. Attach the ground wires to the reinforcing steel by thermite welding.
- C. Where ground rods are indicated or used, they shall be copper clad, not less than 3/4 inch in diameter, 10 feet long, driven into the earth such that at least 8 feet is in contact with the soil, as required by NEC Article 250-52. Excess length may be cut off.
- D. Make ground connections by brazing, thermite welding, or with approved compression grounding connectors. Grounding and bonding to steel shall be done with thermite welding.
- E. The point of contact of each thermite weld shall be wire brushed or filed to a bare metal surface. Thermite welding cartridges and molds shall be used in accordance with the manufacturer's recommendations. After the welds have been made and cooled, slag shall be brushed from the welded area and the joint thoroughly cleaned. Use materials made by Burndy, Erico (Cadweld), or equal.
- F. Compression grounding connectors shall meet the following requirements:
 - 1. Compression grounding connectors shall be suitable for the intended use; shall be suitable for direct-burial and embedded applications; and shall be designed for connecting to copper and copper-clad conductors, both stranded and solid, and to copper-clad, galvanized, and stainless steel ground rods.
 - 2. Connectors shall be pre-filled with corrosion-inhibiting compound which is compatible with the conductors being joined.
 - 3. Connectors shall meet the requirements of IEEE standard 837-1984 (or later revision), and shall meet UL standards for direct burial in earth and embedment in concrete.
 - 4. Connectors shall be selected and installed according to the recommendations of the manufacturer.
 - 5. Compression grounding connectors shall be Burndy "Hyground," or equal.

3.11 LIGHTING FIXTURES

- A. Deliver lamps to the project in their original cartons. After construction of the total project is completed, wash fixtures, clean lamps, touch up any paint scratches or chips, remove labels from fixture lenses, and replace noisy ballasts.

3.12 TESTING, GENERAL

- A. Testing, test plans, and test reports shall be provided by the Contractor as specified herein. The Contractor shall perform tests as required to demonstrate that the equipment and systems covered in this Section operate safely and meet the requirements of these Specifications. The Contractor shall provide labor, instruments, and other material to complete the tests.
- B. Test plans and test reports shall be submitted as formal submittals and shall meet all applicable requirements of the Article, SUBMITTALS.

- C. Tests and test plans shall be in the cause and effect format. The person conducting the test shall initiate an action (cause) and, upon the system's or subsystem's producing the correct result (effect), the specific test requirement will have been satisfied.
- D. Tests and test plans shall be integrated across equipment and systems. The Contractor shall coordinate and integrate the documentation and efforts of suppliers and subcontractors to achieve unified tests and test plans.

3.13 OPERATIONAL READINESS TEST (ORT)

- A. Prior to startup, all equipment and systems specified under this Section shall be inspected and tested to show that they are ready for operation.
- B. In addition to the requirements in this Section, the ORT shall meet the applicable requirements of Section 7, INSPECTION AND TEST PROCEDURES, and Section 8, SYSTEM FUNCTION TEST, of ANSI Standard ANSI/NETA MTS-2007, MAINTENANCE TESTING SPECIFICATIONS.
- C. The test shall be performed from a test plan prepared by the Contractor.
- D. The ORT shall include the following:
 - 1. Perform a detailed point-to-point wire check of interconnection wiring. After installation, termination, and identification of conductors, perform a point-to-point wire check to verify that all wiring has been properly installed and identified, and that there are no shorts between wires, shields, and ground. Lift wires from terminals as required to perform this test.
 - 2. Insulation Test:
 - a. Protect voltage-sensitive equipment during insulation testing. Follow manufacturer's recommendations regarding disconnection of phase and neutral wires of sensitive equipment such as surge protection devices (SPD's). Reconnect equipment after testing.
 - b. Perform a Megger test on all power wiring. Use a 1,000-volt Megger on 480-volt wiring applications, and use a 500-volt Megger on wire and cable used for applications 240V and below.
 - c. Insulation resistance measurements of each branch power circuit shall be made with loads connected and contactors, if any, blocked closed to give complete circuits. Insulation resistance of the complete circuit shall be measured from the circuit breaker load terminals with the breaker open. The Contractor shall witness and make a record of these values and shall submit it to the Engineer. Values of resistance of less than 10 megohms are not acceptable.
 - d. Perform a Megger test on all motors. Use a 1,000-volt Megger on motors rated 460 volts. The Contractor shall make a record of these values and shall submit it to the Engineer. Values of resistance of less than 10 megohms are not acceptable.
 - e. Perform a Megger test on all dry-type transformers. Use a 1,000-volt Megger on windings rated from 480 volts to 600 volts, and use a 500-volt Megger on windings rated from 120 volts to 277 volts. The Contractor shall make a record of these values and shall submit it to the Engineer. Values of resistance of less than 10 megohms are not acceptable.
 - f. The Engineer shall be notified at least 1 week prior to the insulation test so that he may witness the test if he chooses.

