

**WASHINGTON WATER DISTRICT
WASHINGTON, CALIFORNIA**

CONTRACT DOCUMENTS AND SPECIFICATIONS

FOR

CABY WATER SYSTEM IMPROVEMENTS

IN

WASHINGTON WATER DISTRICT

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PART A

LEGAL AND PROCEDURAL DOCUMENTS

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NOTICE TO CONTRACTORS
CABY Water System Improvements
Washington Water District

Sealed proposals for **CABY Water System Improvements** will be received by the District at **City Hall, City of Nevada City, 317 Broad Street, Nevada City, California, 95959**, until **3:00 PM, September 15th, 2016**, at which time, or as soon thereafter as practicable; all such proposals will be publicly opened and read at City Hall, 317 Broad Street, Nevada City, California.

Bids shall be enclosed and sealed in an envelope addressed to the **City of Nevada City** at the above stated address and shall be marked "Washington Water District – CABY Water System Improvements."

The work includes the furnishing of all labor, materials, and equipment required for the job in accordance with the plans, specifications and other contract documents as set forth by the City Engineer. Such bid documents will be on file with the District and are available for inspection during office hours. Bid proposals may be obtained at the office of said City Hall at 317 Broad Street, Nevada City, California on or after **August 25th, 2016**.

A non-mandatory pre-bid meeting will be held at **Washington Water Treatment Plant, 18061 Maybert Road, Washington, CA** on **September 1 at 10:00 AM** to discuss the project.

The District reserves the right to reject all bids; or to accept any portion of bid schedule; to reject any bid which is incomplete or irregular; to determine which proposal is, in its judgment, the lowest responsible bid of a responsible bidder and to waive any informality or minor irregularity of any bid.

DATED: August 25, 2016

CITY OF NEVADA CITY

Bryan K. McAlister, P.E.
City Engineer

DIVISION I

GENERAL REQUIREMENTS

This specification and accompanying drawings cover the material to be furnished and labor to be performed on a CABY Water System Improvements, located in the Washington Water District, State of California and shall consist of all work hereinafter specified and shown on the accompanying drawings.

1. General requirements of the specifications:

General requirements hereunder apply to the technical sections of the specifications as applicable whether repeated therein or not.

The term "Engineer" will hereinafter mean the office of the District Engineer preparing the drawings and specifications, or his authorized representatives. All correspondence and approvals, shop drawings, submittals, etc., called for in the specifications shall be directed to the Engineer.

All work shall be executed to the entire satisfaction of the District Engineer, and shall consist of all work hereinafter specified and shown on the accompanying drawings.

Should any contractor be in doubt as to the intent and meaning of the drawings and specifications, he/she shall make written inquiry of District Engineer regarding the portion or portions of the work in question, from whom he/she shall receive a written answer; and if the drawings and specifications are in error or do not fully explain the portion or portions of the work in question, the inquiry and answer will be sent to the contractor.

Neither the OWNER, district engineer, or his/her representative will be responsible in any manner for any oral answers to inquiries or for any oral instruction whatsoever.

INFORMATION FOR BIDDERS

1. Inspection of Site

Each bidder shall inspect the site of the work in order to determine the location of the proposed work and the actual conditions of the site. If in the course of such inspection a bidder finds conditions which appear to conflict with the letter or intent of the contract documents, or with any other information furnished him, he may apply to the District for additional information or for clarification before submitting his bid.

The submission of a proposal by the bidder shall constitute an acknowledgment that, if awarded the contract, he has relied on his own knowledge of (a) the site of the work, (b) access to the site, (c) availability of existing utilities and (d) all other data and matters required for the performance of the contract. No claim for additional compensation will be allowed which is based upon a lack of knowledge of the above matters.

2. Examination of Contract Documents

Each bidder shall thoroughly examine the plans, specifications, and all other contract documents. The submission of a proposal shall constitute an acknowledgment that the bidder has made such examination, and the failure of a bidder to do so shall in no way relieve him from any obligation under the bid or the contract. No claim for additional compensation will be allowed which is based upon a lack of knowledge of any contract document.

3. Interpretation of Contract Documents; Addenda

No interpretation of the plans, specifications, or other contract documents will be made orally to any bidder. Oral interpretations or clarifications will be without legal effect. Each request for such interpretation shall be in writing addressed to District Engineer, City of Nevada City, 317 Broad Street, Nevada City, California 95959, and must be received by him at least five (5) days prior to the date fixed for the opening of bids. Any such interpretations, and any supplemental instructions, will be in the form of written addenda to the specifications, which, if issued, will be sent by certified mail, with return receipt requested, to all prospective bidders at their addresses furnished for such purposes, not later than three (3) days prior to the date fixed for the opening of bids. Failure of any bidder to receive any such addendum or interpretation shall not relieve such bidder from any obligation under his bid as submitted. All addenda so issued shall become part of the contract documents.

4. Proposals

Proposals shall be made on the Bid Proposal forms supplied herein. All proposals shall state the prices proposed, both in writing and in figures, shall give all other required information and shall be signed by the bidder or his authorized representative. If the proposal is made by an individual, his name, signature, and post office address shall be shown; if made by a partnership, the name and post

office address of the firm and the signature of at least one of the general partners must be shown; if made by a corporation, the proposal shall show the name and post office address of the corporation, the state in which the corporation was formed and the title of the person signing on behalf of the corporation.

Each proposal shall be enclosed in a sealed envelope and marked as specified in the notice to CONTRACTOR'S. Any erasures, alterations, omissions, or irregularities of any kind may result in a rejection of the bid. No oral, telephonic, or telegraphic proposals or modifications will be considered.

5. Bid Prices

Bid prices shall include all costs and expenses necessary for the completion of the contract, including but not limited to the furnishing of all labor and services, superintendence, material, tools, equipment, power and water, and all federal, state and local taxes. In the event of a difference between the price quoted in words and a price quoted in figures for the same quotation, the words shall be the amount bid.

6. List of Subcontractors

As required by Section 4104 of the Government Code, each proposal shall include (on a sheet attached to the Bid Proposal form) a statement of the names and location of the place of business of each subcontractor who will perform work or labor or render service to the prime contractor in or about the construction of the work or improvement, or a subcontractor licensed by the State of California who, under subcontract to the prime contractor, specifically fabricates and installs a portion of the work of improvement according to detailed drawings contained in the plans and specifications, in an amount in excess of one-half of one percent of the prime contractor's total bid. Such statement shall show also the portion of the work which will be done by each such subcontractor.

7. Bidder's Security

No Bid bond shall be required for this project.

8. Rejection of Bids

The District reserves the right to reject all bids; to reject any bid which is incomplete or irregular, or which is not accompanied by adequate bid security; to determine which proposal is, in its judgment, the lowest responsible bid of a responsible bidder; and to waive any informality or minor irregularity in any bid.

9. Award of Contract

Within forty-five (45) days after the time announced for the opening bid, the District will act either to accept a proposal or to reject all proposals. The acceptance of a proposal will be made by delivering in person or by certified mail to the successful bidder a written notice of award of the contract.

10. Execution of Contract

Within ten (10) days after receiving the notice of award of the contract, the successful bidder shall execute the Agreement, in duplicate, and furnish to the District all bonds and evidences of insurance, in proper form, as required by the General Conditions.

BID PROPOSAL

CABY WATER SYSTEM IMPROVEMENTS
Washington Water District, Washington, CA

TO: City of Nevada City, City Hall, Nevada City, California.

The undersigned, as a bidder, submits the following proposal for the CABY Water System Improvements in the Washington Water District of Washington, California, and offers to perform all work and furnish all labor, materials, tools, equipment, power and water as required for the completion of said project, in accordance with the plans, specifications and all other contract documents referred to in the Notice to CONTRACTOR'S. The bidder has inspected the project site and has examined all conditions affecting the proposed work.

If this bid is accepted, the bidder agrees to execute the Agreement, and furnish to the City all required bonds and evidences of insurance, within ten (10) days after receiving written notice of the award of contract, and complete the project within one hundred twenty (120) calendar days after receiving written notice to proceed.

Attached to this bid and made a part hereof is a list of proposed subcontractors, setting forth all information required by Section 4104 of the Government Code.

The bidder acknowledges receipt of the following addenda:

The undersigned is (state whether individual, partnership or corporation)_____.

DATED:_____

FIRM NAME:_____

BY:_____

Signature of OWNER or Authorized Officer

ADDRESS:_____

Contact Person:_____

PHONE: _____

Cell No.:_____

CONTRACTOR'S LICENSE NO:_____

EXPIRATION: _____

E-MAIL ADDRESS: _____

BID SCHEDULE

Item No.	Description	Unit	Estimated Quantity	Bid Unit Price	Bid Price
1	Mobilization	L.S.	1		
2	Clearing and Grubbing	L.S.	1		
3	Booster Pump System	L.S.	1		
4	Water Plant Mechanical	L.S.	1		
5	SCADA System and Server	L.S.	1		
6	Automatic Bypass Valves	EA	2		
7	Water Plant Electrical	L.S.	1		
8	Standpipe System	L.S.	1		
9	36" Water Plant Pipeline	L.F.	210		
10	8" Water Plant Pipeline	L.F.	220		
11	2" Service and Meter Assy	L.S.	1		
12	Water Storage Tank Mechanical	L.S.	1		
13	Water Storage Electrical and Telemetry	L.S.	1		
14	Water Storage Tank Communication Conduit	L.F.	700		
15	Water Storage Tank Off-Site Electrical and Telemetry	L.S.	1		

GRAND TOTAL

LIST OF SUBCONTRACTORS

<u>NAME</u>	<u>PLACE OF BUSINESS</u>	<u>PORTION OF WORK</u>
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

AGREEMENT

THIS AGREEMENT is made this _____ day of _____, between the WASHINGTON WATER DISTRICT, a municipal corporation, hereinafter called "District," and _____, hereinafter called "Contractor."

WHEREAS, District has caused to be prepared certain plans, specifications and other contract documents pertaining to the **CABY Water System Improvements** in said District; and

WHEREAS, after notice duly given, District has awarded the contract for such work to Contractor;

NOW, THEREFORE, IT IS AGREED by and between said parties as follows:

1. Scope of Work. The contractor agrees to furnish all labor, materials, tools and equipment, required to complete the water meter installation, District of Washington, California, in accordance with the plans, specifications and other contract documents hereinafter specified. All such work shall be performed in a good and workmanlike manner and to the satisfaction of the designer of said project.

2. Contract Price. As consideration for all such work, District agrees to pay to Contractor the total sum of _____ (\$ _____) Dollars, payable in the manner hereinafter set forth.

3. Contract Documents. The complete contract between the parties hereto consists of the Notice to CONTRACTOR'S, the Information to Bidders, the Bid Proposal, the Performance Bond, the Payment Bond, the General Conditions, the Plans and Specifications, and all other drawings and printed or written explanatory matter pertaining thereto. All of the foregoing documents are intended to cooperate, so that any work or requirement specified in any of them is to be carried out or observed the same as if mentioned in all.

4. Time for Performance. Within five (5) days after the execution of this Agreement, District shall give Contractor written Notice to Proceed, and thereafter Contractor shall commence the work and shall prosecute the same with due diligence until completion and acceptance by District; provided, however, that all such work shall be completed and ready for use within **one hundred twenty (120) calendar days** after Contractor receives said Notice to Proceed.

5. Extension of Time. If, because of adverse weather conditions, strikes, inability of the Contractor (through no fault on his/her part) to obtain necessary materials, or other cause beyond the reasonable control of Contractor, Contractor is unable to complete the required work within the allowed time, he shall be entitled to an extension or extensions of such time, commensurate with the unavoidable delay thus caused; provided, however that Contractor shall apply to District for approval of any such extension prior to the expiration of the time for performance as specified in the preceding paragraph.

6. Contractor's Failure to Complete Work. If Contractor fails to prosecute the work with such diligence as will insure its completion within the time hereinabove specified, or any extension thereof, or fails to complete such work within such time, or if Contractor shall otherwise violate this Agreement, District may give written notice to Contractor of District's intention to terminate this

Agreement unless, within five (5) days after services of such notice, satisfactory arrangements are made with the District for the completion of such work or the curing of such breach; and if such arrangements are not made within such time, District may, at its option, terminate this Agreement by giving written notice of such termination to Contractor.

7. Payments to Contractor. On or before the tenth day of each month during the progress of the work, Contractor shall submit to the Engineer an itemized statement of all labor and materials incorporated into the improvement during the preceding month and the portion of the contract price applicable thereto. Upon the written approval of said statement by the Engineer it shall be submitted to the District at its next regular or adjourned regular meeting, and within seven (7) days after approval by the District, District shall pay to Contractor a sum equal to one hundred (100%) percent of the contract price apportionment.

8. Indemnification. Contractor agrees to hold District, and its officers, agents, and employees harmless from any and all liability and claims for damages for death and personal injury, and for property damage, incident to or arising out of the operations of Contractor or any subcontractor under this Agreement, and Contractor further agrees to defend District, and its officers, agents, and employees in any and all lawsuits which may be brought for such damages caused, or alleged to have been caused, by such operations. In addition, Contractor agrees to furnish to the District evidences of insurance coverage as specified in the General Conditions. The approval of such insurance by District shall not constitute a waiver or limitation of any rights under this indemnity agreement, regardless of whether such insurance shall be held to be inapplicable to any such damage or claims therefore.

Executed in duplicate this _____ day of _____, _____.

ATTEST:

Washington Water District

By: _____

By: _____

Contractor

By: _____

GENERAL CONDITIONS

1. Inspection of Construction

The Engineer shall have access to the work and the site of the work at all times and the Contractor shall afford such access to the Engineer and shall furnish all relevant information requested by him. At the request of the Engineer the Contractor shall open for inspection any part of the work which has been covered up, and if any part of the work has been covered up in contravention of the instructions of the Engineer, or if on being opened up, is found not to be in accordance with the terms of the contract, the expense of opening and recovering shall be charged to the Contractor. If the work has been covered up but not in contravention of such instructions and is found to be in accordance with the terms of the contract, the actual cost of opening and recovering shall be borne by the District, and in such case, if the work of opening and recovering is done by the Contractor, it shall be considered as extra work and paid for accordingly.

2. Change Orders

If for any reason it becomes necessary or desirable to change the alignment, dimensions, or design of the work, the District shall have the right to issue written change orders therefore. If the Contractor considers that any such change involves extra work, he shall immediately so notify the Engineer in writing, and shall make claim for compensation for such work not later than the first day of the month following the month in which the work was performed. If, in the opinion of the Engineer, any change order results in a change in the amount of work performed, the contract price shall be adjusted for extra work or omitted work, as the case may be.

3. Contractor's Employees and Subcontractors

The Contractor shall at all times be responsible for the adequacy and efficiency of his employees and any subcontractor and the latter's employees. All workers shall have adequate skill and experience to perform properly the work assigned to them.

4. Errors and Omissions

If the Contractor in the course of the work becomes aware of any error or omission in the contract documents, or of any discrepancy between such documents and the physical conditions of the work site, he shall immediately inform the Engineer, who shall take such action as he may deem necessary in order to rectify the matter. Any work done after such discovery and without the authorization of the Engineer will be at the Contractor's risk.

5. Guaranty of Work

For a period of one (1) year after final acceptance of the work by the District, the Contractor shall make all repairs and replacements arising out of any defective workmanship or materials. If the Contractor fails to make such repairs or replacements within ten (10) days after receiving written notice to do so or within such further time as may be allowed by the District, the District may undertake such repairs or replacements, in which case the Contractor shall be liable to the District for the cost thereof.

6. Contractor's Responsibility for Work

The Contractor shall be responsible for the proper care and protection of the work, and of all materials delivered to the work site, until completion of the work and its final acceptance by the District.

7. Performance Bond

A performance bond shall be required for this project.

8. Payment Bond

A (labor materials) bond shall be required for this project.

9. Workmen's Compensation Insurance

The Contractor shall carry workmen's compensation insurance for all employees working on or about the site of the work, and if any work is subcontracted, the Contractor shall require each subcontractor to carry such insurance for all of the latter's employees, unless they are covered by the Contractor's insurance.

10. Public Liability Insurance

The Contractor shall carry public liability insurance insuring against all liability and claims for personal injury, death, and property damage incident to or arising out of the operations of the Contractor, or any subcontractor, under the contract, in the following amounts: \$1,000,000.00 for personal injury or death of any one person, \$1,000,000.00 for any one accident or occurrence; and \$100,000.00 property damage. Such insurance shall include, as additional insured's, the Washington Water District, its officers, agents, and employees.

11. Evidence of Insurance: Non-Cancellation Claus

The Contractor shall deliver to the District, concurrently with the execution of the contract, certificates evidencing all insurance required by the contract, and each such certificate shall include a provision to the effect that the policy or policies cannot be canceled or materially modified unless the insurer gives the District at least fifteen (15) days written notice thereof prior to such cancellation or modification.

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GENERAL CONDITIONS

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GENERAL CONDITIONS

ARTICLE 1 - DEFINITIONS

Whenever used in these General Conditions or in the other Contract Documents, the following terms have the meanings indicated which are applicable to both the singular and plural thereof:

Agreement - The written agreement between OWNER and CONTRACTOR covering the Work to be performed; other Contract Documents are attached to the Agreement.

Application for Payment - The form furnished by ENGINEER which is to be used by CONTRACTOR in requesting progress payments and which is to include the schedule of values required by paragraph 14.1 and an affidavit of CONTRACTOR that progress payments therefore received on account of the Work have been applied by CONTRACTOR to discharge in full all of CONTRACTOR'S obligations reflected in prior Applications for Payment.

Bid - The offer or proposal of the Bidder submitting on the prescribed form setting forth the prices for the Work to be performed.

Bidder - Any person, firm, or corporation submitting a Bid for the Work.

Bonds - Bid, performance, and payment bonds and other instruments of security, furnished by CONTRACTOR and his surety in accordance with the Contract Documents.

Change Order - A written order to CONTRACTOR signed by OWNER authorizing an addition, deletion, or revision in the Work, or an adjustment in the Contract Price or the Contract Time issued after execution of the Agreement.

Contract Documents - The Agreement, Addenda (whether issued prior to the opening of Bid or the execution of the Agreement), Instructions to Bidders, CONTRACTOR'S Bid, the Bonds, the Notice of Award, these General Conditions, the Supplementary Conditions, the Specifications, Drawings and Modifications.

Contract Price - The total moneys payable to CONTRACTOR under the Contract Documents.

Contract Time - The number of days stated in the Agreement for the completion of the Work, computed as provided in paragraph 17.2.

CONTRACTOR - The person, firm, or corporation with whom OWNER has executed the Agreement.

Day - A calendar day of twenty-four hours measured from midnight to the next midnight.

Drawings - The drawings which show the character and scope of the Work to be performed and which have been prepared or approved by ENGINEER and are referred to in the Contract Documents.

ENGINEER - The person, firm or corporation named as such in the Agreement.

Field Order - A written order issued by ENGINEER which clarifies or interprets the Contract

Documents in accordance with paragraph 9.3 or orders minor changes in the Work in accordance with paragraph 10.2.

Modification - (a) A written amendment of the Contract Documents signed by both parties, (b) a Change Order, (c) a written clarification or interpretation issued by ENGINEER in accordance with paragraph 9.3, or (d) a written order for a minor change or alteration in the Work issued by ENGINEER pursuant to paragraph 10.2. A Modification may only be issued after execution of the Agreement.