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3. Check motor rotation. After final service connections are made, check and correct, if necessary, the rotation of all motors.
 4. Perform a detailed line-by-line check of the control sequence from the control diagrams.
 5. Perform a detailed check of each I/O point to and from all instrumentation and control devices. This check shall confirm the correct polarity, where applicable, of each signal.
 6. Calibrate each instrument and device, where applicable.
- E. In addition, the ORT shall demonstrate that the complete interconnected systems specified under this Section meet the requirements of the Drawings and Specifications.
- F. After completion of the ORT, the Contractor shall prepare a test report and shall submit it for review. The ORT shall be successfully completed and the test report submitted to and favorably reviewed by the Engineer before the FAT (Functional Acceptance Test) is performed. As a minimum, the ORT test report shall include the following:
1. Written confirmation by the Contractor that the ORT has been completed.
 2. Calibration data for each instrument and device, where applicable.
 3. Record of insulation test values.
 4. Motor protective device data, neatly tabulated, obtained from visual inspection by the Contractor after installation of equipment.
 - a. Equipment driven
 - b. Motor horsepower
 - c. Nameplate amperes
 - d. Service factor
 - e. Temperature rating
 - f. Overload catalog number
 - g. Overload current range and setting
 - h. Circuit breaker or fuse rating for combination starters
 - i. Circuit breaker trip rating for magnetic-only circuit breakers

3.14 FUNCTIONAL ACCEPTANCE TEST (FAT)

- A. Once the facility has been started up and is operating, and after written confirmation by the Contractor that the ORT has been completed, a witnessed FAT shall be performed on the equipment and systems specified under this Section to demonstrate that they are operating as specified and meet the requirements of the Specifications.
- B. The FAT shall be performed by the Contractor and may be coordinated with testing of equipment and systems covered under other Sections of these Specifications.
- C. The Contractor shall prepare a test plan for the FAT and shall submit it for review at least 30 days before the FAT is performed. As part of the test plan, the Contractor shall list the personnel who will be present to assist with and witness the FAT. This list shall include any Contractor's personnel, subcontractors, suppliers' representatives, and other necessary personnel.
- D. Each function shall be demonstrated. The FAT shall operate all equipment and systems over the full operating range, shall demonstrate proper operation of alarms and indicators, and, in general, shall demonstrate that the equipment and systems meet the requirements of the Drawings and Specifications.

- E. If any equipment or system fails the FAT, the Contractor shall correct the problem and shall repeat the test until it is successful.
- F. The FAT shall be performed in the presence of the Owner and the Engineer.
- G. After completion of the FAT, the Contractor shall prepare a test report and shall submit it for review. The system will not be accepted before the FAT is successfully completed and the test report submitted to and favorably reviewed by the Engineer.

3.15 FINAL ADJUSTMENTS

- A. Upon completion of the FAT, final adjustments shall be made to the equipment as necessary.

3.16 FIELD SUPPORT

- A. Provide the services of an experienced, factory-trained service engineer or technician to assist with installation, checkout, startup, and testing.
- B. Timing and length of site visits shall be coordinated with the Contractor, but minimum effort shall be 2 man-days on the site for installation and checkout. The service engineer or technician shall also be present during the ORT and FAT for the systems and equipment specified in this Section. This time does not include training of Owner's personnel and content of training sessions.

END OF SECTION

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SECTION 16050 – ELECTRICAL

ATTACHMENT A – ELECTRICAL COMPONENTS

1.1 GENERAL

- A. This attachment covers miscellaneous electrical components. Refer also to Section 16150, POWER DISTRIBUTION EQUIPMENT.

1.2 PRODUCTS

- C21 Receptacles And Wall Switches
- C22 Pushbuttons, Selector Switches, And Indicating Lights
- C30 Plug-in Relays
- C33 Digital Voltmeter-Ammeter
- C41 Surge Protective Device (SPD)
- C52 Thermostat
- C61 Lighting Fixtures
- C99 Maintenance Bypass Switch

C21 RECEPTACLES AND WALL SWITCHES

- A. General: Provide receptacles and wall switches, as indicated, in suitable enclosures.
- B. Single and Duplex Convenience Receptacles: Receptacles shall be NEMA 5-15 configuration and rating (two pole, three wire, grounding, 15 amperes, 125 volts). Contact arrangement shall be such that contact is made on two sides of each inserted blade. Bases shall be of ivory phenolic or nylon composition. Wire terminals shall be screw type. Receptacles shall be UL listed and shall meet the requirements of Federal Specification WC596. Receptacles shall be Hubbell 5262I, Leviton 5262I, or equal.
- C. GFCI Receptacles: Receptacles with ground fault circuit interrupters (GFCI) shall be duplex, shall have NEMA 5-15 configuration and rating, and shall fit standard-sized outlet boxes. Interrupters shall trip on a 5-mA ground fault, not on overloads, shall be capable of interrupting 1,000 amperes without damage, and shall have provision for testing. GFCI receptacles shall be Hubbell GF5262I, Leviton 6599I, or equal.
- D. Wall Switches shall be totally enclosed. Operating handles shall be of ivory-colored phenolic composition. Switches shall be rated 20 amperes at 120/277 volts, 60 Hz, and shall be suitable for the control of tungsten lamp loads. Wire terminals shall be screw type. Switches shall be UL listed.

C 22 PUSHBUTTONS, SELECTOR SWITCHES, AND INDICATING LIGHTS

- A. Pushbuttons, selector switches, and indicating lights shall be heavy-duty oiltight, and shall be manufactured to the requirements of NEMA ICS. Provide suitable NEMA-rated enclosures or mount in panels as indicated.
- B. Unless noted otherwise, provide extra-large, integral, metal service legends (legend plates) indicating their specific functions, and laminated phenolic nameplates indicating the equipment they control.

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- C. Unless noted otherwise, pushbuttons shall be momentary contact and shall have the number and type of contacts as indicated or as required.
- D. Unless noted otherwise, selector switches shall be maintained contact, shall have the number of positions indicated, and shall have the number and type of contacts as indicated or as required.
- E. Indicating lights shall be push-to-test, LED type unless noted otherwise. Provide transformer type on ac circuits and resistor type on dc circuits.
- F. Pushbuttons, selector switches, and indicating lights shall be Eaton 10250T series, Schneider/Square D Type K Heavy Duty, Allen-Bradley Bulletin 800T, General Electric CR104P Heavy Duty, or equal.

C 30 PLUG-IN RELAYS

- A. Plug-in relays shall be enclosed, with contacts rated 10 amps at 120 volts, 60 Hz, and 28 volts dc. Enclosures shall be clear plastic. Relays shall operate reliably at 80% of rated coil voltage and shall be provided with an energized indicating light. Coil burdens shall be not greater than 1.5 watts for dc coils or 2.6 voltamperes for 60-Hz coils. The relays shall be IDEC RR Series, Potter and Brumfield KRPA Series, or equal.
- B. Time delay relays with ranges up to 180 seconds shall be enclosed and shall operate properly at any voltage within plus or minus 15% of the nominal voltage rating, and shall have a time delay on energization or deenergization, as required, which is knob-adjustable over the range 2 to 180 seconds. They shall have double-pole double-throw contacts rated 10 amps at 120 volts, 60 Hz. The relays shall be Potter and Brumfield CD Series, or equal.

C 33 DIGITAL VOLTMETER-AMMETER

- A. Voltmeter-ammeter shall have a selectable digital readout displaying line-to-line volts and line amps.
- B. Meter shall be compatible with the configuration shown on the Drawings.
- C. Display shall have three lines of bright numbers, minimum line height 0.5 inch.
- D. Accuracy shall be 0.5% or better.
- E. Meter shall be Eaton IQ 200 Series, or equal.

C 41 SURGE PROTECTIVE DEVICE (SPD)

- A. Provide SPD's as shown on the Drawings and specified herein.
- B. SPD's shall be suitable for the application (voltage and bus configuration) and shall be applied according to the recommendations of the manufacturer.
- C. As a minimum, the SPD shall protect against high transient voltages in the following modes: line-to-line, line-to-neutral, and line-to-ground.

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- D. The SPD shall be integrated into electrical equipment (panelboard, switchboard, or MCC), or provided with a NEMA 4 enclosure. It shall have fused input connections and front panel indicators that display the status of the protection provided by the SPD.
- E. The SPD shall be designed, tested, and labeled to the ANSI C62.41 standard as listed below:

<u>ANSI/IEEE Category</u>	<u>Application</u>
Category A	Branch Circuits
Category B	Distribution Panelboards
- F. Provide SPD's rated for peak surge currents not less than the rating shown on the Drawings.
- G. SPD shall be manufactured by Eaton, Hubbell, Leviton, MCG Electronics-DLA, or equal.

C 52 THERMOSTAT

- A. Thermostat for supply fan shall be a heavy-duty thermostat with snap-action switch. Unit shall include thermometer and adjustment. Switch shall be single-pole, double-throw. Adjustable range shall be 40 to 105 degrees F, minimum. Contact rating shall be 7 amps minimum at 120 volts, 60 Hz. Provide switching subbase with a three-position switch labeled AUTO-OFF-FAN. The unit shall be Honeywell/Tradeline T6051 with Q651A subbase, or equal.