Notice of Award - The written notice by OWNER to the apparent successful Bidder stating that upon compliance with the conditions precedent to be fulfilled by him within the time specified, OWNER will execute and deliver the Agreement to him.

Notice to Proceed - A written notice given by OWNER to CONTRACTOR (with a copy to ENGINEER) fixing the date on which the Contract Time will commence to run and on which CONTRACTOR shall start to perform his obligations under the Contract Document.

OWNER - A public body or authority, corporation, association, partnership, or individual for whom the Work is to be performed.

Project - The entire construction to be performed as provided in the Contract Documents.

Resident Project Representative - The authorized representative of ENGINEER who is assigned to the Project site or any part thereof.

Shop Drawings - All drawings, diagrams, illustrations, brochures, schedules, and other data which are prepared by CONTRACTOR, a Subcontractor, manufacturer, supplier, or distributor and which illustrate the equipment, material, or some portion of the Work.

Specifications - Those portions of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards, and workmanship as applied to the Work. The specifications are customarily organized in 16 divisions in accordance with the Uniform System for Construction Specifications endorsed by the Construction Specifications Institute. [Note: the term "Technical Provisions" formerly described what is now referred to as the Specifications. For uniformity with the usage of other professional societies the term "Project Manual" is used to describe the volume formerly referred to as "The Specifications." The Project Manual contains documents concerning bidding requirements which in general govern relationships prior to the execution of the Agreement (such as the Invitation to Bid, Instructions to Bidders, Bid Bonds and Notice of Award) and the other portions of the Contract Documents.]

Subcontractor - An individual, firm, or corporation having a direct contract with CONTRACTOR or with any other Subcontractor for the performance of a part of the Work at the site.

Substantial Completion - The date as certified by ENGINEER when the construction of the Project or a specified part thereof is sufficiently completed, in accordance with the Contract Documents, so that the Project or specified part can be utilized for the purpose for which it was intended: or if there be no such certification, the date when final payment is due in accordance with paragraph 14.13.

Work - Any and all obligations, duties and responsibilities necessary to the successful completion of the Project assigned to or undertaken by CONTRACTOR under the Contract Documents, including all labor, materials, equipment and other incidentals, and the furnishing thereof.

ARTICLE 2 - PRELIMINARY MATTERS

Execution of Agreement:

2.1 At least three counterparts of the Agreement and such other Contract Documents as practicable will be executed and delivered by CONTRACTOR to OWNER within fifteen days of the Notice of Award: and OWNER will execute and deliver one counterpart to CONTRACTOR within ten days of receipt of the executed Agreement from CONTRACTOR. ENGINEER will identify those portions of the Contract Documents not so signed and such identification will be binding on all parties. OWNER, CONTRACTOR, and ENGINEER shall each receive an executed counterpart of the Contract Documents and additional conformed copies as required.

Delivery of Bonds:

2.2 When he delivers the executed Agreement to OWNER, CONTRACTOR shall also deliver to OWNER such Bonds as he may be required to furnish in accordance with paragraph 5.1.

Copies of Documents:

2.3 OWNER shall furnish to CONTRACTOR up to ten copies (unless otherwise provided in the Supplementary Conditions) of the Contract Documents as are reasonably necessary for the execution of the Work. Additional copies will be furnished, upon request, at the cost of reproduction.

Contractor's Pre-Start Representations:

2.4 CONTRACTOR represents that he has familiarized himself with, and assumes full responsibility for having familiarized himself with, the nature and extent of the Contract Documents, Work, locality, and with all local conditions and federal, state, and local laws, ordinances, rules, and regulations that may in any manner affect performance of the Work, and represents that he has correlated his study and observations with the requirements of the Contract Documents. CONTRACTOR also represents that he has studied all surveys and investigation reports of subsurface and latent physical conditions referred to in the General Requirements (Division 1) of the Specifications and made such additional surveys and investigations as he deems necessary for the performance of the Work at the Contract Price in accordance with the requirements of the Contract Documents and that he has correlated the results of all such data with the requirements of the Contract Documents.

Commencement of Contract Time: Notice to Proceed:

2.5 The Contract Time will commence to run on the thirtieth day after the day on which the executed Agreement is delivered by OWNER to CONTRACTOR: or if Notice to Proceed is given, on the day indicated in the Notice to Proceed; but in no event shall the Contract Time commence to run later than the ninetieth day after the day of Bid opening or the thirtieth day after the day on which OWNER delivers the executed Agreement to CONTRACTOR. A Notice to Proceed may be given at any time within thirty days after the day on which OWNER delivers the executed Agreement to CONTRACTOR.

Starting the Project:

2.6 CONTRACTOR shall start to perform his obligations under the Contract Documents on the date when the Contract Time commences to run. No Work shall be done at the site prior to the date on which the Contract Time commences to run.

Before Starting Construction:

2.7 Before undertaking each part of the Work, CONTRACTOR shall carefully study and compare the Contract Documents and check and verify pertinent figures shown thereon and all applicable field measurements. He shall at once report in writing to ENGINEER any conflict, error, or discrepancy which he may discover, however, he shall not be liable to OWNER or ENGINEER for his failure to discover any conflict, error, or discrepancy in the Drawings or Specifications.

2.8 Within ten days after delivery of the executed Agreement by OWNER to CONTRACTOR, CONTRACTOR shall submit to ENGINEER for approval, an estimated progress schedule indicating the starting and completion dates of the various stages of the Work, and a preliminary schedule of Shop Drawing submissions.

2.9 Before starting the Work at the site, CONTRACTOR shall furnish OWNER and ENGINEER certificates of insurance as required by Article 5. Within twenty days after delivery of the executed Agreement by OWNER to CONTRACTOR, but before starting the Work at the site, a conference will be held to review the above schedules to establish procedures for handling Shop Drawings and other submissions and for processing Applications for Payment, and to establish a working understanding between the parties as to the Project. Present at the conference will be OWNER or his representative, ENGINEER, Resident Project Representatives, CONTRACTOR, and his Superintendent.

ARTICLE 3 - CORRELATION, INTERPRETATION, AND INTENT OF CONTRACT DOCUMENTS

3.1 It is the intent of the Specifications and Drawings to describe a complete Project to be constructed in accordance with the Contract Documents. The Contract Documents comprise the entire Agreement between OWNER and CONTRACTOR. They may be altered only by a Modification.

3.2 The Contract Documents are complementary; what is called for by one is as binding as if called for by all. The CONTRACTOR finds a conflict, error, or discrepancy in the Contract Documents, he shall call it to ENGINEER'S attention in writing at once and before proceeding with the Work affected thereby; however, he shall not be liable to OWNER or ENGINEER for his failure to discover any conflict, error, or discrepancy in the Specifications or Drawings. In resolving such conflicts, errors, or discrepancies, the documents shall be given precedence in the following order: Agreement, Modifications, Addenda, Supplementary Conditions, Specifications and Drawings. Figure dimensions on Drawings shall govern over scale dimensions, and detailed Drawings shall govern over general Drawings. Any Work that may reasonably be inferred from the Specifications or Drawings as being required to produce the intended result shall be supplied whether or not it is specifically called for. Work, materials, or equipment described in words which so applied have a well-known technical or trade meaning shall be deemed to refer to such recognized standards.

ARTICLE 4 - AVAILABILITY OF LANDS; PHYSICAL CONDITIONS; REFERENCE POINTS

Availability of Lands:

4.1 OWNER shall furnish, as indicated in the Contract Documents and not later than the date when needed by CONTRACTOR, the lands upon which the Work is to be done, rights-of-way thereto, and such other lands which are designated for the use of CONTRACTOR. Easements for permanent structures or permanent changes in existing facilities will be obtained and paid for by OWNER, unless otherwise specified in the Contract Documents. If CONTRACTOR believes that any delay in OWNER'S furnishing these lands or easements entitles him to an extension of the Contract Time, he may make a claim therefore as provided in Article 12. CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

Physical Conditions - Surveys and Reports:

4.2 Reference is made to the General Requirements (Division 1) of the Specifications for identification of those surveys and investigation reports of subsurface and latent physical conditions at the Project site or otherwise affecting performance of the Work which have been relied upon by ENGINEER in preparation of the Drawings and Specifications.

Unforeseen Physical Conditions:

4.3 CONTRACTOR shall promptly notify OWNER and ENGINEER in writing of any subsurface or latent physical conditions at the site differing materially from those indicated in the Contract Documents. ENGINEER will promptly investigate those conditions and advise OWNER in writing if further surveys or subsurface tests are necessary. Promptly thereafter, OWNER shall obtain the necessary additional surveys and tests and furnish copies to ENGINEER and CONTRACTOR. If ENGINEER finds that the results of such surveys or tests indicate that there are subsurface or latent physical conditions which differ materially from those intended in the Contract Documents, and which could not reasonably have been anticipated by CONTRACTOR, a Change Order shall be issued incorporating the necessary revisions.

Reference Points:

4.4 OWNER shall provide engineering surveys for construction to establish reference points which in his judgment are necessary to enable CONTRACTOR to proceed with the Work. CONTRACTOR shall be responsible for surveying and laying out the Work (unless otherwise provided in the Supplementary Conditions), and shall protect and preserve the established reference points and shall make no changes or relocations without the prior written approval of OWNER. He shall report to ENGINEER whenever any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations. CONTRACTOR shall replace and accurately relocate all reference points so lost, destroyed, or moved.

ARTICLE 5 - BONDS AND INSURANCE

Performance, Payment, and Other Bonds:

5.1 CONTRACTOR shall furnish performance and payment Bonds as security for the faithful performance and payment of all his obligations under the Contract Documents. These Bonds shall be in amounts at least equal to the Contract Price, and (except as otherwise provided in the Supplementary Conditions) in such form and with such sureties as are licensed to conduct business in the state where the Project is located and are named in the current list of "Surety Companies Acceptable on Federal Bonds" as published in the Federal Register by the Audit Staff Bureau of Accounts, U.S. Treasury Department.

5.2 If the surety on any Bond furnished by CONTRACTOR is declared a bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located is revoked, CONTRACTOR shall within five days thereafter substitute another Bond and surety, both of which shall be acceptable to OWNER.

Contractor's Liability Insurance:

5.3 CONTRACTOR shall purchase and maintain such insurance as will protect him from claims under workman's compensation laws, disability benefit laws, or other similar employee benefit laws; from claims for damages because of bodily injury, occupational sickness or disease, or death of his employees, and claims insured by usual personal injury liability coverage; and from claims for injury to or destruction of tangible property, including loss of use resulting therefrom – any or all of which may arise out of or result from CONTRACTOR'S operations under the Contract Documents, whether such operations be by himself or by any Subcontractor or anyone directly or indirectly employed by any of them or for whose acts any of them may be legally liable. This insurance shall include the specific coverage and be written for not less than any limits of liability and maximum deductibles specified in the Supplementary Conditions or General Requirements (Division 1) or required by law, whichever is greater, shall include parties. Before starting Work, CONTRACTOR shall file with OWNER and ENGINEER certificates of such insurance, acceptable to OWNER; these certificates shall contain a provision that the coverage afforded under the policies will not be cancelled or materially changed until at least fifteen days prior written notice has been given to OWNER and ENGINEER.

Any deductibles or self-insured retentions must be declared to and approved by the OWNER. At the option of the OWNER, either: the insurer shall reduce or eliminate such deductibles or self-insured retentions as respects the OWNER, its officers, officials, employees and volunteers; or the

CONTRACTOR shall provide a financial guarantee satisfactory to the OWNER guaranteeing payment of losses and related investigations, claim administration and defense expenses.

The general liability and automobile liability policies are to contain, or be endorsed to contain, the following provisions:

1. The ENGINEER and the OWNER, its officers, officials, employees, and volunteers are to be covered as insured's with respect to liability arising out of automobiles owned, leased, hired or borrowed by or on behalf of the CONTRACTOR; and with respect to liability arising out of work or operations performed by or on behalf of the CONTRACTOR including materials, parts or equipment furnished in connection with such work or operations. General liability coverage can be provided in the form of an endorsement to the CONTRACTOR'S insurance.
2. For any claims related to this project, the CONTRACTOR'S insurance coverage shall be primary insurance as respects the ENGINEER and the OWNER, its officers, officials, employees, and volunteers. Any insurance or self-insurance maintained by the ENGINEER and the OWNER, its officers, officials, employees, or volunteers shall be excess of the CONTRACTOR'S insurance and shall not contribute with it.
3. Each insurance policy required by this clause shall be endorsed to state that coverage shall be cancelled by either party, except after fifteen (15) days prior written notice by certified mail, return receipt requested, has been given to the OWNER and the ENGINEER.
4. Coverage shall not extend to any indemnity coverage for the active negligence of the additional insured in any case where an agreement to indemnify the additional insured would be invalid under *Subdivision (b) of Section 2782 of the Civil Code*.

Insurance is to be placed with a current A.M. Best's rating of no less than A:VII.

CONTRACTOR shall furnish the OWNER with original certificates and amendatory endorsements effecting coverage required by this clause. The endorsements should be on forms provided by the OWNER or on other than the OWNER'S forms, provided those endorsements or policies conform to the requirements. All certificates and endorsements are to be received and approved by the OWNER before work commences. The OWNER reserved the right to require complete, certified copies of all required insurance policies, including endorsements affecting the coverage required by these specifications at any time.

CONTRACTOR shall include all Subcontractors as insured's under its policies or shall furnish separate certificates and endorsements for each Subcontractor. All coverage for Subcontractors shall be subject to all of the requirements stated herein.

OWNER'S Liability Insurance:

5.4 OWNER shall be responsible for purchasing and maintaining his own liability insurance and, at his option, may purchase and maintain such insurance as will protect him against claims which may arise from operations under the Contract Documents.

Property Insurance:

5.5 Unless otherwise provided, OWNER shall purchase and maintain property insurance upon the Project to the full insurable value hereof. This insurance shall include the interests of OWNER, CONTRACTOR, and Subcontractors in the Work, shall insure against the perils of Fire, Extended Coverage, Vandalism, and Malicious Mischief, and such other perils as may be specified in the Supplementary Conditions or General Requirements (Division 1), and shall include damages, losses, and expenses arising out of or resulting from any insured loss or incurred in the repair or replacement of any insured property (including fees and charges of engineers, architects, attorneys, and other professionals).

5.6 OWNER shall purchase and maintain such steam boiler and machinery insurance as may be required by the Supplementary Conditions or by law. This insurance shall include the interests of OWNER, CONTRACTOR, and Subcontractors in the Work.

5.7 Any insured loss under the policies of insurance required by paragraphs 5.5 and 5.6 is to be adjusted with OWNER and made payable to OWNER as trustee for the insured's, as their interests may appear, subject to the requirements of any applicable mortgage clause and of paragraph 5.11.

5.8 OWNER shall file a copy of all policies with CONTRACTOR before an exposure to loss may occur. If OWNER does not intend to purchase such insurance, he shall inform CONTRACTOR in writing prior to commencement of the Work. CONTRACTOR may then affect insurance which will protect the interests of himself and his Subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to OWNER. If CONTRACTOR is damaged by failure of OWNER to purchase or maintain such insurance and so to notify CONTRACTOR, then OWNER shall bear reasonable costs properly attributable thereto.

5.9 If CONTRACTOR requests in writing that other special insurance be included in the property insurance policy, OWNER shall, if possible, include such insurance and the cost thereof shall be charged to CONTRACTOR by appropriate Change Order.

5.10 OWNER and CONTRACTOR waive all rights against each other for damages caused by fire or other perils to the extent covered by insurance provided under paragraphs 5.5 through 5.11, inclusive, except such rights as they may have to the proceeds of such insurance held by OWNER as trustee. CONTRACTOR shall require similar waivers by Subcontractors in accordance with paragraph 6.12.

5.11 OWNER as trustee shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within five days after the occurrence of loss to OWNER'S exercise of this power, and if such objection be made, arbitrators shall be chosen as provided in Article 16. OWNER as trustee shall, in that case, make settlement with the insurers in accordance with the directions of such arbitrators. If distribution of the insurance proceeds by arbitration is required, the arbitrators will direct such distribution.

Additional Bonds and Insurance:

5.12 Prior to delivery of the executed Agreement by OWNER to CONTRACTOR, OWNER

may require CONTRACTOR to furnish such other Bonds and such additional insurance, in such form and with such sureties or insurers as OWNER may require. If such other Bonds or such other insurance are specified by written instructions given prior to opening of Bids, the premiums shall be paid by CONTRACTOR; if subsequent thereto, they shall be paid by OWNER (except as otherwise provided in paragraph 6.7).

ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

Supervision and Superintendence:

6.1 CONTRACTOR shall supervise and direct the Work efficiently and with his best skill and attention. He shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction, but he shall not be solely responsible for the negligence of others in the design or selection of a specific means, method, technique, sequence, or procedure of construction which is indicated in and required by the Contract Documents. CONTRACTOR shall be responsible to see that the finished Work complies accurately with the Contract Documents.

6.2 CONTRACTOR shall keep on the Work at all times during its progress a competent resident superintendent, who shall not be replaced without written notice to OWNER and ENGINEER except under extraordinary circumstances. The superintendent will be CONTRACTOR'S representative at the site and shall have authority to act on behalf of CONTRACTOR. All communications given to the superintendent shall be as binding as if given to CONTRACTOR.

Labor, Materials, and Equipment:

6.3 CONTRACTOR shall provide competent, suitably qualified personnel to survey and lay out the Work and perform personnel to survey and lay out the Work and perform construction as required by the Contact Documents. He shall at all times maintain good discipline and order at the site.

6.4 CONTRACTOR shall furnish all materials, equipment, labor, transportation, construction equipment, and machinery, tools, appliances, fuel, power, light, heat, telephone, water, and sanitary facilities and all other facilities and incidentals necessary for the execution, testing, initial operation, and completion of the Work.

6.5 All materials and equipment shall be new, except as otherwise provided in the Contract Documents. If required by ENGINEER, CONTRACTOR shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

6.6 All materials and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with the instructions of the applicable manufacturer, fabricator, or processors, except as otherwise provided in the Contract Documents.

Substitute Materials or Equipment:

7.1 If the General Requirements (Division 1 of the Specifications), law, ordinance, or

applicable rules or regulations permit CONTRACTOR to furnish or use a substitute that is equal to any material or equipment specified, and if CONTRACTOR wishes to furnish or use a proposed substitute, he shall, prior to the conference called for by paragraph 2.9 (unless another time is provided in the General Requirements), make written application to ENGINEER for approval of such substitute certifying in writing that the proposed substitute will perform adequately the functions called for by the general design, be similar and of equal substance to that specified and be suited to the same use and capable of performing the same function as that specified; stating whether or not its incorporation in or use in connection with the Project is subject to the payment of any license fee or royalty; and identifying all variations of the proposed substitute from that specified and indicating available maintenance service. No substitute shall be ordered or installed without the written approval of ENGINEER who will be the judge of equality and may require CONTRACTOR to furnish such other data about the proposed substitute as he considers pertinent. No substitute shall be ordered or installed without such performance guarantee and bonds as OWNER may require which shall be furnished at CONTRACTOR'S expense.