C 61 LIGHTING FIXTURES

- A. Lighting fixtures shall be of the types and sizes shown on the Drawings, and shall be furnished and installed complete with mounting devices and junction boxes where required.
- B. LED fixtures hung in continuous rows shall have wiring channels approved for use as wireways.
- C. Chain-suspended LED fixtures shall have galvanized steel chains.
- D. Cord-connected fixtures shall have type SO cord with two No. 14 AWG conductors and one No. 14 AWG ground, locking-type nylon cap matching the receptacle, and gland-type fixture entrance.

C 99 MAINTENANCE BYPASS SWITCH

- A. Provide a service bypass switch that provides ability to supply utility power to loads, while completely isolating the UPS from both utility power and the load.
- B. Bypass switch shall be rated 120 volt, 20 amp with (6) NEMA 5-15R and (2) 5-20R outlets.

- C. Bypass switch shall allow bumpless transfer of one power source to another without disruption of service to equipment.
- D. Bypass switch shall be APC Model No. SBP2200RM, or equal.

END OF SECTION

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SECTION 16150

POWER DISTRIBUTION AND MOTOR CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This Section covers the following power distribution and motor control equipment:
 - 1. Motor control centers
 - 2. Panelboards
 - 3. Dry-type transformers (600V and below)
 - 4. Circuit breakers
 - 5. Motor controllers (motor starters)
 - 6. Solid-state reduced-voltage motor starters
 - 7. Elapsed time meters (ETM)
 - 8. Motor overload relays, electronic
 - 9. Disconnecting means
- B. Clearances: Coordinate the layout, fabrication, and installation of equipment, and meet all applicable clearance requirements in front of and around equipment. Meet the requirements of the National Electrical Code, these Specifications, and the Authorities Having Jurisdiction. Obtain approvals from Authorities Having Jurisdiction including the power company.
- C. For peripheral devices such as relays, surge protective devices, selector switches, and other devices, refer to Section 16050, ELECTRICAL.
- D. The work covered in this Section shall include all applicable portions of Section 16050, ELECTRICAL.

1.2 SUBMITTALS

- A. Provide complete submittals including submittals on seismic requirements, product information, electrical drawings, schematics, interconnection diagrams, layout submittals, etc., as specified in Section 16050, ELECTRICAL.
- B. For service entrance equipment, meter base, and other related materials, submit written approval of submittals from the serving utility, Pacific Gas and Electric (PG&E).

1.3 OPERATION AND MAINTENANCE (O&M) MANUALS

- A. Provide complete O&M manuals as specified in Section 16050, ELECTRICAL.

1.4 WARRANTY

- A. Provide warranty as specified in Section 16050, ELECTRICAL.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Products shall meet the applicable requirements of Section 16050, ELECTRICAL.
- B. Unless otherwise indicated, provide all first-quality new materials, free from any defects, and suitable for the intended use and the space provided. Provide materials that are UL listed, recognized, classified, or verified wherever standards have been established.
- C. Furnish and install all incidental items not specifically shown or specified which are required by good practice to provide the complete systems specified herein.
- D. Where two or more units of the same class of material or equipment are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer.
- E. Refer to Section 16050, ELECTRICAL, for general requirements on the following:
 - 1. Seismic requirements
 - 2. Standard products
 - 3. Supply voltage distortion
 - 4. Equipment finish
 - 5. Enclosures

2.2 MOTOR CONTROL CENTERS

- A. Each motor control center shall be designed, manufactured, and tested in accordance with NEMA ICS.
- B. Each motor control center shall have a NEMA Type 12 enclosure; NEMA Class I, Type B wiring; and shall have a ground bus and no neutral bus.
- C. Motor control centers shall be entirely steel enclosed and shall not be greater than 21 inches deep. Motor control centers with portions of the enclosure or cubicle door which protrude forward of the base front panel are not acceptable.
- D. As required by the NEC, handles of switches and circuit breakers in their highest position shall be within 6-1/2 feet of the floor. Locate handles and add handle extensions as needed to meet this requirement for all equipment, taking into account equipment mounting channels and a 4-inch equipment mounting pad.
- E. Finish shall be manufacturer's standard gray over a primer and rust inhibitor. Construction shall be sheet steel reinforced with channel or angle irons. Sections shall be constructed so that they may be butted flush, end-to-end, without interference from bolts, nuts, or cover plates. Provide mounting channels, top and bottom horizontal wiring compartments, and copper ground bus. Wiring compartments and buses shall be front accessible. Construction shall allow for future expansion to additional sections on the right end of the MCC.
- F. Control wiring shall be stranded copper, No. 16 AWG minimum. Wire shall be rated 600 volts, 90 degrees C. Wiring shall be arranged neatly and cut to proper length.

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Wires shall be bundled and tied down. Wiring shall not be spliced or tapped except at device or component terminals or at terminal blocks. Terminal strips shall be single level. High-density ("double-deck") terminals are not acceptable.

- G. Each motor control unit and feeder tap unit shall be stab connected, except where impracticable, due to size or weight of the unit. Each shall be in an individual compartment isolated by steel barriers, shall be front wired, and shall have pull-apart terminal blocks for control wiring. Provide defeater mechanism for door interlocks. Terminal blocks shall have covers to prevent contact with energized parts and shall be permanently marked with the same wire number as shown on the control schematics (elementary diagrams) and wiring diagrams. Identify each control conductor at both ends. Horizontal bus shall be constructed to allow future extension to additional sections. Provide pressure-type solderless lugs for each incoming line and bus tap. Vertical bus shall be full height, rated 300 amps minimum; except vertical bus is not required in vertical sections which contain equipment which is not stab connected. Provide vertical bus in spare vertical sections. Each disconnecting device shall have barriers over the lugs on the line side. Provide an engraved laminated phenolic nameplate for each unit, with blank nameplates for empty or spare units.
- H. Digital voltmeter/ammeter shall be as specified in Section 16050, ELECTRICAL, Attachment A, ELECTRICAL COMPONENTS.
- I. Unless noted otherwise, relays in the motor control center shall be of the plug-in type, as described in Section 16050, Attachment A, ELECTRICAL COMPONENTS.
- J. For components included as part of the motor control center, meet the applicable requirements covered elsewhere in this Section and Section 16050, ELECTRICAL.
- K. Provide submittals as required elsewhere in these Specifications. Include outline drawings and floor plans; schedule of all units, accessories, and nameplates, with specifications and description for each component; individual control diagram (elementary diagram) for each unit with no diagrams typical for more than one unit; and individual wiring diagram (connection diagram) for each unit with no diagrams typical for more than one unit.
- L. Motor control centers shall be Eaton, General Electric, Allen-Bradley, or equal.

2.3 PANELBOARDS

- A. Lighting and power panelboards shall be circuit breaker type as indicated and shall meet the standards established by UL, NEMA PB 1, and the NEC. Provide panelboards with fully rated short-circuit current equipment ratings. Series-rated equipment ratings are not acceptable. Circuit breakers shall be of the indicating type, providing ON, OFF, and TRIPPED positions of the operating handle.
- B. Panels used as service entrance equipment shall have UL approval for that use.
- C. Panelboards shall have copper bus and bolt-on circuit breakers.
- D. Circuit breakers shall be quick-make, quick-break, with non-interchangeable thermal-magnetic action, in accordance with the NEC. The use of tandem or dual circuit breakers in a normal single-pole space to provide the number of poles or

spaces specified is not acceptable. All multiple-pole circuit breakers shall be designed so that an overload on one pole automatically causes all poles to open. Circuit breakers shall meet the requirements of UL and NEMA AB 1. GFCI (ground fault circuit interrupter) breakers shall trip in approximately 0.025 second with a ground fault of 5mA.

2.4 TRANSFORMERS, DRY-TYPE, 600 VOLTS AND BELOW

- A. Provide self-cooled dry-type transformers of the ratings indicated, built in accordance with the latest IEEE, UL, ANSI, and NEMA standards. Provide manufacturer's standard insulation class and standard temperature rise; except temperature rise shall be not greater than 115 degrees C for transformers 30kVA and smaller. The transformers shall be rated for the specified temperature rise.
- B. Transformers shall have copper windings.
- C. Ventilating openings shall be designed to prevent accidental access to live parts in accordance with UL, NEMA, and the NEC standards for ventilated enclosures. Terminal compartments shall be located at the bottom of the transformers. Transformers shall be manufacturer's standard gray or ANSI 61 gray applied over a primer and rust inhibitor.
- D. Provide taps on all transformers 3kVA and larger. For transformers 9kVA and larger, provide a minimum of four taps. For smaller transformers, provide a minimum of two taps.
- E. Taps shall be full capacity. For transformers with two taps, the taps shall be 5% above and 5% below normal. For transformers with four taps, the taps shall be 2-1/2% and 5% above normal, and 2-1/2% and 5% below normal.
- F. Transformer sound level shall be in accordance with NEMA and ANSI standards. Transformers shall have standard sound levels unless otherwise indicated.
- G. Provide transformers with built-in mounting lugs. Transformers 30kVA and larger shall have integral vibration isolators completely isolating the core and coil assembly from the transformer enclosure. Smaller transformers shall have either integral vibration isolators or external vibration isolators which isolate the enclosure from the structure on which it is mounted.
- H. Dry-type transformers greater than 15kVA shall meet the latest minimum efficiency requirements of Section 1605.3(t) of Title 20, California Code of Regulations, as defined in NEMA TP1.
- I. Transformers shall be Eaton, General Electric, Square-D, or equal.