Concerning Subcontractors:

6.8 CONTRACTOR shall not employ any Subcontractor or other person or organization (including those who are to furnish the principal items of materials or equipment), whether initially or as a substitute, against whom OWNER or ENGINEER may have reasonable objection. A Subcontractor or other person or organization identified in writing to OWNER and ENGINEER by CONTRACTOR prior to the Notice of Award and not objected to in writing by OWNER or ENGINEER prior to the Notice of Award will be deemed acceptable to OWNER and ENGINEER. Acceptance of any Subcontractor, other person or organization by OWNER or ENGINEER shall not constitute a waiver of any right of OWNER or ENGINEER to reject defective Work or Work not in conformance with the Contract Documents. If OWNER or ENGINEER after due investigation has reasonable objection to any Subcontractor, other person or organization proposed by CONTRACTOR after the Notice of Award. CONTRACTOR shall submit an acceptable substitute and the Contract Price shall be increased or decreased by the difference in cost occasioned by such substitution, and an appropriate Change Order shall be issued. CONTRACTOR shall not be required to employ any Subcontractor, other person or organization against whom he has reasonable objection. CONTRACTOR shall not without the consent of OWNER and ENGINEER make any substitution for any Contractor, other person or organization who has been accepted by OWNER and ENGINEER unless ENGINEER determines that there is good cause for doing so.

6.9 CONTRACTOR shall be fully responsible for all acts and omissions of his Subcontractors and of persons and organizations directly or indirectly employed by them and of persons and organizations for whose acts any of them may be liable to the same extent that he is responsible for the acts and omissions of persons directly employed by him. Nothing in the Contract Documents shall create any contractual relationship between OWNER or ENGINEER and any Subcontractor or other person or organization having a direct contract with CONTRACTOR, nor shall it create any obligation on the part of OWNER or ENGINEER or pay or to see to the payment of any moneys due any Subcontractor or other person or organization, except as may otherwise be required by law. OWNER or ENGINEER may furnish to any Subcontractor or other person or organization, to the extent practicable, evidence of amounts paid to CONTRACTOR on account of specific Work done in accordance with the schedule of values.

6.10 The divisions and sections of the Specifications and the identifications of any Drawings

shall not control CONTRACTOR in dividing the Work among Subcontractors or delineating the Work to be performed by any specific trade.

6.11 CONTRACTOR agrees to bind specifically every Subcontractor to the applicable terms and conditions of the Contract Documents for the benefit of OWNER.

6.12 All Work performed for CONTRACTOR by a Subcontractor shall be pursuant to an appropriate agreement between CONTRACTOR and the Subcontractor which shall contain provisions that waive all rights the contracting parties may have against one another for damages caused by fire or other perils covered by insurance provided in accordance with paragraphs 5.5 through 5.11, inclusive, except such rights as they may have to the proceeds of such insurance held by OWNER as trustee under paragraph 5.9. CONTRACTOR shall pay each Subcontractor a just share of any insurance moneys received by CONTRACTOR under paragraph 5.5 through 5.11, inclusive.

Patent Fees and Royalties:

6.13 CONTRACTOR shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work of an invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if to the actual knowledge of OWNER or ENGINEER its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by OWNER in the Contract Documents. CONTRACTOR shall indemnify and hold harmless OWNER and ENGINEER and anyone directly or indirectly employed by either of them from and against all claims, damages, losses, and expenses (including attorneys' fees) arising out of 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, and shall defend all such claims in connection with any alleged infringement of such rights.

Permits:

6.14 CONTRACTOR shall obtain and pay for all construction permits and licenses and shall pay all governmental charges and inspection fees necessary for the prosecution of the Work, which are applicable at the time of his Bid. OWNER shall assist CONTRACTOR, when necessary, in obtaining such permits and licenses. CONTRACTOR shall also pay all public utility charges.

Laws and Regulations:

6.15 CONTRACTOR shall give all notices and comply with all laws, ordinances, rules, and regulations applicable to the Work. If CONTRACTOR observes that the Specifications and Drawings are at variance therewith, he shall give ENGINEER prompt written notice thereof, and any necessary changes shall be adjusted by an appropriate Modification. If CONTRACTOR performs any Work knowing it to be contrary to such laws, ordinances, rules, and regulations, and without such notice to ENGINEER, he shall bear all costs arising therefrom; however, it shall not be his primary responsibility to make certain that the Specifications and Drawings are in accordance with such laws, ordinances, rules, and regulations.

Taxes:

6.16 CONTRACTOR shall pay all sales, consumer, use, and other similar taxes required to be paid by him in accordance with the law of the place where the Work is to be performed.

Use of Premises:

6.17 CONTRACTOR shall confine his equipment, the storage of materials and equipment, and the operations of his workmen to areas permitted by law, ordinances, permits, or the requirements of the Contract Documents, and shall not unreasonably encumber the premises with materials or equipment.

6.18 CONTRACTOR shall not load nor permit any part of any structure to be loaded with weights that will endanger the structure, nor shall he subject any part of the Work to stresses or pressures that will endanger it.

Record Drawings:

6.19 CONTRACTOR shall keep one record copy of all Specifications, Drawings, Addenda, Modifications, and Shop Drawings at the site in good order and annotated to show changes made during the construction process. These shall be available to ENGINEER and shall be delivered to him for OWNER upon completion of the Project. [*Note: Further provisions in respect of such record drawings may be included in the General Requirements (Division 1).*]

Safety and Protection:

6.20 CONTRACTOR shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. He shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

6.20.1 all employees on the Work and other persons who may be affected thereby,

6.20.2 all the Work and all materials or equipment to be incorporated therein, whether in storage on or off the site and

6.20.3 other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

CONTRACTOR shall comply with all applicable laws, ordinances, rules, regulations, and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury, or loss. He shall erect and maintain, as required by the conditions and progress of the Work, all necessary safeguards for its safety and protection. He shall notify OWNER'S of adjacent utilities when prosecution of the Work may affect them. All damage, injury, or loss to any property referred to in paragraph 6.20.2 or 6.20.3 caused, directly or indirectly, in whole or in part, by CONTRACTOR, any Subcontractor or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, shall be remedied by CONTRACTOR: 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 either of them or anyone for whose acts either of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of CONTRACTOR. CONTRACTOR'S duties and responsibilities for the safety and protection of the Work shall continue until such time as all the Work is completed and ENGINEER has issued a notice to OWNER and CONTRACTOR in accordance with paragraph 14.13 that Work is acceptable

6.21 CONTRACTOR shall designate a responsible member of his organization at the site whose duty shall be the prevention of accidents. This person shall be CONTRACTOR'S superintendent unless otherwise designated in writing by CONTRACTOR to OWNER.

Emergencies:

6.22 In emergencies affecting the safety of persons or the Work or property at the site or adjacent thereto, CONTRACTOR, without special instruction or authorization from ENGINEER or OWNER, is obligated to act, at his discretion, to prevent threatened damage, injury, or loss. He shall give ENGINEER prompt written notice of any significant changes in the Work or deviations from the Contract Documents caused thereby, and a Change Order shall thereupon be issued covering the changes and deviations involved. If CONTRACTOR believes that additional work done by him in any emergency which arose from causes beyond his control entitles him to an increase in the Contract Price or an extension of the Contract Time, he may make a claim therefore as provided in Articles 11 and 12.

Shop Drawings and Samples:

6.23 After checking and verifying all field measurements. CONTRACTOR shall submit to ENGINEER for approval, in accordance with the accepted schedule of Shop Drawing submissions (see paragraph 2.8) five copies (or at ENGINEER'S option, one reproducible copy) of all Shop Drawings, which shall have been checked by and stamped with the approval of CONTRACTOR and identified as ENGINEER may require. The data shown on the Shop Drawings will be complete with respect to dimensions, design criteria, materials of construction, and the like to enable ENGINEER to review the information as required.

6.24 CONTRACTOR shall also submit to ENGINEER for approval with such promptness as to cause no delay in Work, all samples required by the Contract Documents. All samples will have

been checked by and stamped with the approval of CONTRACTOR, identified clearly as to material, manufacturer, any pertinent catalog numbers and the use for which intended.

6.25 At the time of submission, CONTRACTOR shall in writing call ENGINEER'S attention to any deviations that the Shop Drawing or sample may have from the requirements of the Contract Documents.

6.26 ENGINEER will review and approve with reasonable promptness Shop Drawings and samples, but his review and approval shall be only for conformance with the design concept of the Project and for compliance with the information given in the Contract Documents. The approval of a separate item as such will not indicate approval of the assembly in which the item functions. CONTRACTOR shall make any corrections required by ENGINEER and shall return the required number of corrected copies of Shop Drawings and resubmit new samples until approved. CONTRACTOR shall direct specific attention in writing or on resubmitted Shop Drawings to revisions other than the corrections called for by ENGINEER on previous submissions. CONTRACTOR'S stamp of approval on any Shop Drawing or sample shall constitute a representation to OWNER and ENGINEER that CONTRACTOR has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or he assumes full responsibility for doing so, and that he has reviewed or coordinated each Shop Drawing or sample with the requirements of the Work and the Contract Documents.

6.27 Where a Shop Drawing or sample submission is required by the Specifications, no related Work shall be commenced until the submission has been approved by ENGINEER. A copy of each approved Shop Drawing and each approved sample shall be kept in good order by CONTRACTOR at the site and shall be available to ENGINEER.

6.28 ENGINEER'S approval of Shop Drawings or samples shall not relieve CONTRACTOR from his responsibility for any deviations from the requirements of the Contract Documents unless CONTRACTOR has in writing called ENGINEER'S attention to such deviation at the time of submission and ENGINEER has given written approval to the specific deviation, nor shall any approval by ENGINEER relieve CONTRACTOR from responsibility for errors or omissions in the Shop Drawings.

[Note: Further provisions in respect to Shop Drawings and samples may be included in the General Requirements (Division 1).]

Cleaning:

6.29 CONTRACTOR shall keep the premises free from accumulations of waste materials, rubbish, and other debris resulting from the Work, and at the completion of the Work he shall remove all waste materials, rubbish, and debris from and about the premises as well as all tools, construction equipment and machinery, and surplus materials, and shall leave the site clean and ready for occupancy by OWNER. CONTRACTOR shall restore to their original condition those portions of the site not designated for alteration by the Contract Documents. *[Note: Further provisions in respect to cleaning may be included in the General Requirements (Division 1).]*

Indemnification:

6.30 CONTRACTOR shall indemnify and hold harmless OWNER and ENGINEER and their agents and employees from and against all claims, damages, losses, and expenses including attorneys' fees arising out of or resulting from the performance of the Work, provided that any such claim, damage, loss, or expense (a) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including the loss of use resulting therefrom and (b) is caused in whole or in part by any negligent act or omission of CONTRACTOR, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by a party indemnified hereunder.

6.31 In any and all claims against OWNER or ENGINEER or any of their agents or employees by an employee of CONTRACTOR, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under paragraph 6.30 shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for CONTRACTOR or any Subcontractor under workmen's compensation acts, disability benefit acts or other employee benefit acts.

6.32 The obligations of CONTRACTOR under paragraph 6.30 shall not extend to the liability of ENGINEER, his agents, or employees arising out of (a) the preparation or approval of maps, drawings, opinions, reports, surveys, Change Orders, designs or specifications or (b) the giving of or the failure to give directions or instructions by ENGINEER, his agents, or employees provided such giving or failure to give is the primary cause of injury or damage.

ARTICLE 7 - WORK BY OTHERS

7.1 OWNER may perform additional work related to the Project by himself, or he may let other direct contracts therefore which shall contain General Conditions similar to these. CONTRACTOR shall afford the other CONTRACTOR'S who are parties to such direct contracts (or OWNER, if he is performing the additional work himself), reasonable opportunity for the introduction and storage of materials and equipment and the execution of work, and shall properly connect and coordinate his Work with theirs.

7.2 If any part of CONTRACTOR'S Work depends for proper execution or results upon the work of any such other contractor (or OWNER), CONTRACTOR shall inspect and promptly report to ENGINEER in writing any defects or deficiencies in such work that render it unsuitable for such proper execution and results. His failure so to report shall constitute an acceptance of the other work as fit and proper for the relationship of his Work except as to defects and deficiencies which may appear in the other work after the execution of his Work.

7.3 CONTRACTOR shall do all cutting, fitting, and patching of his Work that may be required to make its several parts come together properly and fit it to receive or be received by such other work. CONTRACTOR shall not endanger any work by others by cutting, excavating, or otherwise altering their work and will only cut or alter their work with the written consent of ENGINEER and of the other CONTRACTOR'S whose work will be affected.

7.4 If the performance of additional work by other CONTRACTOR'S or OWNER is not noted in the Contract Documents prior to the execution of the contract, written notice thereof shall be given to CONTRACTOR prior to starting any such additional work. If CONTRACTOR believes that the performance of such additional work by OWNER or others involves him in additional expenses or entitles him to an extension of the Contract Time, he may make a claim therefore as provided in Articles 11 and 12.

ARTICLE 8 - OWNER'S RESPONSIBILITIES

8.1 OWNER shall issue all communications to CONTRACTOR through ENGINEER.

8.2 In case of termination of the employment of ENGINEER, OWNER shall appoint an engineer against whom CONTRACTOR makes no reasonable objections, whose status under the Contract Documents shall be that of the former ENGINEER. Any dispute in connection with such appointment shall be subject to arbitration.

8.3 OWNER shall furnish the data required of him under the Contract Documents promptly and shall make payments to CONTRACTOR promptly after they are due as provided in paragraph 14.4 and 14.13.

8.4 OWNER'S duties in respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in paragraphs 4.1 and 4.4. Paragraph 4.2 refers to OWNER'S identifying and making available to CONTRACTOR copies of surveys and investigation reports of subsurface and latent physical conditions at the site or otherwise affecting performance of the Work which have been relied upon by ENGINEER in preparing the Drawings and Specifications.

8.5 OWNER'S responsibilities in respect of liability and property insurance are set forth in paragraph 5.4 and 5.5.

8.6 In addition to his rights to request changes in the Work in accordance with Article 10, OWNER (especially in certain instances as provided in paragraph 10.4) shall be obligated to execute Change Orders.

8.7 OWNER'S responsibility in respect of certain inspections, tests, and approvals is set forth in paragraph 13.2.

8.8 In connection with OWNER'S right to stop Work or suspend work see paragraphs 13.8 and 15.1. Paragraph 15.2 deals with the OWNER'S right to terminate services of CONTRACTOR under certain circumstances.

ARTICLE-9 ENGINEER'S STATUS DURING CONSTRUCTION

OWNER'S Representative:

9.1 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 Articles 1 through 17 of these General Conditions and shall not be extended without written consent of OWNER and ENGINEER.

Visits to Site:

9.2 ENGINEER will make periodic visits to the site to observe the progress and quality of the executed Work and to determine, in general, if the Work is proceeding in accordance with the Contract Documents. He will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. His efforts will be directed toward providing assurance for OWNER that the completed Project will conform to the requirements of the Contract Documents. On the basis of his on-site observations as an experienced and qualified design professional, he will keep OWNER informed of the progress of the Work and will endeavor to guard OWNER against defects and deficiencies in the Work of CONTRACTOR'S.

Clarifications and Interpretations:

9.3 ENGINEER will issue with reasonable promptness such written clarifications or interpretations of the Contract Documents (in the form of Drawings or otherwise) as he may determine necessary, which shall be consistent with or reasonably inferable from the overall intent of the Contract Documents. If CONTRACTOR believes that a written clarification or interpretation entitles him to an increase in the Contract Price, he may make a claim therefore as provided in Article 11.

Rejecting Defective Work:

9.4 ENGINEER will have authority to disapprove or reject Work which is "defective" (which term is hereinafter used to describe Work that is unsatisfactory, faulty, or defective, or does not conform to the requirements of the Contract Documents or does not meet the requirements of any inspection, test or approval referred to in paragraph 13.2 or has been damaged prior to approval of final payment). He will also have authority to require special inspection or testing of the Work as provided in paragraph 13.7, whether or not the Work is fabricated, installed, or completed.

Shop Drawings, Change Orders and Payments:

9.5 In connection with ENGINEER'S responsibility for Shop Drawings and samples, see paragraphs 6.23 through 6.28 inclusive.

9.6 In connection with ENGINEER'S responsibility for Change Orders, see Articles 10, 11, and 12.

9.7 In connection with ENGINEER'S responsibilities in respect of Applications for Payment, etc., see Article 14.

Resident Project Representative:

9.8 If OWNER and ENGINEER agree, ENGINEER will furnish a Resident Project Representative and assistants to assist ENGINEER in carrying out his responsibilities at the site. The duties, responsibilities, and limitations of authority of any such Resident Project Representative and assistants shall be as set forth in an exhibit to be incorporated in the Contract Documents.

Decisions on Disagreements:

9.9 ENGINEER will be the interpreter of the requirements of the Contract Documents and the judge of the performance thereunder. In his capacity as interpreter and judge he will exercise his best efforts to insure faithful performance by both OWNER and CONTRACTOR. He will not show partiality to either and will not be liable for the result of any interpretation or decision rendered in good faith. Claims, disputes, and other matters relating to the execution of or performance under the Contract Documents shall be referred to ENGINEER for decision; which he will render in writing within a reasonable time.

9.10 Either OWNER or CONTRACTOR may demand arbitration with respect to any such claim, dispute or other matter that has been referred to ENGINEER, except any which have been waived by the making or acceptance of final payment as provided in paragraph 14.16, such arbitration to be in accordance with Article 14.16, such arbitration to be in accordance with Article 16. However, no demand for arbitration of any such claim, dispute, or other matter shall be made until the earlier of (a) the date on which ENGINEER has rendered his decision or (b) the tenth day after the parties have presented their evidence to ENGINEER if he has not rendered his written decision before that date. No demand for arbitration shall be made later than thirty days after the date on which ENGINEER rendered his written decision in respect to the claim, dispute, or other matter as to which arbitration is sought; and the failure to demand arbitration within said thirty days' period shall result in ENGINEER'S decision being final and binding upon OWNER and CONTRACTOR. If ENGINEER renders a decision after arbitration proceedings have been initiated, such decision may be entered as evidence but shall not supersede the arbitration proceedings, except where the decision is acceptable to the parties concerned.

Limitations on ENGINEER'S Responsibilities:

9.11 Neither ENGINEER'S authority to act under this Article 9 or elsewhere in the Contract Documents nor any decision made by him in good faith either to exercise or not exercise such authority shall give rise to any duty or responsibility of ENGINEER to CONTRACTOR, any Subcontractor, any material-man, fabricator, supplier, or any of their agents or employees any other person performing any of the Work.

9.12 ENGINEER will not be responsible for CONTRACTOR'S means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, and he will not be responsible for CONTRACTOR'S failure to perform the Work in accordance with the Contract Documents.

9.13 ENGINEER will not be responsible for the acts or omissions of CONTRACTOR, or any Subcontractors, or any of his or their agents or employees, or any other persons at the site or otherwise performing any of the Work.

ARTICLE 10 - CHANGES IN THE WORK

10.1 Without invalidating the Agreement, OWNER may, at any time or from time to time, other additions, deletions, or revisions in the Work; these will be authorized by Change Orders. Upon receipt of a Change Order, CONTRACTOR shall proceed with the Work involved. All such Work shall be executed under the applicable conditions of the Contract Documents. If any Change Order causes an increase or decrease in the Contract Price or an extension or shortening of the Contract Time, an equitable adjustment will be made as provided in Article 11 or Article 12 on the basis of a claim made by either party.