2.5 CIRCUIT BREAKERS

- A. Circuit breakers shall be of the indicating type providing ON, TRIPPED, and OFF positions of the operating handle. Include provisions for padlocking circuit breakers in the OFF position (except in panelboards). Interlock enclosures to prevent opening the cover with the circuit breaker in the ON position, and provide defeater mechanisms. Circuit breakers shall be quick-make, quick-break, with thermal-magnetic action

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(except for magnetic-only trip breakers in motor starters). An overload of one pole of all multiple-pole circuit breakers shall automatically cause all poles to open. Circuit breakers shall meet the requirements of UL 489 and NEMA AB 1. Unless noted otherwise, interrupting rating shall be not less than 22,000 amps rms symmetrical for circuit breakers on the 480-volt system, and not less than 10,000 amps rms symmetrical for those on lower voltage systems.

- B. Breakers with solid-state trip units shall have trip units of the true RMS sensing type. The electronic trip units shall have adjustable long-time, short-time, instantaneous, and ground fault trips. Breakers with solid-state trips shall be General Electric Spectra Series; Westinghouse R-frame or SPB; Square D LE, ME, NE, PE or SE; or equal.
- C. For circuit breakers with programmable trip points, provide complete documentation, including operating instructions and setpoints and ranges, and a hand-held programmer (if available). Documentation shall be adequate to instruct an electrician on the use of the programmer to check and set trip points and ranges on the breaker. Documentation and trip points and ranges shall be provided as part of the formal submittal on the circuit breaker.
- D. The use of tandem or dual circuit breakers in a normal single-pole space to provide the number of poles or spaces specified is not acceptable.
- E. GFCI (ground fault circuit interrupter) breakers shall trip in approximately 0.025 second with a ground fault of 5mA.

2.6 MOTOR CONTROLLERS (MOTOR STARTERS)

- A. Provide each motor with a suitable controller and devices that will perform the functions as specified for the respective motors. Controllers shall conform to the applicable requirements of NEMA ICS, the NEC, and UL. Provide suitable laminated phenolic nameplates for each starter.
- B. Motor horsepower ratings and enclosures shown are what is expected. This information is for guidance only and does not limit the equipment size.
 - 1. When motors furnished differ from the expected ratings and inrush, make the necessary adjustments to wiring, conduit, disconnect devices, motor starters, branch circuit protection, and other affected material or equipment to accommodate the motors actually installed, at no additional cost to the Owner.
 - 2. Provide motor short-circuit and ground-fault protection as required by the National Electrical Code for the nameplate rating and actual inrush current of the motors actually provided.
- C. Motor starters shall be of NEMA standard ratings, except none shall be smaller than Size 1 unless otherwise indicated. Contactors shall be standard NEMA-rated sizes.
- D. Each motor control unit and feeder tap unit shall be stab connected, except where impracticable, due to size or weight of the unit. Each shall be in an individual compartment isolated by steel barriers, shall be front wired, and shall have pull-apart terminal blocks for control wiring. Provide defeater mechanism for door interlocks. Terminal blocks shall have covers to prevent contact with energized parts and shall be permanently marked with the same wire number as shown on the control schematics (elementary diagrams) and wiring diagrams. Identify each control conductor at both

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ends. Each disconnecting device shall have barriers over the lugs on the line side. Provide an engraved laminated phenolic nameplate for each unit, with blank nameplates for empty or spare units.

- E. Motor circuit protectors (MCP's) in combination starters shall meet the applicable requirements of NEMA AB 1 and UL 489; shall be molded case, magnetic trip only; shall be lockable in the open position; and shall have interrupting current ratings required for the application. Each magnetic trip only circuit breaker shall have an adjustable trip range which at least covers the range from 800% to 1,300% of motor full-load current.
- F. Full-voltage magnetic starters shall meet the requirements of NEMA ICS Class A, with the rating and enclosure shown. Contactors used shall be standard NEMA-rated sizes.

2.7 SOLID-STATE REDUCED-VOLTAGE MOTOR STARTERS (SSRVS)

- A. Provide SSRVS's as specified herein and as shown on the Drawings.
- B. SSRV's shall be an integrated package, including SCR's, bypass contactor, motor overload protection, 120-volt control power transformer, and controls and monitoring as required.
- C. As a minimum, the SSRVS shall include three selectable starting modes:
 - 1. Ramp start, with adjustable initial torque setting and adjustable ramp time.
 - 2. Current limit start, with adjustable current limit and adjustable ramp time.
 - 3. Pump control option, with special adjustable parameters for starting and stopping the motor in a centrifugal pump system.
- D. As an acceptable alternative to paragraph C above, the SSRVS may have voltage ramps as described below:
 - 1. The initial voltage ramp, which lasts for five cycles, brings the motor voltage from 0 to preset initial pedestal voltage (10%-90%).
 - 2. The acceleration ramp, which increases the motor voltage from the preselected initial voltage to 100% voltage over the selected acceleration time period.
 - 3. The fast ramp, which brings the motor voltage to 100% if the motor reaches full speed before the end of the acceleration ramp.
- E. The motor starting current may be limited. Minimum adjustable current range shall be 100-600% of the motor full-load current.
- F. Motor overload protection shall protect the motor from overheating under all operating conditions, including low speed (low ventilation) operation when motor current may be less than motor rated current. Adjustment range shall be at least 30% to 100% of the maximum continuous rating of the starter.
- G. The bypass (run) contactor shall be fully rated and shall close at the end of the starting cycle to bypass the SCR's. SCR firing shall be suspended while bypass (run) contactor is closed.
- H. Continuous output rating of each SSRVS shall be not less than 115% of the full-load rating of the driven motor.