10.2 ENGINEER may authorize minor changes or alterations in the Work not involving extra cost and not inconsistent with the overall intent of the Contract Documents. These may be accomplished by a Field Order. If CONTRACTOR believes that any minor change or alteration authorized by ENGINEER entitles him to an increase in the Contract Price, he may make a claim therefore as provided in Article 11.

10.3 Additional Work performed by CONTRACTOR without authorization of a Change Order will not entitle him to an increase in the Contract Price or an extension of the Contract Time, except in the case of an emergency as provided in paragraph 6.22 and except as provided in paragraphs 10.2 and 13.7.

10.4 OWNER shall execute appropriate Change Orders prepared by ENGINEER covering changes in the Work to be performed as provided in paragraph 4.3, and Work performed in an emergency as provided in paragraph 6.22 and any other claim of CONTRACTOR for a change in the Contract Time or the Contract Price which is approved by ENGINEER.

10.5 It is CONTRACTOR'S responsibility to notify his Surety of any changes affecting the general scope of the Work or change in the Contract Price and the amount of the applicable Bonds shall be adjusted accordingly. CONTRACTOR shall furnish proof of such adjustment to OWNER.

ARTICLE 11 - CHANGE OF THE CONTRACT PRICE

11.1 The Contract Price constitutes the total compensation payable to CONTRACTOR for performing the Work. All duties, responsibilities, and obligations assigned to or undertaken by CONTRACTOR shall be at his expense without change in the Contract Price.

11.2 The Contract Price may only be changed by a Change Order. Any claim for an increase in the Contract Price shall be based on written notice delivered to OWNER and ENGINEER within fifteen days of the occurrence of the event giving rise to the claim. Notice of the amount of the claim with supporting data shall be delivered within forty-five days of such occurrence unless ENGINEER allows an additional period of time to ascertain accurate cost data. All claims for adjustments in the Contract Price shall be determined by ENGINEER if OWNER and CONTRACTOR cannot otherwise agree on the amount involved. Any change in the Contract Price resulting from any such claim shall be incorporated in a Change Order.

11.3 The value of any Work covered by a Change Order or of any claim for an increase or decrease in the Contract Price shall be determined in one of the following ways:

11.3.1 Where the Work involved is covered by unit prices contained in the Contract Documents, by application of unit prices to the quantities of the items involved.

11.3.2 By mutual acceptance of a lump sum.

11.3.3 On the basis of the Cost of the Work (determined as provided in paragraphs 11.4 and 11.5) plus a Contractor's Fee for overhead and profit (determined as provided in paragraph 11.6).

Cost of the Work:

11.4 The term Cost of the Work means the sum of all costs necessarily incurred and paid by the CONTRACTOR in the proper performance of the Work. Except as otherwise may be agreed to in writing by OWNER, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items and shall not include any of the costs itemized in paragraph 11.5:

11.4.1 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. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits which shall include social security contributions, unemployment, excise and payroll taxes, workmen's compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. Such employees shall include superintendents and foreman at the site. The expenses of performing work after regular working hours on Sunday or legal holidays shall be included in the above to the extent authorized by OWNER.

11.4.2 Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and manufacturers' field services required in connection therewith. All cash discounts shall accrue to CONTRACTOR unless OWNER deposits funds with CONTRACTOR with which to make payments, in which case the cash discounts shall accrue to OWNER. All trade discounts, rebates and refunds, and all returns from sale of surplus materials and equipment shall accrue to OWNER, and CONTRACTOR shall make provisions so that they may be obtained.

11.4.3 Payments made by CONTRACTOR to the Subcontractors for Work performed by Subcontractors. If required by OWNER, CONTRACTOR shall obtain competitive bids from Subcontractors acceptable to him and shall deliver such bids to OWNER who will then determine with the advice of ENGINEER, which bids will be accepted. If a subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work Plus a Fee, the Cost of the Work shall be determined in accordance with paragraphs 11.4 and 11.5. All subcontracts shall be subject to the other provisions of the Contract Documents insofar as applicable.

11.4.4 Costs of special consultants (including, but not limited to, engineers, architects, testing laboratories, surveyors, lawyers, and accountants) employed for services specifically related to the Work.

11.4.5 Supplemental costs including the following:

11.4.5.1 The proportion of necessary transportation, traveling, and subsistence expenses of CONTRACTOR'S employees incurred in discharge of duties connected with the Work.

11.4.5.2 Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office and temporary facilities at the site and hand tools not owned by the workmen, 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.

11.4.5.3 Rentals of all construction equipment and machinery and the parts thereof whether rented from CONTRACTOR or others in accordance with rental agreements approved by OWNER with the advice of ENGINEER, and the costs of transportation, loading, unloading, installation, dismantling and removal thereof--all in accordance with terms of said rental agreements. The rental of any such equipment, machinery or parts shall cease when the use thereof is no longer necessary for the Work.

11.4.5.4 Sales, use or similar taxes related to the Work, and for which CONTRACTOR is liable, imposed by any governmental authority.

11.4.5.5 Deposits lost for causes other than CONTRACTOR'S negligence, royalty payments and fees for permits and licenses.

11.4.5.6 Losses, damages and expenses, not compensated by insurance or otherwise, sustained by CONTRACTOR in connection with the execution of, and to, the Work, provided they have resulted from causes other than the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of OWNER. No such losses, damages and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's Fee. If, however, any such loss or damage requires reconstruction and CONTRACTOR is placed in charge thereof, he shall be paid for his services a fee proportionate to that stated in paragraph 11.6.2.

11.4.5.7 The cost of utilities, fuel and sanitary facilities at the site.

11.4.5.8 Minor expenses such as telegrams, long distance telephone calls, telephone service at the site, expressage and similar petty cash items in connection with the Work.

11.4.5.9 Cost of premiums for bonds and insurance which OWNER is required to pay in accordance with paragraph 5.12.

11.5 The term Cost of the Work shall not include any of the following:

11.5.1 Payroll costs and other compensation of CONTRACTOR'S officers, executives, principals (of partnership and sole proprietorships), general managers, engineers, architects, estimators, lawyers, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks and other personnel employed by CONTRACTOR whether at the site or in his principal or a branch office for general administration of the Work and not specifically included in the schedule referred to in subparagraph 11.4.1--all of which are to be considered administrative costs covered by the Contractor's Fee.

11.5.2 Expenses of CONTRACTOR'S principal and branch offices other than his office at the site.

11.5.3 Any part of CONTRACTOR'S capital expenses, including interest on CONTRACTOR'S capital employed for the Work and charges against CONTRACTOR for delinquent payments.

11.5.4 Cost of premiums for all bonds and for all insurance policies whether or not CONTRACTOR is required by the Contract Documents to purchase and maintain the same (except as otherwise provided in subparagraph 11.4.5.9).

11.5.5 Costs due to 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.

11.5.6 Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in paragraph 11.4.

Contractor's Fee:

11.6 The Contractor's Fee which shall be allowed to CONTRACTOR for his overhead and profit shall be determined as follows:

11.6.1 a mutually acceptable fixed fee; or if none can be agreed upon,

11.6.2 a fee based on the following percentages of the various portions of the Cost of the Work:

11.6.2.1 for costs incurred under paragraphs 11.4.1 and 11.4.2, the Contractor's Fee shall be ten percent,

11.6.2.2 for costs incurred under paragraph 11.4.3, the Contractor's Fee shall be five percent; and if a subcontract is on the basis of Cost of the Work Plus a Fee, the maximum allowable to the Subcontractor as a fee for overhead and profit shall be ten percent, and

11.6.2.3 no fee shall be payable on the tasks of costs itemized under paragraphs 11.4.4, 11.4.5 and 11.5.

11.7 The amount of credit to be allowed by CONTRACTOR to OWNER for any such change which results in a net decrease in cost, will be the amount of the actual net decrease. When both additions and credits are involved in any one change, the combined overhead and profit shall be figured on the basis of the net increase, if any.

11.8 Whenever the cost of any Work is to be determined pursuant to paragraphs 11.4 and 11.5, CONTRACTOR will submit in form prescribed by ENGINEER an itemized cost breakdown together with supporting data.

Cash Allowance:

11.9 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 done by such material-men, suppliers or Subcontractors and for such sums within the limit of the allowances as ENGINEER may approve. Upon final payment, the Contract Price shall be adjusted as required and an appropriate Change Order issued. CONTRACTOR agrees that the original Contract Price includes such sums as he deems proper for costs and profit on account of cash allowances. No demand for additional cost or profit in connection therewith will be allowed.

ARTICLE 12 - CHANGE OF THE CONTRACT TIME

12.1 The Contract Time may only be changed by a Change Order. Any claim for an extension in the Contract Time shall be based on written notice delivered to OWNER and ENGINEER within fifteen days of the occurrence of the event giving rise to the claim. Notice of the extent of the claim with supporting data shall be delivered within forty-five days of such occurrence unless ENGINEER allows an additional period of time to ascertain more accurate data. All claims for adjustment in the Contract Time shall be determined by ENGINEER if OWNER and CONTRACTOR cannot otherwise agree. Any change in the Contract Time resulting from any such claim shall be incorporated in a Change Order.

12.2 The Contract Time will be extended in an amount equal to time lost due to delays beyond the control of CONTRACTOR if he makes a claim therefore as provided in paragraph 12.1. Such delays shall include, but not be restricted to, acts or neglect by any separate contractor employed by OWNER, fires, floods, labor disputes, epidemics, abnormal weather conditions, or acts of God.

12.3 All time limits stated in the Contract Documents are of the essence of the Agreement. The provisions of this Article 12 shall not exclude recovery for damages (including compensation for additional professional services) for delay by either party.

ARTICLE 13 - WARRANTY AND GUARANTEE; TESTS AND INSPECTIONS; CORRECTION, REMOVAL OF ACCEPTANCE OF DEFECTIVE WORK

Warranty and Guarantee:

13.1 CONTRACTOR warrants and guarantees to OWNER and ENGINEER that all materials and equipment will be new unless otherwise specified and that all Work will be of good quality and free from faults or defects and in accordance with the requirements of the Contract Documents and of any inspections, tests or approvals referred to in paragraph 13.2. All unsatisfactory Work, all faulty or defective Work, and all Work not conforming to the requirements of the Contract Documents at the time of acceptance thereof or of such inspections, test or approvals, shall be considered defective. Prompt notice of all defects shall be given to CONTRACTOR. All defective Work, whether or not in place, may be rejected, corrected or accepted as provided in this Article 13.

Tests and Inspections:

13.2 If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any Work to specifically be inspected, tested, or approved by some public body, CONTRACTOR shall assume full responsibility therefore, pay all costs in connection therewith and furnish ENGINEER the required certificates of inspection, testing or approval. All other inspections, tests and approvals required by the Contract Documents shall be performed by organizations acceptable to OWNER and CONTRACTOR and the costs thereof shall be borne by OWNER unless otherwise specified.

13.3 CONTRACTOR shall give ENGINEER timely notice of readiness of the Work for all inspections, tests or approvals. If any such Work required so to be inspected, tested or approved is covered without written approval of ENGINEER, it must, if requested by ENGINEER, be uncovered for observation, and such uncovering shall be at CONTRACTOR'S expense unless CONTRACTOR has given ENGINEER timely notice of his intention to cover such Work and ENGINEER has not acted with reasonable promptness in response to such notice.

13.4 Neither observations by ENGINEER nor inspections, tests or approvals by persons other than CONTRACTOR shall relieve CONTRACTOR from his obligations to perform the Work in accordance with the requirements of the Contract Documents.

Access to Work:

13.5 ENGINEER and his representatives and other representatives of OWNER will at

reasonable times have access to the Work. CONTRACTOR shall provide proper and safe facilities for such access and observation of the Work and also for any inspection or testing thereof by others.

Uncovering Work:

13.6 If any Work is covered contrary to the written request of ENGINEER, it must, if requested by ENGINEER, be uncovered for his observation and replaced at CONTRACTOR'S expense.

13.7 If any Work has been covered which ENGINEER has not specifically requested to observe prior to its being covered, or if ENGINEER considers it necessary or advisable that covered Work be inspected or tested by others, 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, furnishing all necessary labor, material and equipment. If it is found that such Work is defective, CONTRACTOR shall bear all the expenses of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction, including compensation for additional professional services, and an appropriate deductive Change Order shall be issued. If, however, such Work is not found to be defective, CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction if he makes a claim therefore as provided in Articles 11, and 12.

OWNER May Stop the Work:

13.8 If the Work is defective, or CONTRACTOR fails to supply sufficient skilled workmen or suitable materials or equipment, or if CONTRACTOR fails to make prompt payments to Subcontractors or for labor, materials or equipment, OWNER may order CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of OWNER to stop the Work shall not give rise to any duty on the part of OWNER to exercise this right for the benefit of CONTRACTOR or any other party.

Correction or Removal of Defective Work:

13.9 If required by ENGINEER prior to approval of final payment, CONTRACTOR shall promptly, without cost to OWNER and as specified by ENGINEER, either correct or defective Work, whether or not fabricated, installed or completed, or, if the Work has been rejected by ENGINEER, remove it from the site and replace it with non-defective Work. If CONTRACTOR does not correct such defective Work or remove and replace such rejected Work within a reasonable time, all as specified in a written notice from ENGINEER, OWNER may have the deficiency corrected or the rejected Work removed and replaced. All direct or indirect costs of such correction or removal and replacement, including compensation for additional professional services, shall be paid by CONTRACTOR, and an appropriate deductive Change Order shall be issued. CONTRACTOR shall also bear the expenses of making good all Work of others destroyed or damaged by his correction, removal or replacement of his defective Work.

One Year Correction Period:

13.10 If after the approval of final payment and prior to the expiration of one year after the date of Substantial Completion or such longer period of time as may be prescribed by law or by the terms

of any applicable special guarantee required by the Contract Documents, any Work is found to be defective, CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER'S written instructions, either correct such defective Work, or, if it has been rejected by OWNER, remove it from the site and replace it with non-defective Work. If CONTRACTOR does not promptly comply with the terms of such instructions, OWNER may have the defective Work corrected or the rejected Work removed and replaced, and all direct and indirect costs of such removal and replacement, including compensation for additional professional services, shall be paid by CONTRACTOR.

Acceptance of Defective Work:

13.11 If instead of requiring correction or removal and replacement of defective Work, OWNER (and, prior to approval of final payment, also ENGINEER) prefers to accept it, he may do so. In such case, if acceptance occurs prior to approval of final payment, a Change Order shall be issued incorporating the necessary revisions in the Contract Documents, including appropriate reduction in the Contract Price; or, if the acceptance occurs after approval of final payment, an appropriate amount shall be paid by CONTRACTOR to OWNER.

Neglected Work by Contractor:

13.12 If CONTRACTOR shall fail to prosecute the Work in accordance with the Contract Documents, including any requirements of the progress schedule, OWNER, after seven days' written notice to CONTRACTOR may, without prejudice to any other remedy he may have, make good such deficiencies and the cost thereof (including compensation for additional professional services) shall be charged against CONTRACTOR if ENGINEER approves such action, in which case a Change Order shall be issued incorporating the necessary revisions in the Contract Documents including an appropriate reduction in the Contract Price. If the payments then or thereafter due CONTRACTOR are not sufficient to cover such amount, CONTRACTOR shall pay the difference to OWNER.

ARTICLE 14 - PAYMENTS AND COMPLETION

Schedules:

14.1 At least ten days prior to submitting the first Application for a progress payment, CONTRACTOR shall submit a progress schedule, a final schedule of Shop Drawing and a schedule of values of the Work. These schedules shall be satisfactory in form and substance to ENGINEER. The schedule of values shall include quantities and unit prices aggregating the Contract Price, and shall subdivide the Work into component parts in sufficient detail to serve as the basis for progress payments during construction. Upon approval of the schedules of values by ENGINEER, it shall be incorporated into the form of Application for Payment furnished by ENGINEER.

Application for Progress Payment:

14.2 At least ten days before such progress payment falls due (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 data and schedules as ENGINEER may reasonably require. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and

suitably stored at the site or at another location agreed to in writing, the Application for Payment shall also be accompanied by such data, satisfactory to OWNER, as will establish OWNER'S title to the material and equipment and protect his interest therein, including applicable insurance. Each subsequent Application for Payment shall include an affidavit of CONTRACTOR stating that all previous progress payments received on account of the Work have been applied to discharge in full all of CONTRACTOR'S obligations reflected in prior Applications for Payment.

Contractor's Warranty of Title:

14.3 CONTRACTOR warrants and guarantees that title to all Work, materials and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to OWNER at the time of payment free and clear of all liens, claims, security interests and encumbrances (hereafter in these General Conditions referred to as "Liens").

Approval of Payments:

14.4 ENGINEER will, within ten days after receipt of each Application for Payment, either indicate in writing his approval of payment and present the Application to OWNER or return the Application to CONTRACTOR indicating in writing his reasons for refusing to approve payment. In the latter case, CONTRACTOR may make the necessary corrections and resubmit the Application. OWNER shall, within ten days of presentation to him of an approved Application for Payment, pay CONTRACTOR the amount approved by ENGINEER.

14.5 ENGINEER'S approval of any payment requested in an Application for Payment will constitute a representation by him to OWNER, based on ENGINEER'S on-site observations of the Work in progress as an experienced and qualified design professional and on his review of the Application for Payment and the accompanying data and schedules that the Work has progressed to the point indicated; that, to the best of his knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents (subject to the evaluation of the Work as a functioning Project upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents and any qualifications stated in his approval); and that CONTRACTOR is entitled to payment of the amount approved. However, by approving any such payment ENGINEER will not thereby be deemed to have represented that he made exhaustive or continuous on-site inspections to check the quality or the quantity of the Work, or that he has reviewed the means, methods, techniques, sequences, or procedures of construction, or that he has made any examination to ascertain how or for what purpose CONTRACTOR has used the moneys paid or to be paid to him on account of the Contract Price, or that title to any Work, materials or equipment has passed to OWNER free and clear of any Liens.

14.6 ENGINEER'S approval of final payment will constitute an additional representation by him to OWNER that the conditions precedent to CONTRACTOR'S being entitled to final payment as set forth in paragraph 14.13 have been fulfilled.

14.7 ENGINEER may refuse to approve the whole or any part of any payment if, in his opinion, it would be incorrect to make such representations to OWNER. He may also refuse to approve any such payment, or, because of subsequently discovered evidence or the results of subsequent inspections or tests, nullify any such payment previously approved, to such extent as may be necessary in his opinion to protect OWNER from loss because:

14.7.1 the Work is defective, or completed Work has been damaged requiring correction or replacement,

14.7.2 claims or Liens have been filed or there is reasonable cause to believe such may be filed,

14.7.3 the Contract Price has been reduced because of Modifications,

14.7.4 OWNER has been required to correct defective Work or complete the Work in accordance with paragraph 13.11, or

14.7.5 of unsatisfactory prosecution of the Work, including failure to furnish acceptable submittals or to clean up.

Substantial Completion:

14.8 Prior to final payment, CONTRACTOR may, in writing to OWNER and ENGINEER, certify that the entire Project is substantially complete and request that ENGINEER issue a certificate of Substantial Completion. Within a reasonable time thereafter, OWNER, CONTRACTOR and ENGINEER shall make an inspection of the Project to determine the status of completion. If ENGINEER does not consider the Project substantially complete, he will notify CONTRACTOR in writing giving his reasons therefore. If ENGINEER considers the Project substantially complete, he will prepare and deliver to OWNER a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion and the responsibilities between OWNER and CONTRACTOR for maintenance, heat and utilities. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment, and the certificate shall fix the time within which such items shall be completed or corrected, said time to be within the Contract Time. OWNER shall have seven days after receipt of the tentative certificate during which he may make written objection to ENGINEER as to any provisions of the certificate or attached list. If, after considering such objections, ENGINEER concludes that the Project is not substantially complete, he will within fourteen days after submission of the tentative certificate to OWNER notify CONTRACTOR in writing, stating his reasons therefore. If, after consideration of OWNER'S objections, ENGINEER considers the Project substantially complete, he will within said fourteen days execute and deliver to OWNER and CONTRACTOR a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as he believes justified after consideration of any objections from OWNER.