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- I. The starter shall have a maximum motor current setting that can be adjusted. Minimum adjustment range shall be 50% to 100% of the starter frame size.
- J. The SSRVS shall have a 30-second rating not less than 300% of the starter frame size.
- K. The SSRVS shall be capable of starting a motor using a 30-second ramp time up to five times an hour when the starting current is 300% of the motor full-load current rating.
- L. As a minimum, the following protective functions shall be provided. Error codes shall be stored in memory.
 - 1. Current limit: 100% to 700% of motor full-load current.
 - 2. Overload (I^2t): Selectable for NEMA Class 5, 10, 20, or 30.
 - 3. Loss of input phase.
 - 4. 50% current differential between any two phases.
 - 5. Thyristor short circuit.
 - 6. Heat sink overheating.
 - 7. Loss of output phase.
 - 8. Stalled rotor.
 - 9. CPU error.
- M. SSRVS's shall be Eaton Type S811, General Electric GE ASTAT-XT, or equal.

2.8 ELAPSED TIME METERS (ETM)

- A. Elapsed time meters shall be panel mounted, synchronous motor driven, 0 to 99,999 hours, without reset knob, Crompton Series 077, Yokogawa Series 240, or equal.

2.9 MOTOR OVERLOAD RELAYS, ELECTRONIC

- A. Provide electronic overload relays in motor controllers as specified herein and as shown on the Drawings.
- B. Overload relays shall include the following features:
 - 1. Selectable Trip Class: 10, 20, or 30. Set for Class 20, unless noted otherwise.
 - 2. Thermal overload protection. Adjust for the actual motors when exact nameplate data is available.
 - 3. Phase loss protection.
 - 4. Phase unbalance protection, selectable ENABLE or DISABLE. Select ENABLE, unless noted otherwise.
 - 5. Ground fault protection, selectable ENABLE or DISABLE. Select ENABLE, unless noted otherwise.
 - 6. Reset, selectable MANUAL or AUTOMATIC. Select MANUAL, unless noted otherwise.
 - 7. Trip status indication.
- C. The Contractor shall choose the specific overload device required and current transformers if required, when the exact nameplate currents are known for the equipment actually provided.

2.10 DISCONNECTING MEANS

A. General

1. Disconnecting means, whether switches, circuit breakers, or connectors, shall be listed and rated for the intended use, shall be applied according to the recommendations of the manufacturer, and shall meet other applicable requirements of this Section and Section 16050, ELECTRICAL.

PART 3 - EXECUTION

3.1 GENERAL

- A. For general requirements, refer to Section 16050, ELECTRICAL, including the following:
1. Protection during construction
 2. Equipment installation, including seismic requirements
 3. Demolition
 4. Cutting and patching
 5. Cleaning and touchup painting
 6. Grounding

3.2 TESTING

- A. Provide Operational Readiness Test (ORT) and Functional Acceptance Test (FAT) for the items specified in this Section. Coordinate testing with testing of other systems and equipment. Meet applicable requirements of Section 16050, ELECTRICAL.

3.3 MANUFACTURER'S REPRESENTATIVE

- A. Arrange for a technical representative of the manufacturer to attend pre-commissioning checkout of the equipment and to train the operating personnel in the operation, shutdown, startup, and maintenance of the equipment.

END OF SECTION

SECTION 16200
ELECTRIC MOTORS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This Section covers cage-type induction motors rated less than 600 volts.
- B. Motors shall meet the applicable requirements of this Section as referred to in equipment specifications.

1.2 GENERAL

- A. Horsepower, speed, and other motor features and requirements are called out in other Sections.
- B. Submittals, O&M manuals, testing, and test plans shall meet the requirements of the Section in which each motor is specified.
- C. Motors shall meet all applicable requirements of the Section in which each motor is specified.
- D. Motor submittal shall state that the motor(s) meet the latest applicable efficiency requirements of the Department of Energy and the latest edition of NEMA MG1.
- E. Provide submittals as called out in Section 01610, GENERAL PRODUCT REQUIREMENTS, which demonstrate that design, fabrication, and installation of products meet the seismic requirements of that Section.

1.3 WARRANTY

- A. The work and materials covered in this Section shall be guaranteed for a period of 1 year from the date of acceptance thereof against defective materials, design, and workmanship.
- B. Warranty coverage shall include any and all costs for labor, travel, lodging, and parts.