14.9 OWNER shall have the right to exclude CONTRACTOR from the Project after the date

of Substantial Completion, but OWNER shall allow CONTRACTOR reasonable access to complete or correct items on the tentative list.

Partial Utilization:

14.10 Prior to final payment, OWNER may request CONTRACTOR in writing to permit him to use a specified part of the Project which he believes he may use without significant interference with construction of the other parts of the Project. If CONTRACTOR agrees, he will certify to OWNER and ENGINEER that said part of the Project is substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Project. Within a reasonable thereafter OWNER, CONTRACTOR and ENGINEER shall make an inspection of that part of the Project to determine its status of completion. If ENGINEER does not consider that it is substantially complete, he will notify OWNER and CONTRACTOR in writing giving his reasons therefore. If ENGINEER considers that part of the Project to be substantially complete, he will execute and deliver to OWNER and CONTRACTOR a certificate to that effect, fixing the date of Substantial Completion as to that part of the Project, attaching thereto a tentative list of items to be completed or corrected before final payment and fixing the responsibility between OWNER and CONTRACTOR for maintenance, heat and utilities as to that part of the Project. OWNER shall have the right to exclude CONTRACTOR from any part of the Project which ENGINEER has so certified to be substantially complete, but OWNER shall allow CONTRACTOR reasonable access to complete or correct items on the tentative list.

Final Inspection:

14.11 Upon written notice from CONTRACTOR that the Project is complete, ENGINEER will 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 is incomplete or defective. CONTRACTOR shall immediately take such measures as are necessary to remedy such deficiencies.

Final Application for Payment:

14.12 After CONTRACTOR has completed all such corrections to the satisfaction of ENGINEER and delivered all maintenance and operating instructions, schedules, guarantees, Bonds, certificates of inspection and other documents--all as required by the Contract Documents, he may make application for final payment following the procedure for progress payments. The final Application for Payment shall be accompanied by such data and schedules as ENGINEER may reasonably require, together with complete and legally effective releases or waivers (satisfactory to OWNER) of all Liens arising out of the Contract Documents and the labor and services performed and the material and equipment furnished thereunder. In lieu thereof and as approved by OWNER, CONTRACTOR may furnish receipts or releases in full; an affidavit of CONTRACTOR that the releases and receipts include all labor, services, materials and equipment for which a Lien could be filed, and that all payrolls, material and equipment bills, and other indebtedness connected with the Work for which OWNER or his property might in any way be responsible, have been paid or otherwise satisfied; and consent of the Surety, if any, to final payment. If any Subcontractor, materialman, fabricator or supplier fails to furnish a release or receipt in full, CONTRACTOR may furnish a Bond or other collateral satisfactory to OWNER to indemnify him against any Lien.

Approval of Final Payment:

14.13 If, on the basis of his observation and review of the Work during construction, his final inspection and his review of the final Application for Payment--all as required by the Contract Documents, ENGINEER is satisfied that the Work has been completed and CONTRACTOR has fulfilled all his obligations under the Contract Documents, he will, within ten days after receipt of the final Application for Payment, indicate in writing his approval of payment and present the Application to OWNER for payment. Thereupon ENGINEER will give written notice to OWNER and CONTRACTOR that the Work is acceptable subject to the provisions of paragraph 14.16. Otherwise, he will return the Application to CONTRACTOR, indicating in writing his reasons for refusing to approval final payment, in which case CONTRACTOR shall make the necessary corrections and resubmit the Application. OWNER shall, within ten days of presentation to him of an approved final Application for Payment, pay CONTRACTOR the amount approved by ENGINEER.

14.14 If after Substantial Completion of the Work final completion thereof is materially delayed through no fault of CONTRACTOR, and ENGINEER so confirms, OWNER shall, upon certification by ENGINEER, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required in paragraph 5.1, the written consent of the Surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the CONTRACTOR to the ENGINEER prior to certification of such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

Contractor's Continuing Obligation:

14.15 CONTRACTOR'S obligation to perform the Work and complete the Project in accordance with the Contract Documents shall be absolute. Neither approval or any progress or final payment by ENGINEER, nor the issuance of a certificate of Substantial Completion, nor any payment by OWNER to CONTRACTOR under the Contract Documents, nor any use or occupancy of the Project or any part thereof by OWNER, nor any act of acceptance by OWNER nor any failure to do so, nor any correction of defective work by OWNER shall constitute an acceptance of Work not in accordance with the Contract Documents.

Waiver of Claim:

14.16 The making and acceptance of final payment shall constitute:

14.16.1 a waiver of all claims by OWNER against CONTRACTOR other than those arising from unsettled Liens, from defective work appearing after final inspection pursuant to paragraph 14.11 or from failure to comply with the requirements of the Contract Documents or the terms of any special guarantees specified therein, and

14.16.2 a waiver of all claims by CONTRACTOR against OWNER other than those previously made in writing and still unsettled.

ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

OWNER May Suspend Work:

15.1 OWNER may, at any time and without cause, suspend the Work or any portion thereof for a period of not more than ninety days by notice in writing to CONTRACTOR and ENGINEER which shall fix the date on which Work shall be resumed. CONTRACTOR shall resume the Work on the date so fixed. CONTRACTOR will be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to any suspension if he makes a claim therefore as provided in Articles 11 and 12.

OWNER May Terminate:

15.2 If CONTRACTOR is adjusted a bankrupt or insolvent, or if he makes a general assignment for the benefit of his creditors, or if a trustee or receiver is appointed for CONTRACTOR or for any of his property, or if he files a petition to take advantage of any debtor's act, or to reorganize under the bankruptcy or similar laws, or if he repeatedly fails to supply sufficient skilled workmen or suitable materials or equipment, or if he repeatedly fails to make prompt payments to Subcontractors or for labor, materials or equipment or if he disregards laws, ordinances, rules, regulations or orders of any public body having jurisdiction, or if he disregards the authority of ENGINEER, or if he otherwise violates any provision of the Contract Documents, then OWNER may, without prejudice to any other right or remedy and after giving CONTRACTOR and his Surety seven days' written notice, terminate the services of CONTRACTOR and take possession of the Project and of all materials, equipment, tools, construction equipment and machinery thereon owned by CONTRACTOR, and finish the Work by whatever method he may deem expedient. In such case CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds the direct and indirect costs of completing the Project, including compensation for additional professional services, such excess shall be paid to CONTRACTOR. If such costs exceed such unpaid balance, CONTRACTOR shall pay the difference to OWNER. Such costs incurred by OWNER shall be determined by ENGINEER and incorporated in a Change Order.

15.3 Where CONTRACTOR'S services have been so terminated by OWNER, said terminations shall not affect any rights of OWNER against CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of moneys by OWNER due CONTRACTOR will not release CONTRACTOR from liability.

15.4 Upon seven days' written notice to CONTRACTOR and ENGINEER, OWNER may, without cause and without prejudice to any right or remedy, elect to abandon the Project and terminate the Agreement. In such case, CONTRACTOR shall be paid for all Work executed and any expense sustained plus a reasonable profit.

Contractor May Stop Work or Terminate:

15.5 If, through no act or fault of CONTRACTOR, the Work is suspended for a period of more than ninety days by OWNER or under an order of court or other public authority, or ENGINEER fails to act on any Application for Payment within thirty days after it is submitted, or OWNER fails to pay CONTRACTOR any sum approved by ENGINEER or awarded by arbitrators within thirty days of its approval and presentation, then CONTRACTOR may, upon seven days' written notice to OWNER and ENGINEER, terminate the Agreement and recover from OWNER payment for all Work executed and any expense sustained plus a reasonable profit. In addition and in lieu of terminating the Agreement, if ENGINEER has failed to act on an Application for Payment or OWNER has failed to make any payment as aforesaid, CONTRACTOR may upon seven days' notice to OWNER and ENGINEER stop the Work until he has been paid all amounts then due.

ARTICLE 16 - ARBITRATION

16.1 All claims, disputes and other matters in question arising out of, or relating to, this Agreement or the breach thereof except for claims which have been waived by the making or acceptance of final payment as provided by paragraph 14.16, shall be decided by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association then obtaining. This Agreement so to arbitrate shall be specifically enforceable under the prevailing arbitration law. The award rendered by the arbitrators shall be final, and judgment may be entered upon it in any court having jurisdiction thereof.

16.2 Notice of the demand for arbitration shall be filed in writing with the other party to the Agreement and with the American Arbitration Association, and a copy shall be filed with ENGINEER. The demand for arbitration shall be made within the thirty-day period specified in paragraph 9.10 where applicable, and in all other cases within a reasonable time after the claim, dispute or other matter in question has arisen, and in no event shall it be made after institution of legal or equitable proceedings based on such claim, dispute or other matter in question would be barred by the applicable statute of limitations.

16.3 CONTRACTOR will carry on the Work and maintain the progress schedule during any arbitration proceedings, unless otherwise agreed by him and OWNER in writing.

ARTICLE 17 - MISCELLANEOUS

Giving Notice:

17.1 Whenever any provision of the Contract Documents requires the giving of written notice it shall be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to him who gives the notice.

Computation of Time:

17.2 When any period of time is referred to in the Contract Documents by days, it shall be computed to exclude the first and include the last day of such period. If the last day of 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 shall be omitted from the computation.

General:

17.3 All moneys not paid when due hereunder shall bear interest at the maximum rate allowed by law at the place of the Project.

17.4 All Specifications, Drawings and copies thereof furnished by ENGINEER shall remain his property. They shall not be used on another Project, and, with the exception of those sets which have been signed in connection with the execution of the Agreement, shall be returned to him on request upon completion of the Project.

17.5 The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder, and, in particular but without limitation, the warranties, guarantees and obligations imposed upon CONTRACTOR by paragraphs 6.30, 13.1, 13.10 and 14.3 and the rights and remedies available to OWNER and ENGINEER thereunder, shall be in addition to, and shall not be construed in any way as a limitation of, any rights and remedies available to them which are otherwise imposed or available by law, by special guarantees or by other provisions of the Contract Documents.

17.6 Should OWNER or CONTRACTOR suffer injury or damage to his person or property because of any error, omission or act of the other or of any of his employees or agents or others for whose acts he is legally liable, claim shall be made in writing to the other party within a reasonable time of the first observance of such injury or damage.

17.7 The Contract Documents shall be governed by the law of the place of the Project.

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SUPPLEMENTARY CONDITIONS

1.1 Standard Codes

The following standard codes may be referred to herein:

Uniform Building Code (ICBO), current addition
Uniform Plumbing Code (IAPMO), current addition
National Electrical Code, current addition

2.1 Abbreviations

Wherever the following abbreviations are used, the intent and meaning shall be interpreted as follows:

Conc.	concrete
Elev.	elevation
Ext.	exterior
FT, ft.	feet
GA, ga.	gage
MAX., max.	maximum
MIN., min.	minimum
L.F.	lineal feet
SQ. FT.	square feet
DIA.	diameter
EA.	each
NO.	number
L.S.	lump sum
CMP	corrugated metal pipe
AB	aggregate base
SSP	sanitary sewer pipe
PSI, psi	pounds per square inch
PSF, psf	pounds per square foot
TYP	typical

3.1 Time of Completion

The CONTRACTOR shall prosecute the work so that all portions of the project shall be complete and ready for use within ninety (90) days after the date of notice to proceed.

4.1 Damages for Avoidable Delay

In accordance with the provisions of this contract, the CONTRACTOR and the OWNER agree that OWNER will incur extra cost and expense if the work is not completed within the time allowed in the previous paragraph. Inasmuch as the amount of these damages will be difficult to compute, CONTRACTOR and OWNER hereby agree that CONTRACTOR shall pay \$100.00 per calendar day for each day beyond the time of completion for which the work has not been completed by CONTRACTOR. Completion is defined for purposes of this article as the condition of the work at the time the Engineer prepares a definitive certificate of Substantial Completion as referred to in Article 14.8 of the General Conditions.

5.1 Insurance Requirements

CONTRACTOR shall purchase and maintain insurance as required under Article 5.3 of the General Conditions in amounts of coverage not less than the following amounts:

- | | | |
|-------|---|--|
| 5.1.1 | General Liability:
(Including operations, products and completed operations) | \$1,000,000 per occurrence for bodily injury, personal injury and property damage. If Commercial General Liability Insurance or other form with a general aggregate limit is used, either the general aggregate limit shall apply separately to this project/location or the general aggregate limit shall be twice the required occurrence limit. |
| 5.1.2 | Automobile Liability: | \$1,000,000 per accident for bodily injury and property damage. |

6.1 Indemnity

CONTRACTOR shall indemnify and hold harmless ENGINEER and the OWNER and its officers, officials, employees and volunteers from and against all claims, damages, losses and expenses including attorney fees arising out of the performance of the work described herein, caused in whole or in part by any negligent act or omission of the CONTRACTOR, any subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, except where caused by the active negligence, sole negligence, or willful misconduct of the OWNER.

7.1 Prevailing Wages

Contractor shall pay each laborer, workman or mechanic in accordance with Federal Prevailing Wage Rates and the California Labor Code (excerpts included herein). These wage rates are hereby made a part of this contract:

State General Prevailing Wage Determinations in effect on date advertised

General prevailing wage determination

Journeyman and Apprentice Prevailing Wage Rates can be accessed at the following websites:

<http://www.dir.ca.gov/dlsr/DPreWageDetermination.html> and

<http://www.dir.ca.gov/das/publicworks.html>

Reference: Labor Code 1773.2

Federal Prevailing Wage Determinations in effect on bid date
General Decision # CA150009 08/12/2016 CA9
General Decision County Index for CA: <http://www.wdol.gov/wdol/scafiles/davisbacon/ca.html> .
Select the county where the work will be performed. Reference: Davis Bacon Act

Excerpts from CA Labor Code

1771.1. (a) A contractor or subcontractor shall not be qualified to bid on, be listed in a bid proposal, subject to the requirements of Section 4104 of the Public Contract Code, or engage in the performance of any contract for public work, as defined in this chapter, unless currently registered and qualified to perform public work pursuant to Section 1725.5. It is not a violation of this section for an unregistered contractor to submit a bid that is authorized by Section 7029.1 of the Business and Professions Code or by Section 10164 or 20103.5 of the Public Contract Code, provided the contractor is registered to perform public work pursuant to Section 1725.5 at the time the contract is awarded.

1774. The contractor to whom the contract is awarded, and any subcontractor under him, shall pay not less than the specified prevailing rates of wages to all workmen employed in the execution of the contract.

1775. (a) (1) The contractor and any subcontractor under the contractor shall, as a penalty to the state or political subdivision on whose behalf the contract is made or awarded, forfeit not more than two hundred dollars (\$200) for each calendar day, or portion thereof, for each worker paid less than the prevailing wage rates as determined by the director for the work or craft in which the worker is employed for any public work done under the contract by the contractor or, except as provided in subdivision (b), by any subcontractor under the contractor.

(2) (A) The amount of the penalty shall be determined by the Labor Commissioner based on consideration of both of the following:

(i) Whether the failure of the contractor or subcontractor to pay the correct rate of per diem wages was a good faith mistake and, if so, the error was promptly and voluntarily corrected when brought to the attention of the contractor or subcontractor.

(ii) Whether the contractor or subcontractor has a prior record of failing to meet its prevailing wage obligations.

(B) (i) The penalty may not be less than forty dollars (\$40) for each calendar day, or portion thereof, for each worker paid less than the prevailing wage rate, unless the failure of the contractor or subcontractor to pay the correct rate of per diem wages was a good faith mistake and, if so, the error was promptly and voluntarily corrected when brought to the attention of the contractor or subcontractor.

(ii) The penalty may not be less than eighty dollars (\$80) for

each calendar day, or portion thereof, for each worker paid less than the prevailing wage rate, if the contractor or subcontractor has been assessed penalties within the previous three years for failing to meet its prevailing wage obligations on a separate contract, unless those penalties were subsequently withdrawn or overturned.

(iii) The penalty may not be less than one hundred twenty dollars (\$120) for each calendar day, or portion thereof, for each worker paid less than the prevailing wage rate, if the Labor Commissioner determines that the violation was willful, as defined in subdivision (c) of Section 1777.1.

(C) If the amount due under this section is collected from the contractor or subcontractor, any outstanding wage claim under Chapter 1 (commencing with Section 1720) of Part 7 of Division 2 against that contractor or subcontractor shall be satisfied before applying that amount to the penalty imposed on that contractor or subcontractor pursuant to this section.

(D) The determination of the Labor Commissioner as to the amount of the penalty shall be reviewable only for abuse of discretion.

(E) The difference between the prevailing wage rates and the amount paid to each worker for each calendar day or portion thereof for which each worker was paid less than the prevailing wage rate shall be paid to each worker by the contractor or subcontractor, and the body awarding the contract shall cause to be inserted in the contract a stipulation that this section will be complied with.

(b) If a worker employed by a subcontractor on a public works project is not paid the general prevailing rate of per diem wages by the subcontractor, the prime contractor of the project is not liable for any penalties under subdivision (a) unless the prime contractor had knowledge of that failure of the subcontractor to pay the specified prevailing rate of wages to those workers or unless the prime contractor fails to comply with all of the following requirements:

(1) The contract executed between the contractor and the subcontractor for the performance of work on the public works project shall include a copy of the provisions of this section and Sections 1771, 1776, 1777.5, 1813, and 1815.

(2) The contractor shall monitor the payment of the specified general prevailing rate of per diem wages by the subcontractor to the employees, by periodic review of the certified payroll records of the subcontractor.

(3) Upon becoming aware of the failure of the subcontractor to pay his or her workers the specified prevailing rate of wages, the contractor shall diligently take corrective action to halt or rectify the failure, including, but not limited to, retaining sufficient funds due the subcontractor for work performed on the public works project.

(4) Prior to making final payment to the subcontractor for work performed on the public works project, the contractor shall obtain an

affidavit signed under penalty of perjury from the subcontractor that the subcontractor has paid the specified general prevailing rate of per diem wages to his or her employees on the public works project and any amounts due pursuant to Section 1813.

(c) The Division of Labor Standards Enforcement shall notify the contractor on a public works project within 15 days of the receipt by the Division of Labor Standards Enforcement of a complaint of the failure of a subcontractor on that public works project to pay workers the general prevailing rate of per diem wages.

1776. (a) Each contractor and subcontractor shall keep accurate payroll records, showing the name, address, social security number, work classification, straight time and overtime hours worked each day and week, and the actual per diem wages paid to each journeyman, apprentice, worker, or other employee employed by him or her in connection with the public work. Each payroll record shall contain or be verified by a written declaration that it is made under penalty of perjury, stating both of the following:

(1) The information contained in the payroll record is true and correct.

(2) The employer has complied with the requirements of Sections 1771, 1811, and 1815 for any work performed by his or her employees on the public works project.

(b) The payroll records enumerated under subdivision (a) shall be certified and shall be available for inspection at all reasonable hours at the principal office of the contractor on the following basis:

(1) A certified copy of an employee's payroll record shall be made available for inspection or furnished to the employee or his or her authorized representative on request.

(2) A certified copy of all payroll records enumerated in subdivision (a) shall be made available for inspection or furnished upon request to a representative of the body awarding the contract and the Division of Labor Standards Enforcement of the Department of Industrial Relations.

(3) A certified copy of all payroll records enumerated in subdivision (a) shall be made available upon request by the public for inspection or for copies thereof. However, a request by the public shall be made through either the body awarding the contract or the Division of Labor Standards Enforcement. If the requested payroll records have not been provided pursuant to paragraph (2), the requesting party shall, prior to being provided the records, reimburse the costs of preparation by the contractor, subcontractors, and the entity through which the request was made. The public may not be given access to the records at the principal office of the contractor.

(c) Unless required to be furnished directly to the Labor

Commissioner in accordance with paragraph (3) of subdivision (a) of Section 1771.4, the certified payroll records shall be on forms provided by the Division of Labor Standards Enforcement or shall contain the same information as the forms provided by the division. The payroll records may consist of printouts of payroll data that are maintained as computer records, if the printouts contain the same information as the forms provided by the division and the printouts are verified in the manner specified in subdivision (a).

(d) A contractor or subcontractor shall file a certified copy of the records enumerated in subdivision (a) with the entity that requested the records within 10 days after receipt of a written request.

(e) Except as provided in subdivision (f), any copy of records made available for inspection as copies and furnished upon request to the public or any public agency by the awarding body or the Division of Labor Standards Enforcement shall be marked or obliterated to prevent disclosure of an individual's name, address, and social security number. The name and address of the contractor awarded the contract or the subcontractor performing the contract shall not be marked or obliterated. Any copy of records made available for inspection by, or furnished to, a multiemployer Taft-Hartley trust fund (29 U.S.C. Sec. 186(c)(5)) that requests the records for the purposes of allocating contributions to participants shall be marked or obliterated only to prevent disclosure of an individual's full social security number, but shall provide the last four digits of the social security number. Any copy of records made available for inspection by, or furnished to, a joint labor-management committee established pursuant to the federal Labor Management Cooperation Act of 1978 (29 U.S.C. Sec. 175a) shall be marked or obliterated only to prevent disclosure of an individual's social security number.

(f) (1) Notwithstanding any other provision of law, agencies that are included in the Joint Enforcement Strike Force on the Underground Economy established pursuant to Section 329 of the Unemployment Insurance Code and other law enforcement agencies investigating violations of law shall, upon request, be provided nonredacted copies of certified payroll records. Any copies of records or certified payroll made available for inspection and furnished upon request to the public by an agency included in the Joint Enforcement Strike Force on the Underground Economy or to a law enforcement agency investigating a violation of law shall be marked or redacted to prevent disclosure of an individual's name, address, and social security number.

(2) An employer shall not be liable for damages in a civil action for any reasonable act or omission taken in good faith in compliance with this subdivision.

(g) The contractor shall inform the body awarding the contract of the location of the records enumerated under subdivision (a), including the street address, city, and county, and shall, within

five working days, provide a notice of a change of location and address.

(h) The contractor or subcontractor has 10 days in which to comply subsequent to receipt of a written notice requesting the records enumerated in subdivision (a). In the event that the contractor or subcontractor fails to comply within the 10-day period, he or she shall, as a penalty to the state or political subdivision on whose behalf the contract is made or awarded, forfeit one hundred dollars (\$100) for each calendar day, or portion thereof, for each worker, until strict compliance is effectuated. Upon the request of the Division of Labor Standards Enforcement, these penalties shall be withheld from progress payments then due. A contractor is not subject to a penalty assessment pursuant to this section due to the failure of a subcontractor to comply with this section.

(i) The body awarding the contract shall cause to be inserted in the contract stipulations to effectuate this section.

(j) The director shall adopt rules consistent with the California Public Records Act (Chapter 3.5 (commencing with Section 6250) of Division 7 of Title 1 of the Government Code) and the Information Practices Act of 1977 (Title 1.8 (commencing with Section 1798) of Part 4 of Division 3 of the Civil Code) governing the release of these records, including the establishment of reasonable fees to be charged for reproducing copies of records required by this section.

1777.5. (a) Nothing in this chapter shall prevent the employment of properly registered apprentices upon public works.

(b) Every apprentice employed upon public works shall be paid the prevailing rate of per diem wages for apprentices in the trade to which he or she is registered and shall be employed only at the work of the craft or trade to which he or she is registered.

(c) Only apprentices, as defined in Section 3077, who are in training under apprenticeship standards that have been approved by the Chief of the Division of Apprenticeship Standards and who are parties to written apprentice agreements under Chapter 4 (commencing with Section 3070) of Division 3 are eligible to be employed at the apprentice wage rate on public works. The employment and training of each apprentice shall be in accordance with either of the following:

(1) The apprenticeship standards and apprentice agreements under which he or she is training.

(2) The rules and regulations of the California Apprenticeship Council.

(d) When the contractor to whom the contract is awarded by the state or any political subdivision, in performing any of the work under the contract, employs workers in any apprenticeable craft or trade, the contractor shall employ apprentices in at least the ratio set forth in this section and may apply to any apprenticeship program in the craft or trade that can provide apprentices to the site of the public work for a certificate approving the contractor under the

apprenticeship standards for the employment and training of apprentices in the area or industry affected. However, the decision of the apprenticeship program to approve or deny a certificate shall be subject to review by the Administrator of Apprenticeship. The apprenticeship program or programs, upon approving the contractor, shall arrange for the dispatch of apprentices to the contractor. A contractor covered by an apprenticeship program's standards shall not be required to submit any additional application in order to include additional public works contracts under that program.

"Apprenticeable craft or trade," as used in this section, means a craft or trade determined as an apprenticeable occupation in accordance with rules and regulations prescribed by the California Apprenticeship Council. As used in this section, "contractor" includes any subcontractor under a contractor who performs any public works not excluded by subdivision (o).

(e) Prior to commencing work on a contract for public works, every contractor shall submit contract award information to an applicable apprenticeship program that can supply apprentices to the site of the public work. The information submitted shall include an estimate of journeyman hours to be performed under the contract, the number of apprentices proposed to be employed, and the approximate dates the apprentices would be employed. A copy of this information shall also be submitted to the awarding body if requested by the awarding body. Within 60 days after concluding work on the contract, each contractor and subcontractor shall submit to the awarding body, if requested, and to the apprenticeship program a verified statement of the journeyman and apprentice hours performed on the contract. The information under this subdivision shall be public. The apprenticeship programs shall retain this information for 12 months.

(f) The apprenticeship program that can supply apprentices to the area of the site of the public work shall ensure equal employment and affirmative action in apprenticeship for women and minorities.

(g) The ratio of work performed by apprentices to journeymen employed in a particular craft or trade on the public work may be no higher than the ratio stipulated in the apprenticeship standards under which the apprenticeship program operates where the contractor agrees to be bound by those standards, but, except as otherwise provided in this section, in no case shall the ratio be less than one hour of apprentice work for every five hours of journeyman work.

(h) This ratio of apprentice work to journeyman work shall apply during any day or portion of a day when any journeyman is employed at the jobsite and shall be computed on the basis of the hours worked during the day by journeymen so employed. Any work performed by a journeyman in excess of eight hours per day or 40 hours per week shall not be used to calculate the ratio. The contractor shall employ apprentices for the number of hours computed as above before the end of the contract or, in the case of a subcontractor, before the end of the subcontract. However, the contractor shall endeavor, to the

greatest extent possible, to employ apprentices during the same time period that the journeymen in the same craft or trade are employed at the jobsite. Where an hourly apprenticeship ratio is not feasible for a particular craft or trade, the Administrator of Apprenticeship, upon application of an apprenticeship program, may order a minimum ratio of not less than one apprentice for each five journeymen in a craft or trade classification.

(i) A contractor covered by this section who has agreed to be covered by an apprenticeship program's standards upon the issuance of the approval certificate, or who has been previously approved for an apprenticeship program in the craft or trade, shall employ the number of apprentices or the ratio of apprentices to journeymen stipulated in the applicable apprenticeship standards, but in no event less than the 1 to 5 ratio required by subdivision (g).

(j) Upon proper showing by a contractor that he or she employs apprentices in a particular craft or trade in the state on all of his or her contracts on an annual average of not less than one hour of apprentice work for every five hours of labor performed by journeymen, the Administrator of Apprenticeship may grant a certificate exempting the contractor from the 1 to 5 hourly ratio, as set forth in this section for that craft or trade.

(k) An apprenticeship program has the discretion to grant to a participating contractor or contractor association a certificate, which shall be subject to the approval of the Administrator of Apprenticeship, exempting the contractor from the 1 to 5 ratio set forth in this section when it finds that any one of the following conditions is met:

(1) Unemployment for the previous three-month period in the area exceeds an average of 15 percent.

(2) The number of apprentices in training in the area exceeds a ratio of 1 to 5.

(3) There is a showing that the apprenticeable craft or trade is replacing at least one-thirtieth of its journeymen annually through apprenticeship training, either on a statewide basis or on a local basis.

(4) Assignment of an apprentice to any work performed under a public works contract would create a condition that would jeopardize his or her life or the life, safety, or property of fellow employees or the public at large, or the specific task to which the apprentice is to be assigned is of a nature that training cannot be provided by a journeyman.

(l) When an exemption is granted pursuant to subdivision (k) to an organization that represents contractors in a specific trade from the 1 to 5 ratio on a local or statewide basis, the member contractors shall not be required to submit individual applications for approval to local joint apprenticeship committees, if they are already covered by the local apprenticeship standards.

(m) (1) A contractor to whom a contract is awarded, who, in

performing any of the work under the contract, employs journeymen or apprentices in any apprenticeable craft or trade shall contribute to the California Apprenticeship Council the same amount that the director determines is the prevailing amount of apprenticeship training contributions in the area of the public works site. A contractor may take as a credit for payments to the council any amounts paid by the contractor to an approved apprenticeship program that can supply apprentices to the site of the public works project. The contractor may add the amount of the contributions in computing his or her bid for the contract.

(2) At the conclusion of the 2002-03 fiscal year and each fiscal year thereafter, the California Apprenticeship Council shall distribute training contributions received by the council under this subdivision, less the expenses of the Department of Industrial Relations for administering this subdivision, by making grants to approved apprenticeship programs for the purpose of training apprentices. The funds shall be distributed as follows:

(A) If there is an approved multiemployer apprenticeship program serving the same craft or trade and geographic area for which the training contributions were made to the council, a grant to that program shall be made.

(B) If there are two or more approved multiemployer apprenticeship programs serving the same craft or trade and county for which the training contributions were made to the council, the grant shall be divided among those programs based on the number of apprentices from that county registered in each program.

(C) All training contributions not distributed under subparagraphs (A) and (B) shall be used to defray the future expenses of the Department of Industrial Relations for the administration and enforcement of apprenticeship standards and requirements under this code.

(3) All training contributions received pursuant to this subdivision shall be deposited in the Apprenticeship Training Contribution Fund, which is hereby created in the State Treasury. Upon appropriation by the Legislature, all moneys in the Apprenticeship Training Contribution Fund shall be used for the purpose of carrying out this subdivision and to pay the expenses of the Department of Industrial Relations.

(n) The body awarding the contract shall cause to be inserted in the contract stipulations to effectuate this section. The stipulations shall fix the responsibility of compliance with this section for all apprenticeable occupations with the prime contractor.

(o) This section does not apply to contracts of general contractors or to contracts of specialty contractors not bidding for work through a general or prime contractor when the contracts of general contractors or those specialty contractors involve less than thirty thousand dollars (\$30,000).

(p) An awarding body that implements an approved labor compliance

program in accordance with subdivision (b) of Section 1771.5 may, with the approval of the director, assist in the enforcement of this section under the terms and conditions prescribed by the director.

1813. The contractor or subcontractor shall, as a penalty to the state or political subdivision on whose behalf the contract is made or awarded, forfeit twenty-five dollars (\$25) for each worker employed in the execution of the contract by the respective contractor or subcontractor for each calendar day during which the worker is required or permitted to work more than 8 hours in any one calendar day and 40 hours in any one calendar week in violation of the provisions of this article. In awarding any contract for public work, the awarding body shall cause to be inserted in the contract a stipulation to this effect. The awarding body shall take cognizance of all violations of this article committed in the course of the execution of the contract, and shall report them to the Division of Labor Standards Enforcement.

1815. Notwithstanding the provisions of Sections 1810 to 1814, inclusive, of this code, and notwithstanding any stipulation inserted in any contract pursuant to the requirements of said sections, work performed by employees of contractors in excess of 8 hours per day, and 40 hours during any one week, shall be permitted upon public work upon compensation for all hours worked in excess of 8 hours per day at not less than 1 1/2 times the basic rate of pay.

8.1. General Notes:

- A. The CONTRACTOR shall examine the working drawings: architectural, structural, mechanical and electrical, and shall notify the architect and/or engineers of any discrepancies he may find before proceeding with the work.
- B. The CONTRACTOR shall verify and be responsible for all dimensions and conditions at the site and shall notify the designer of discrepancies between the actual conditions and information shown on the drawings before proceeding with the work.
- C. All work shall conform to the minimum standards for the latest edition of the Uniform Building Code, State of California Caltrans Standard Specifications, and such other regulating agencies exercising authority over any portion of the work.
- D. Specifications (if included) are integral to the drawings. Notify designer before proceeding with any work if any disparity arises between drawings and specifications.
- E. All work shall conform to the best practice prevailing in the various trades comprising the work.
- F. Specific notes and details shall take precedence over General Notes and Typical Details. Dimensions shall supersede scale.
- G. Details shown describe the general intent and character of the project. Any specific areas not drawn shall be similar to those details that are related in location, intent, or function.
- H. All subcontractors shall be held responsible for all conditions, ordinances, code and requirements pertinent to their category of work as dictated by regulatory agencies.
- I. All subcontractors shall be held responsible for any damage to another's work caused by subcontractor, its employees or agents.
- J. General CONTRACTOR to maintain site in a clean and neat manner. Remove and legally dispose of all debris, rubbish, etc. Remove all materials from those not intended for their application, such as paint spatters, masking materials, asphalt, etc.

9.1 Technical Specification

Attached and included herein as part of this contract:

- TECHNICAL SPECIFICATIONS and
- CONTRACT DRAWINGS

**WASHINGTON COUNTY WATER DISTRICT
WATER SYSTEM IMPROVEMENTS - 2015**

TECHNICAL SPECIFICATIONS

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SECTION 01100
SUMMARY OF WORK

PART 1 GENERAL

- 1.1 **SCOPE OF WORK** - The work to be performed in this project includes the construction and installation of water system improvements for Washington County Water District, including modifications to the existing surface water treatment facilities. This work shall include site work, yard piping, construction and installation of water treatment equipment, chemical feed equipment, pumping facilities, break tank, contact pipeline, electrical instrumentation and controls, building lighting and electrical systems, painting and coating of project elements, and related work. Work will be phased and staged so as to allow for continuous treated water supply to the community (excepting brief periods for transferring service from existing to new facilities). Work to be performed includes furnishing all labor, material, tools, equipment, and incidentals required to construct all of the treatment facilities as detailed in the Contract Drawings and to install all facilities, equipment, pipe, fittings, and appurtenances as shown on the Plans and as described in these Technical Specifications.
- 1.2 **LOCATION OF WORK** - All work is located at the existing water treatment plant and water storage tank site near the community of Washington off of Hwy 20 located approximately 28 miles east of Nevada City, CA in Nevada County. A vicinity map is provided in the project drawings.

PART 2 PRODUCTS - (not used)

PART 3 EXECUTION - (not used)

* * END OF SECTION * *

SECTION 01300
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1 **RESPONSIBLE PARTIES.** Construction of this project is governed by the agreement between the Owner and the Contractor. All statements in the specifications are directed at the Contractor, who has overall responsibility for the work and the subcontractors and suppliers.

- A. **OWNER** - the Owner of this project is Washington County Water District. Throughout these technical specifications, the Owner may be referred to as the Owner, the District or WCWD. The term Owner means the Owner or his authorized representative.

- B. **CONTRACTOR** - the Contractor is the person or entity identified as such in the Owner-Contractor Agreement and is referenced to throughout the Contract Documents as if singular in number and masculine in gender. The term Contractor means the Contractor as defined herein or his authorized representative.

- C. **ENGINEER** - the Engineer is retained by the Owner and is a person lawfully licensed to practice engineering. The Engineer is the design professional responsible for the Engineering design of the project and may act as agent of the Owner within the scope of duties delegated to him.

2 **PERMITS**

The treatment facility is permitted through California Water Resources Control Board, Division of Drinking Water. Delivery of water must comply with California Title 22 standards.

Because the District is a public entity, county building permits are not required for this project.

3 **CONSTRUCTION MEETINGS**

- A. Prior to commencement of work a preconstruction meeting will be held to answer questions, explain procedures, and acquaint the Contractor with Engineer and Owner. It is expected that representatives of local utilities or agencies affected by the work may attend the meeting. The Contractor and his superintendents must attend this meeting.

- B. Subsequent meetings of Contractor, Engineer and Owner may be called by any of the three parties throughout the course of the work. These meetings shall not be called unnecessarily frequently but should occur at least once per month during the construction period. The Contractor must attend these meetings.

4 COOPERATION

- A. The Contractor shall cooperate with the Owner, the Engineer, and regulatory and permitting agencies in scheduling of road closures, shut-down of mains, delivery of materials, and other items that may affect work on contract. In case of conflicts, conflict shall be resolved by negotiations between the parties with the Engineer acting as mediator.

PART 2 PRODUCTS (not used)

PART 3 EXECUTION (not used)

* * END OF SECTION * *

SECTION 01400
QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 CODES, STANDARDS AND REFERENCES

- A. General - All construction shall comply with rules and regulations set forth in Title 24, California Code of Regulations, as most recently adopted by the local building official.

The following publications are adopted by reference and incorporated in the Nevada County Code except as expressly amended or superseded by the provisions of this article. The 2010 Triennial Edition of Title 24, California Code of Regulations (CCR) consisting of the following parts:

Part 2 - California Building Code, Part 2.5 - California Residential Building Code, Part 3 - California Electrical Code, Part 4 - California Mechanical Code, Part 5 - California Plumbing Code, Part 6 - California Energy Code, Part 8 - California Historical Building Code, Part 9 - California Fire Code, Part 10 - California Existing Building Code, Part 11 - California Green Building Standards Code (CALGreen Code), Part 12 — Reference Standards Code. (Ord. 5629-B § 3, 2010).

- B. Codes and Standards - Where applicable, the standards of the following organizations, trades and societies shall be adhered to:

1. AASHTO - American Association of State Highway and Transportation Officials
2. ACI - American Concrete Institute
3. ANSI - American National Standards Institute
4. ASME - American Society of Mechanical Engineers
5. ASTM - American Society for Testing and Materials
6. AWWA - American Water Work Association
7. CAL-OSHA California Division of Occupational Safety and Health Administration
8. CalTrans - California Department of Transportation
9. CCR - California Code of Regulations
10. NSF - National Science Foundation; NSF Standard 61
11. UL - Underwriters Laboratories

These organizations, trades and societies may be referenced by acronym as defined herein.