PART 2 - PRODUCTS

2.1 GENERAL

Unless noted otherwise, motors shall meet the following requirements:

- A. Motors shall be squirrel cage-type induction motors rated 460 volts 3-phase, with horsepower and speed as specified.

- B. Motors shall be designed, manufactured, and tested in accordance with the requirements and recommendations of NEMA MG-1. The motors shall comply with the latest ANSI, NEMA, and IEEE standards, and the National Electrical Code.
- C. Motors shall be rated for continuous duty, with a service factor of 1.15.
- D. The connected load of each motor shall not exceed its nameplate horsepower rating over the entire operating range.
- E. Regarding efficiency, motors shall meet the latest applicable efficiency requirements of the Department of Energy and the latest edition of NEMA MG1.
- F. For all electric motors, nominal efficiency shall be noted on the nameplate.
- G. Electrical power on this project may contain up to 10% harmonic distortion in voltage. All motors covered in this Section shall operate properly under this condition of supply voltage distortion.
- H. Motors shall be capable of passing tests equivalent to the NEMA water immersion test. (The motors need not be actually tested for water immersion.)
- I. Motors shall have a non-hygroscopic, chemical- and humidity-resistant insulation system. Phase insulation in addition to varnish shall be used between the phases of random windings.
- J. Motors shall be designed for the specified ambient temperature, shall be constructed with the Class F insulation, and shall operate with the Class B temperature rise, as defined in latest revision of NEMA MG-1.
- K. If not otherwise specified, motors located indoors shall be rated for 40 degrees C ambient temperature.
- L. Motor lead junction boxes shall be split-case, gasketed, with moisture seal between box and motor frame, and shall have tapped grounding pads for connection of the equipment grounding conductors.
- M. Finish shall be manufacturer's standard gray or ANSI 61 gray over a primer and rust inhibitor.
- N. Motor audible noise shall not exceed the sound power levels called out in NEMA MG-1, Part 9.
- O. Provide a nameplate for each motor. As a minimum, the motor nameplate shall meet the requirements of the latest revision of NEMA MG-1, Part 20.

2.2 VERTICAL MOTORS

- A. Motors operated in a vertical position shall be designed for vertical operation and shall have thrust bearings with a rated life of 40,000 hours, as defined by the latest edition of AFBMA standards.

2.3 ENCLOSURES

- A. Motor enclosures shall be standard NEMA ratings and shall be suitable for the location in which the motor is installed.
- B. Enclosures for motors located in indoor, dry locations shall be TEFC (totally enclosed from cooled), as described in paragraph 1.25.8.2 of NEMA MG-1.

2.4 THERMAL PROTECTION AND SPACE HEATERS

- A. Provide thermal protection and space heaters for motors when so specified or shown on the Drawings.
- B. Thermally protected motors shall be so marked on the nameplate, as described in NEMA MG-1. Provide a motor thermal protection system consisting of thermistors or thermostats, monitoring relay, and relay enclosure. Install a set of three thermistors or thermostats, one embedded in the coils of each phase of the stator windings. Abnormally high temperature conditions in the stator windings shall cause a monitoring relay contact closure, for external use, that shall remain closed until conditions return to normal (i.e., a non-damaging temperature). Provide thermistors or thermostats and monitoring relay which protect the stator winding from overtemperature resulting from motor overload, too-frequent starting, locked-rotor condition, and heating resulting from harmonics in the motor supply voltage. Provide a relay compatible with the thermistors or thermostats with contacts rated 5 amps, 120 volts, 60 Hz, minimum. Contact closure and return-to-normal open conditions shall be automatic at the motor; manual reset shall be provided in the controller. As indicated on the Drawings, install the monitoring relay in the motor controller.
- C. Space heaters shall be rated 120 volts, 60 Hz.

2.5 SPARE PARTS, CONSUMABLE ITEMS, AND TOOLS

- A. Spare parts, consumable items, and tools shall meet the requirements of the Section in which the motor is specified.

PART 3 - EXECUTION

3.1 GENERAL

- A. Meet the requirements of the Section in which each motor is specified.

3.2 PROTECTION DURING CONSTRUCTION

- A. Throughout this Contract, provide protection for motors against loss or damage from the effects of weather. Prior to installation, store motors in indoor, dry locations.
- B. Following installation, protect motors from corrosion, physical damage, and moisture. Provide temporary heating source for motors in damp locations or locations subject to condensation until construction is complete and equipment is energized.

3.3 SEISMIC REQUIREMENTS

- A. Installation of products provided under this Section shall meet the applicable requirements of Section 01610, GENERAL PRODUCT REQUIREMENTS.
- B. Provide calculations signed by a registered civil or structural engineer registered in the state where the project is located. Product installation shall meet the requirements of the calculations.

END OF SECTION

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