- C. References - the project plans and technical specifications may make reference to Standard Plans and Specifications which shall mean the standard plans and

technical specifications as most recently adopted by California Department of Transportation (CalTrans).

1.2 SITE INVESTIGATION AND CONTROL

- A. The Contractor shall check and verify all dimensions and conditions in the field continuously during construction. Any inaccuracies built into the work due to the Contractor's (including subcontractors's) failure to comply with this requirement shall be the Contractor's sole responsibility.
- B. The Contractor shall inspect related and appurtenant work and report in writing to the Owner and Engineer any conditions which will prevent proper completion of the work. Failure to report such conditions shall constitute acceptance of all site conditions, and any required removal, repair, or replacement caused by unsuitable conditions shall be performed by the Contractor solely and entirely at Contractor's expense.

1.3 INSPECTION OF THE WORK

- A. All work performed by the Contractor and Subcontractors shall be inspected by the Contractor. Nonconforming work and any safety hazards in the work area shall be noted and promptly corrected. The Contractor is responsible for the work to be performed safely and in conformance to the Contract Documents.
- B. The work shall be conducted under the general observation of the Owner's Resident Project Representative to ensure strict compliance with the Contract Documents.
- C. The presence of the Owner, or any designated representatives shall not relieve the Contractor of the responsibility for the proper execution of the work in accordance with all requirements of the Contract Documents. Compliance is the responsibility of the Contractor. No act or omission on the part of the Owner or any designated representatives shall be construed as relieving Contractor of this responsibility. Inspection of work later determined to be nonconforming shall not be cause or excuse for acceptance of the non-conforming work. The Owner may accept nonconforming work when adequate compensation is offered and it is in the Owner's best interest as determined by the Owner.
- D. All materials and articles furnished by the Contractor or Subcontractors shall be subject of rigid documented inspection by qualified personnel, and no materials or articles shall be used in the work until they have been inspected and accepted by the Contractor's quality control representative. No work shall be backfilled, buried, cast in concrete, covered, or otherwise hidden until it has been inspected by the Owner. Any work covered in the absence of inspection shall be subject to uncovering. Where uninspected work cannot be easily uncovered, such as in concrete cast over reinforcing steel, all such work shall be subject to demolition, removal, and reconstruction under proper inspection.
- E. Any materials and articles furnished to the Contractor by the Owner shall be subject to rigid inspection by the Contractor's quality control representative before being used or placed by the Contractor. The Contractor shall inform

Owner, in writing, of the results of said inspections within one working day after completion of inspection. In the event that the Contractor believes any material or article provided by the Owner to be of insufficient quality for use in the work, the Contractor shall immediately notify the Owner.

1.4 TIME OF INSPECTION AND TESTS

- A. Samples and test specimens required under these Specifications shall be furnished and prepared for testing in ample time for the completion of the necessary tests and analyses before said articles and materials are to be used. The Contractor shall furnish and prepare all required test specimens at the Contractor's own expense. As provided in the Contract Documents, performance of the certain tests will be by the Owner, and all costs therefor will be borne by the Owner at no cost to the Contractor except that the costs of any test which shows unsatisfactory results shall be back-charged to the Contractor.
- B. Whenever the Contractor is ready to backfill, bury, cast in concrete, hide, or otherwise cover any work under this Contract, the Owner shall be notified not less than 24 hours in advance to request inspection before beginning any such work of covering. Failure of the Contractor to notify the Owner at least 24 hours in advance of any such inspections shall be reasonable cause for the Owner to order a sufficient delay in the Contractor's schedule to allow time for such inspection. The cost of any remedial, or corrective work required, and all costs of such delays, including its impact on other portions of the work, shall be borne by the Contractor.

1.5 SAMPLING AND TESTING

- A. When not otherwise indicated, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered. However, the Owner reserves the right to use any generally-accepted system of inspection that, in the opinion of the Owner, will ensure that the quality of the workmanship is in full accord with the Contract Documents.
- B. The Owner reserves the right to waive tests or quality assurance measures, but waiver of any inspection testing or other quality assurance measure, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief from the indicated testing or other quality assurance requirements as originally specified, and whether or not such guarantee is accompanied by a performance bond to assure execution of any necessary corrective or remedial work, shall not be construed as a waiver of any technical or qualitative requirements of the Contract Documents.
- C. Notwithstanding the existence of such waiver, the Owner shall reserve the right to make independent investigations and tests as specified in the following paragraph and failure of any portion of the work to meet any of the qualitative requirements of the Contract Documents, shall be reasonable cause for the Owner to require the removal or correction and reconstruction of any such work.

- D. In addition to any other inspection or quality assurance provisions that may be indicated, the Owner shall have the right to independently select, test, and analyze, at the expense of the Owner, additional test specimens of any or all of the materials to be used. Results of such tests and analyses shall be considered along with the tests or analyses made by the Contractor to determine compliance with the applicable specifications for the materials so tested or analyzed, provided that wherever any portion of the work is discovered, as a result of any such independent testing or investigation by the Owner, which fails to meet the requirements of the Contract Documents, all costs of such independent inspection and investigation and all costs of removal, correction, reconstruction, or repair of any such work shall be borne by the Contractor.

1.6 RIGHT OF REJECTION

- A. The Owner shall have the right at all times and places to reject any articles or materials to be furnished hereunder which, in any respect, fail to meet the requirements of the Contract Documents, regardless of whether the defects in such articles or materials are detected at the point of manufacture or after completion of the work at the site. If the Owner, through an oversight or otherwise, has accepted materials or work which are defective or in any way contrary to the Contract Documents, such materials, no matter in what stage or condition of manufacture, delivery, or installation, may be rejected.
- B. The Contractor shall promptly remove rejected articles or materials from the site of the work after notification of rejection. Contractor shall replace any rejected materials with acceptable quality materials.
- C. All costs of removal and replacement of rejected articles or materials shall be borne by the Contractor at no increased cost to the Owner.
- D. Failure to promptly remove and replace rejected work or materials shall be considered a breach of this contract and the Owner may, after 7 days notice, terminate the Contractor's right to proceed with the affected work and remove and replace the work and issue a back-charge to cover the cost of the work.

1.7 CONTRACTOR'S QUALITY CONTROL REQUIREMENTS

- A. The Contractor shall establish and execute a Quality Control program for the services which are being procured from the Contractor. The program shall provide the Contractor with adequate measures for verification and conformance to defined requirements by its personnel and lower-tier Subcontractors. This program shall be described in a Quality Control Plan responsive to this section.

1.8 TESTING SERVICES

- A. All tests which require the services of a laboratory to determine compliance with the Contract Documents shall be performed by an independent commercial testing firm acceptable to the Owner. The testing firm's laboratory shall be staffed with experienced technicians, properly equipped and fully qualified to perform the

tests in accordance with the specified standards.

- B. The Contractor's independent testing laboratory shall be accredited by the American Association of State Highway and Transportation Officials (AASHTO) for the tests they will perform and as appropriate to the construction work being performed. The Contractor's laboratory shall be AASHTO accredited in the following:
 - 1. ASTM C1077 - Practice for laboratories Testing Concrete and Concrete Aggregates for use in Construction and Criteria for Laboratory Evaluation.
 - 2. ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design/Construction.
 - 3. ASTM D3666 - Specifications for Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials.
- C. The Owner shall have the right to inspect work performed by the independent testing laboratory both at the project and at the laboratory. This shall include inspection of the independent testing laboratory's internal quality assurance records (quality assurance manual, equipment calibrations, proficiency sample performance, etc.).
- D. The Contractor shall obtain the Owner's acceptance of the testing firm before having services performed, and Contractor shall pay all costs for these testing services.
- E. Testing services provided by the Owner, if any, are for the sole benefit of the Owner. However, test results shall be available to the Contractor. Testing necessary to satisfy the Contractor's internal quality control procedures shall be the sole responsibility of the Contractor.
- F. Testing Services Furnished by Contractor:
 - 1. Unless otherwise indicated, the Contractor shall furnish all testing services in connection with the following materials as required for Owner's review:
 - a. Concrete materials and mix design.
 - b. Embankment, fill, and backfill materials.
 - c. Quality Control testing of all precast concrete.
 - d. Holiday testing of pipeline coatings.
 - e. All tests and inspection of welding work, including welding procedure qualifications, welder operator qualifications, all work performed by the certified welding inspector, all appropriate non-destructive testing and all repair and retest of weld defects.
 - f. Pressure testing and testing of water-tightness.
 - g. All other tests and engineering data required for the Owner's review of materials and equipment proposed to be used in the work.
- G. Testing Services Furnished by Owner:
 - 1. Unless otherwise indicated, the Owner will provide Quality Control testing

services in connection with the following materials and equipment incorporated in the work:

- a. Cast-in-place concrete strength tests.
 - b. Testing of field welds for steel pipe and other nondestructive testing of pipe joints.
 - c. Moisture-density and relative density tests on embankment, fill, and backfill materials.
 - d. In-place field density test on embankments, fills, and backfill.
 - e. Other materials testing and equipment as indicated herein.
2. Testing shall be performed by the Owner, the Engineer, or the Owner's testing firm's laboratory personnel, in general manner and frequency as deemed appropriate by Owner or Engineer.
 3. The testing firm's laboratory shall perform all laboratory tests within a reasonable time consistent with the specified standards and will furnish a written report on each test.
 4. The Contractor shall furnish all sample materials and cooperate in the testing activities, including sampling. The Contractor shall interrupt the work when necessary to allow testing, including sampling to be performed. The Contractor shall have no claim for an increase in Contract Price or Time due to such interruption. When testing activities, including sampling, are performed in the field by the testing firm's laboratory personnel, the Contractor shall furnish personnel and facilities to assist in the activities.

H. Transmittal of Test Reports

1. Written reports of tests and engineering data furnished by the Contractor for the Owner's review of materials and equipment proposed to be used in the work shall be submitted as indicated for Shop Drawings.
 - a. The testing firm retained by the Contractor for material testing shall furnish five copies of written report of each test. Four copies of each test report shall be transmitted to the Owner within 3 days after each test is completed. Each report for each type of test shall be consecutively numbered.
 - b. The Owner shall furnish one copy of each field and laboratory Quality Control test performed by the Owner to the Contractor.

1.9 ACCEPTANCE TESTING

- A. The Contractor shall provide acceptance testing as specified for each item of work. This shall include but not be limited to disinfection and pressure testing of piping, tanks and appurtenances, testing the operation of the water treatment systems, the valves and controls, the pump systems and chemical feed systems, electrical instrumentation and control systems and coating systems. Further details on each system are included in the appropriate sections of these Technical Specifications.
- B. The Owner has the right to reject any project element that fails to meet testing

standards. Contractor must replace or repair or otherwise rectify any defective work element until it meets quality criteria as demonstrated by successful testing.

PART 2 **PRODUCTS** (not used)

PART 3 **EXECUTION** (not used)

* * END OF SECTION * *

SECTION 01500
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SITE CONDITIONS

- A. The water treatment plant project site resides on a remote parcel not owned by the District. The District has an easement for the treatment plant site and adjacent pipeline. There is limited area for parking, staging, and material storage at the plant site. The water tank project site resides on US Forest Service land. District access to the tank site and access road are by Special Use Permit issued to the District.

- B. Site Access: Access to the treatment plant site is via Maybert Road, an approximately 3 mile unimproved dirt and gravel road which is one lane wide in most locations. Maybert Road follows the South Yuba River from Washington to the plant. The water tank project site is accessed by a one lane gravel access road near the intersection of Gaston Grade and Relief Hill Road. Contractor shall provide dust control and coordinate noise so as to limit impacts to residences, cabins, and other impacted parties.

1.2 **CONTRACTOR USE OF FACILITIES** - Contractor shall confine operations at the sites to areas permitted by law, ordinances, permits and the contract documents. Do not unreasonably encumber the site with any materials or equipment. Do not interfere with District's activities in and about existing facilities. Exceptions will be made only with prior agreement with the Owner. Roads for access to and from the construction site, loading areas and parking space shall be as indicated. All traffic and materials delivery shall be confined to these locations. Contractor is responsible for protection and safekeeping of all products stored on the site.

1.3 UTILITIES

- A. Construction Utilities - Contractor shall coordinate with District to ascertain the availability of onsite water and power and the extent to which it will meet his needs during construction and the manner in which it can be made available. If additional utilities are required by Contractor, arrangements shall be made at Contractor's expense.

- B. It shall be the Contractor's responsibility to arrange for the proper marking or designating of the location of known utilities including but not limited to water lines, sewer lines, gas lines, electrical conduits, transformers and telephone and communication lines. The Contractor shall notify Underground Service Alert (telephone 1-811/800-642-2444) at least 2 work days prior to commencing any excavation work. When direction is given on the plans to extend, relocate, lower or otherwise adjust public or private utilities and the work is not specifically

designated on the plans as being performed by others, it shall be the Contractor's responsibility to perform the work using materials and methods which shall provide a finished product equal to or better than the utility as it originally existed and meeting or exceeding the requirement of the utility. The Engineer will be the sole judge as to the acceptability of the work.

- C. Attention is directed to the possible existence of underground facilities not known by the Owner and Engineer or in a location different from that designated on the plans. If the Contractor encounters or has evidence of existence of an underground utility not shown on the plans or marked on the ground he shall:
1. Ascertain the exact location of said underground utility.
 2. Immediately notify the Engineer and follow up with written notification to the Engineer.
 3. Proceed with work in another work area, if possible, until the Engineer directs a course of action. Where it is determined by the Engineer that the rearrangement or repair of an underground utility, the existence of which is not shown on the plans, is essential in order to accommodate the improvements being constructed, the Engineer will provide for the rearrangement or repair of such facility by other forces at the Owners expense or such rearrangement or repair shall be performed by the Contractor and will be paid for as extra work. An extension of time may be granted for delays in connection with this work described herein and for extra work performed by the Contractor.
 4. The Contractor shall cooperate with the Engineer to investigate possible damage of existing underground utilities suspected as a result of the Contractor's operations. The Contractor shall take such measure as necessary to physically prove to the satisfaction of the Engineer that the existing utilities are unharmed or adequately repaired at such locations where the Engineer has reasonable suspicion that damage has occurred. If said utilities are found to be undamaged by the Contractor's operations, the cost of only the uncovering and replacement ordered by the Engineer shall, by appropriate change order, be charged to the Owner.
 5. Should the Contractor desire to have any rearrangement made in any utility, for its convenience in order to make easier its construction operations, which arrangement is in addition to, or different from the rearrangement indicated on the plans, it shall make whatever preparation are necessary with the owner of the utility for such arrangement and bear all expenses and time it takes in connection therewith.
- D. Contractor shall coordinate with the owners of any adjacent or coincident utilities that will be modified, either temporarily or permanently, or relocated or interrupted in any way during the course of construction. Contractor is solely responsible for arranging for and bearing the expense of any such activities. This shall include onsite, adjacent, and offsite utilities that may be impacted by the Contractor, his activities, and those of his subcontractors and agents.

1.4 MOBILIZATION

- A. This work shall consist of preparatory work and operations, including, but not limited to, those necessary for the movement of personnel, equipment, supplies, and incidentals to the project site; for the establishment of all facilities necessary for work on the project; and for all other work and operations which must be performed or costs incurred prior to beginning work on the various contract items at the project site.
- B. Contractor shall be responsible for erecting and maintaining suitable fencing, railings, lighting, security measures and any other facilities appropriate to both protect the work area from intrusion and vandalism and to protect the public and adjacent facilities from construction related hazards of any nature.
- C. Contractor shall provide a protected area in which shall be kept project copies of contract documents, project progress records, etc, which shall be accessible to the Owner or Engineer during normal working hours.
- D. Sanitary Facilities - The Contractor shall provide and maintain suitable chemical toilets at points to be approved by the Owner for use of employees on this work. These facilities shall be adequately maintained during the construction period. At the end of the job such toilets shall be removed completely.
- E. Storage of Materials - It shall be the Contractor's responsibility to establish a secure site for the storage of materials and from which to carry on activities. Contractor shall take precautions to protect stored materials and to prevent the entry of unauthorized persons to such areas when the Contractor is not present. Construction materials shall not be stored in such a manner as to be a hazard to traffic, water supplies, or the public in general. They shall be protected from damage, theft, vandalism and the elements at the sole cost to Contractor.
- F. During construction the Contractor may find it necessary to remove, obstruct or modify such existing facilities as fences, culverts, sidewalks, and small structures. It shall be the Contractor's responsibility to first obtain the permission of the owner of such facility, and subsequently return it to the condition in which it was found, or better.

1.5 SITE CONTROLS

- A. Noise Control - The Contractor shall comply with all sound control and noise level rules, regulations and ordinances. There is no noise control ordinance in effect in the construction area at the time of preparation of these specifications. However, noise complaints are handled by the County Sheriff's office. Each internal combustion engine used for any purpose of the job or related to the job shall be equipped with a muffler of a type recommended by the manufacturer. No internal combustion engine shall be operated on the project without said muffler.

- B. Dust Control - Where dust is created, either by vehicles of the Contractor or of others through work being done by the Contractor, such dust shall be controlled by the Contractor through watering or by cleaning up the material causing the dust. Dust control shall be in compliance with regulations of the Northern Sierra Air Quality Management District.

- C. Traffic Controls - Some of the work (or delivery of materials to the work site) is located in areas of traffic. Contractor shall plan and execute his work in such a way as to minimize disruption in the flow of vehicular and pedestrian traffic, and with regard to the safety of the public.
 - 1. All work shall be planned and carried out so that there will be the least possible inconvenience to the traveling public. Traffic shall be permitted to pass at all times through the work zone unless otherwise specified in the Technical Specifications. One-way traffic may be maintained in the work area during daylight hours only. At least two 10 foot wide traffic lanes shall be maintained at all times during hours of darkness and, where practicable, during daylight hours. The traffic lanes shall be relative to the existing striped centerline if one exists.
 - 2. Warning signs, lights, devices, as specified in the latest edition of the “Manual of Traffic Controls for Construction and Maintenance Work Zones” published by Caltrans, and as required by the Engineer shall be furnished, erected, and maintained by the Contractor, at Contractor's expense, if appropriate. All construction traffic control devices shall be in place and operational prior to beginning work on different phases throughout the contract.
 - 3. The Contractor shall maintain existing “Stop” signs, street signs, and guide signs at all times. If necessary, they may be set in temporary locations until they can be reset to their original positions.

1.6 WATER AND AIR POLLUTION

- A. The work under this contract involves modifications to a public water system, owned and operated by Washington County Water District. The work is above the South Yuba River along the north canyon wall. The Contractor is responsible for preventing any pollution of any nature to the public water system, the adjacent river, and any other water body or facility.

- B. The Contractor shall exercise precautions necessary to protect existing water systems, ditch conduits, streams, lakes, and reservoirs from pollution with fuels, oils, bitumens, chemicals, concrete, soil, dust and other harmful materials and shall conduct and schedule his operations so as to avoid erosion, muddying and silting of said conduit, streams, lakes and reservoirs.

- C. Nothing in the Contract Documents shall relieve the Contractor of the responsibility for compliance with Section 5650 and 12015, California Fish and

Wildlife Code, or other applicable statutes relating to prevention or abatement of water pollution.

- D. The Contractor shall be completely responsible for compliance with all local, county, state, and federal regulations pertaining to water pollution and soil erosion including the payment of any fines or penalties imposed by any government agency as a result of work performed by the Contractor.

- E. The Contractor shall comply with all air pollution control rules, regulations, ordinances and statutes which apply to the work area. This shall include Dust Control Requirements as applicable to this project. The Air Pollution Control Officer can be contacted at the Northern Sierra Air Quality Management District at (530) 274-7546.

PART 2 **PRODUCTS** (not used)

PART 3 **EXECUTION** (not used)

* * END OF SECTION * *

SECTION 01600 SUBMITTALS

PART 1 GENERAL

1.1 NEW AND RECYCLED MATERIALS

- A. Unless otherwise specified, all materials used in the Project shall be new, unused and in factory condition. New materials may have recycled content. Recycled content and its percentage shall be indicated in submittals.
- B. Contractor may request the use of recycled or previously used materials. Any such material, if approved, shall be specifically designated as a recycled or previously used material and shall be held to all guarantee and warranty provisions as would a new material. No recycled or used materials shall be used without written consent.
- C. All material shall be of good quality and good workmanship with no factory defects nor damage of any kind.

1.2 SPECIFIED PRODUCTS AND SUBSTITUTIONS

- A. Products specified by referenced or performance standards: Contractor may select any product which meets the referenced or performance standards given.
- B. Specified products: Wherever catalog numbers, model numbers and specific brand or trade names are used in conjunction with a designated material, product, thing or service mentioned in these specifications, they are used to establish the standards of quality, utility, performance, dimensions and appearance required. The specified product shall be understood to be the basis for the project design.
- C. Matching products. If a specified product is identical or similar to other products already in use or possession of Owner, and if in the Owners opinion, keeping like-products reduces need for extra spare parts, tools or reduces maintenance costs, this is an acceptable reason for disallowing substitution.
- D. For any Substitution, the Contractor must submit such Substitution through the Submittal process. If the Substitution will necessitate the modification of any design element of the project, whether to accommodate new dimensions or different utility or performance or any other characteristic, the Contractor shall clearly identify any and all such modifications or changes with the Submittal, and, if the Substitution is approved, Contractor shall solely bear the cost of any such modifications or adjustments.
- E. Acceptable Equals: Where specifications include the designation “or equal”, “or approved equal”, “or accepted equal”, “or equivalent”, Contractor may request

acceptance as “equal” any material, process or product through the Submittal process.

1.3 SUBMITTALS

- A. Water Treatment System: The Water Treatment System submittals shall include shop drawings for major system components along with detailed documentation for:
1. Finished water pumps
 2. HDPE contact pipe and fittings
 3. Bypass valves and actuators
 4. Break tank
 5. Chlorine analyzer
 6. Piping and valves
 7. Monitoring equipment
 8. Control panel and control logic
 9. Chemical feed equipment
 10. Motor controls
 11. Coating systems
 12. Flow meters
 13. Exhaust fan
 14. Pressure sustaining valve
 15. Pressure transducer assembly and vault
 16. Conduit Schedule
 17. SCADA enclosure and utility pedestal
 18. Standby generator and transfer switch
 19. Meter/main/panel enclosure
 20. Programmable logic controller
- B. Ancillary Project Components: For the construction of site work, concrete, pipe work, valving, chemical feed, electrical, etc., the Contractor shall submit to the Engineer sets of specifications, parts lists, maintenance and operations instructions as supplied by the manufacturers for all equipment items; including shop drawings of piping and pump layout and all electrical controls, and related equipment specified in this section. The Contractor shall make submittals to the Engineer for specific items as further described in detail in these specifications and as listed in the table below: Note that this list may not be complete and the Engineer may request additional submittals.
- C. All Submittals shall be submitted in an electronic Adobe pdf format and will be returned in the same form. After review of the Contractor's submittal, a pdf copy will be returned to the Contractor with the Engineer's comments noted on the submittal packages. The Contractor shall not commence fabrication of any items until the submittal has been reviewed and returned Approved by the Owner's Engineer. Contractor shall allow 2 weeks for review of each submittal or resubmittal.

Item or Product for Submittal	Catalog Cuts and Specifications	Shop Drawings & Structural or Electrical Calculations ¹	Instructions for Operation and Maintenance and Parts lists ^{2,4}
Pumps & Motors	X	X	X
Chemical Feed Systems	X	X	X
Paints & Coatings	X		
Pressure Gauges	X		X
Pipe & Fittings	X		X
Valves & Actuators	X		X
Flow Meters	X		
Check Valves	X		X
Air Release Valves	X		X
Cast In Place Concrete	Mix Design		
Precast Concrete Products	X		
Electrical Equipment	X	X	X
Instrumentation & Control Equipment	X	X	X
Monitoring and Communication Equipment	X	X	X

1. Must be furnished prior to ordering equipment.
2. Must be furnished prior to equipment start-up.
3. Certified shop and installation drawings and data regarding pump and motor characteristics and performance. The data shall include performance curves, based on actual shop test, for head, capacity, efficiency, and horsepower. Motor data and motor performance curve showing torque, current, KW input, KW output, efficiency, and power factor.
4. Manuals: Furnish manufacturer's installation, lubrication, operation and maintenance manuals, bulletins, and parts lists.

PART 2 **PRODUCTS** (not used)

PART 3 **EXECUTION** (not used)

* * END OF SECTION * *

**SECTION 01700
EXECUTION OF WORK**

PART 1 GENERAL

1 PROJECT SCHEDULE

- A. Within seven days of the award of this contract, the Contractor shall submit a Construction Progress Schedule for the work, with sub-schedules of related activities essential to the work progress.
- B. With each Payment Request, the Contractor shall submit the Construction Progress Schedule with the percent complete for each line item.

2 PHASING OF WORK

- A. **General**
Phasing of the work is critical to this project due to the requirement that customers continue to have a treated water supply. Along with the project schedule, contractor shall submit a detailed phasing plan taking into consideration factors defined herein and as shown on the Plans. Contractor shall demonstrate an ability to provide a continuous supply of water to the District customers with a limited number of short term outages.
- B. **Treatment Plant**
Contractor shall be responsible for maintaining the ability to operate the existing treatment plant at all times during the course of the project until such time as the new system is operational and approved to supply water to the distribution system. Contractor shall utilize temporary piping and valves as necessary to accommodate construction of the new facilities while maintaining reasonable operation of existing equipment.

Contractor shall coordinate with District water system operators for all activities involving the existing system including operation of valves, temporary shutdowns, and operation of any plant mechanical or electrical equipment.
- C. **Tanks**
The existing tank can be taken off line for a period of time while work takes place on that portion of the project. No temporary storage facilities will be required, although some special operational procedures will be required and District staff will need to monitor water deliveries closely.

3 PROTECTION OF EXISTING FACILITIES

- A. The Contractor shall protect from damage all facilities that are to remain in place, be installed, relocated, or otherwise rearranged as shown on the plans. The Contractor shall install such shoring, cribbing, falsework, and temporary

structures as required to support and protect existing facilities and utilities during the installation work. Any damage to utilities shall be reported to the utility owner and inspected by that utility prior to repair, and shall be repaired by the Contractor at his sole expense. Such utilities may be above or below ground and publicly or privately owned and shall remain in service during the entire time that this contract is in effect.

- B. During construction the Contractor may find it necessary to remove, obstruct or modify such existing facilities as fences, culverts, sidewalks, and small structures. It shall be the Contractor's responsibility to first obtain the permission of the owner of such facility, and subsequently return it to the condition in which it was found, or better.

4 SAFETY

- A. The Contractor is solely responsible for developing and enforcing the safety procedures to be followed by its workmen, all subcontractors, suppliers and related trades working on its jobs and effectively assuring compliance with such procedures and for ensuring field safety meetings are being conducted for all workers on the project. The Contractor shall always provide for the safety of the public both day and night where they are exposed to its construction operation.
- B. The Contractor is responsible for all safety on the project, whether or not specifically described in these specifications. Contractor responsibility includes worker safety and public safety, and protection of all persons and property. Project site is located in a residential area. Contractor shall exercise all methods to protect the public and employees and agents of the Association from any hazards. Refer to General Conditions for required safety program.
- C. The Owner, the Engineer and field inspectors are not responsible for reviewing or approving or administering the safety procedures developed and followed by the Contractor, his employees and subcontractors.

5 PROJECT CLEANUP

- A. The Contractor shall remove from the vicinity of the completed work all rubbish, unused material, forms, construction stakes, etc. belonging to him or used under his direction during construction. The work shall be left in a neat and presentable manner at all times insofar as construction conditions permit. As portions of the work are completed, the Contractor shall clean the individual sites.

6 TOUCH UP AND REPAIR

- A. The Contractor shall touch-up or repair all finished surfaces on structures, equipment, fixtures, or whatever, that have been damaged prior to final acceptance. Surface on which such touch-up or repair cannot be successfully accomplished shall be completely refinished or in the case of hardware and

similar small items, the items shall be replaced.

PART 2 **PRODUCTS** (not used)

PART 3 **EXECUTION** (not used)

* * END OF SECTION * *

**SECTION 02200
SITE PREPARATION**

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. The work of this Section includes measures required during the Contractor's initial move onto the Site to protect existing fences, structures and associated improvements, streets, and utilities surrounding and/or downslope of construction areas from damage due to the construction process, assessment and notification of any subsurface or latent physical conditions differing from those indicated including the discovery of potentially hazardous materials, and clearing and grubbing.

1.2 LEGAL REQUIREMENTS

- A. The Contractor shall promptly, and before the following conditions are disturbed, notify the Owner in writing of any:
1. Material that the Contractor believes may be material that is hazardous waste as defined in Section 25117 of the Health and Safety Code, that is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing law.
 2. Subsurface or latent physical conditions at the site differing from those indicated. Unknown physical conditions at the site may be of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the contract.
- B. The Owner shall promptly investigate the conditions, and if it finds that the conditions do materially so differ, or do involve hazardous waste, and cause a decrease or increase in the Contractor's cost of, or the time required for, performance of any part of the work shall issue a change order under the procedure described in the contract.
- C. In the event that a dispute arises between the Owner and the Contractor whether the conditions materially differ, or involve hazardous waste, or cause a decrease or increase in the Contractor's cost of, or time required for, performance of any part of the work, the Contractor shall not be excused from any scheduled completion date provided for by the contract, but shall proceed with all work to be performed under the contract. The Contractor shall retain any and all rights provided either by contract or by law which pertain to the resolution of disputes and protests between contracting parties.

PART 2 PRODUCTS (NOT USED)

PART 3

PART 4 EXECUTION

4.1 SITE INSPECTION

- A. Prior to moving onto the Site, the Contractor shall inspect the Site conditions and review maps of existing water pipeline routes and facilities, and documents delineating the Owner's property and right-of-way.

4.2 PROTECTION OF IMPROVEMENTS

- A. Prior to initiating work on the site, Contractor shall take measures to protect existing fences, structures and associated improvements, streets, and utilities surrounding and/or downslope of construction areas from damage due to boulders, trees, or other objects or materials dislodged during the construction process.

4.3 SITE ACCESS

- A. The Contractor shall develop any necessary access to the Site, including access barriers to prohibit entry of unauthorized persons. Contractor is responsible for acquiring any necessary Encroachment Permits and for maintaining, adhering to and enforcing any conditions thereof.

4.4 CLEARING AND GRUBBING

- A. Construction areas shall be cleared of grass and weeds to a depth of 4 to 8 inches and cleared of structures, pavement, sidewalks, concrete or masonry debris, trees, logs, upturned stumps, loose boulders, and any other objectionable material of any kind which would interfere with the performance or completion of the work, create a hazard to safety, or impair the subsequent usefulness of the work, or obstruct its operation.
- B. Within the limits of clearing, the areas below the natural ground surface shall be grubbed to a depth necessary to remove all stumps, roots, buried logs, shallow vegetation, and all other objectionable or deleterious material. All objectionable material from the clearing and grubbing process shall be removed from the Site and wasted in approved safe locations. Organic top soil can be stockpiled for use in landscape areas but it is not suitable for fills.
- C. Only trees, plants and shrubs that are designated for removal shall be removed. The removal of any other trees, shrubs, fences, or other improvements, either inside or outside of right-of-way, if necessary for the Contractor's choice of means and methods, shall be arranged with the owner of the property, and shall be removed and replaced, at no additional cost to the Owner.
- D. Trees, plants, and shrubs that are not to be removed shall be protected from injury and damage. Any such trees, plants or shrubs that are removed or damaged due to the negligence of the Contractor, shall be replaced by the Contractor at no additional cost to

the Owner. Such replacement shall be to the satisfaction of the owner of said trees, plants or shrubs.

1. Burning of waste debris shall conform to all applicable local regulations. Prior to any intended burning, the Contractor shall furnish to the District, a copy of the Contractor's burning permit as issued by the local agency having jurisdiction.
2. Any materials wrongfully removed from the Site shall be paid for by the Contractor. The cost of any such items removed shall be agreed upon by the Owner and the Contractor. That amount shall be withheld from the next progress payment due.
3. All spoils not used on site for fill purposes shall be disposed of by the Contractor at the Contractor's expense.

2 TOP SOIL

- A. Stripping of top soil and separate storage thereof will be required in areas where it is deemed necessary by the Engineer to preserve the quality of top soil.

* * END OF SECTION * *

DIVISION 2 - SITE CONSTRUCTION
SECTION 02300 EARTHWORK

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. This Section includes a description of requirements for materials and services necessary to complete earthwork including trenching, excavation, backfill, structural fill, and compaction as shown and/or specified for construction of all work related to the project.
- B. Related Sections:
 - 1. Section 01400 - Quality Requirements
 - 2. Section 01900 - Facility Decommissioning
 - 3. Section 02200 - Site Preparation

1.2 QUALITY ASSURANCE

- A. Safety Regulations: work shall comply with all Federal, State and county regulations regarding safety, including the requirements of the following:
 - 1. County Requirements: Any work falling under the jurisdiction of the County of Nevada, shall conform to the county's applicable requirements.
 - 2. All trench work shall conform to Trench Construction Safety Orders of California State Industrial Accident Commission
- B. Observations and Inspections: The Owner will observe, and respective utilities agencies' representatives will inspect utilities trenching, excavation, backfilling and compaction as appropriate. See Section 01400 for additional observation and inspection information.
- C. Contractor shall appropriately schedule all inspections prior to commencing trenching and backfilling operations. All installations are subject to satisfactory inspection by appropriate agency.
- D. Geotechnical Report
No Geotechnical Report has been prepared as part of this project.
- E. Relative Compaction Tests
 - 1. Where relative compaction densities are specified in these specifications and/or on the project plans, the laboratory and field tests shall be made in conformance with test methods as applicable: ASTM D 1557, ASTM D 1556, ASTM D 2922, AASHTO T 191 and AASHTO T 238.
 - 2. In-Place density testing of trench backfill shall be conducted by an independent consultant at the expense of the Owner.

1.3 STOCKPILING OF MATERIAL

- A. Stockpiling of excavated and backfill materials within the limits of any Nevada County roadway or driveway will not be allowed. Contractor shall make arrangements for appropriate storage of materials as necessary.
- B. All excavated material shall be removed from site or stockpiled in an approved manner that will not obstruct or cover any hydrants, water and gas valves, manhole covers, fire and police call boxes, or any other utility boxes. Gutters shall be kept open or other satisfactory provisions made for street drainage.

1.4 EXCAVATION AREA

- A. Any street-excavation area shall be kept level with the adjacent street, shoulder or ground and maintained to prevent a traffic or pedestrian hazard until such time as the permanent surfacing is placed.

PART 2 PRODUCTS

2.1 BEDDING, BACKFILL AND STRUCTURAL OR ENGINEERED FILL

- A. Pipe bedding and backfill shall conform to the technical specifications and project plans for the specific type of pipe being used and/or as described in other Sections of these specifications. Trench backfill used within the bedding, shading and transition zones (as defined in trench details) shall be 3/4-inch minus crushed rock or approved granular material. Soil used in intermediate zones shall be non-expansive soil not containing rocks over 3" in any dimension. Upper zones shall be as shown on drawings.
- B. Engineering fill and structural fill shall conform to the material called for in the technical specifications and project plans for area in question (tank foundation, building foundation, etc.) Soil used in fill shall be uncontaminated, granular, non-expansive native or approved import soil. Rocks in fill must be broken to 8" or less in any dimension. Any proposed import soil must be sampled and submitted to Engineer a minimum of 72 hours prior to import. Cohesive, predominantly fine-grained or potentially expansive soil encountered during grading shall be stockpiled for removal, used in landscape areas, or mixed with better material as approved by the Geotechnical Engineer. It may, if specifically approved by Geotechnical Engineer, be used at depths greater than three feet below sub-grade.
- C. **MATERIALS**
 - 1. Class 1 Backfill shall be material consistent with California Department of Transportation Class 1 material.
 - 2. Class 2 Backfill shall be material consistent with California Department of Transportation Class 2 material.
 - 3. Sand shall be free from clay or organic material, suitable for the purpose intended, and shall be of such size that 90 - 100% passes a No. 4 sieve and not more than 5% passes a No. 200 sieve.
 - 4. Native Material - the Contractor's attention is drawn to existing fill onsite that is

not native material and may be unsuitable for use as sub-grade or engineered fill material. Any relatively loose fill material encountered within 5 feet of a proposed structure footprint shall be over-excavated until competent native soil or rock is encountered. The grade shall be re-established with engineered fill as specified.

PART 3 EXECUTION

3.1 TRENCHING

- A. Except by specific approval of the Engineer, no more than three hundred (300) feet of open trench, within the public street, shall be excavated in advance of laying pipe. Not more than two hundred (200) feet of trench shall be left open in the rear of the pipe laying operations. Not more than fifty (50) feet of trench excavation shall remain open at the end of each day's work. The remainder of the trench shall be backfilled, compacted and open to traffic where applicable.
- B. The Contractor shall make a reasonable effort to maintain trench widths to a minimum as to minimize damage to existing structures and the existing pavement. When necessary the Contractor may be required to step the trench walls in order to install the proper shoring and bracing.
- A. Any trenching within three feet of any County, public or private roadway edge of pavement shall be filled to the original ground line elevation before the end of each working day.
- B. Bore pits shall not be excavated at locations that are deemed detrimental to structures, drainage facilities, or trees. Backfill of bore pits shall meet the same requirements as backfill for trenches.
- C. Ponding or jetting the top four feet of structure backfill will not be allowed.
- D. Any damaged tree roots shall be clean cut and a root sealant applied.

3.2 SHORING

- A. Pursuant to Labor Code 6705 and 6707, the Contractor shall include in his base bid all costs incidental to the provision of adequate sheeting, shoring, bracing or equivalent method for the protection of life or limb, which shall conform to all applicable Federal and State Safety Orders including California Occupational Safety and Health Administration (OSHA) requirements.
- B. The Contractor's attention is directed to the provisions for "Shoring and Bracing Drawings" in Section 6705 of the California Labor Code. Before beginning any excavation 5' or more in depth, Contractor shall submit to Owner's representative a detailed plan showing the design of shoring, bracing, sloping, or other provisions to be

made for worker protection from the hazard of caving ground during excavation. The proposed plan shall comply with the standards established by the State of California Construction Safety Orders and Title 24 of the California Code of Regulations (CCR). If the detailed plan varies from such shoring system standards, it shall be prepared by a registered civil or structural engineer whose name and registration number shall be indicated on the Drawing. If a dispute arises as to whether the plan must be prepared by a registered civil or structural engineer, Owner's representative's determination of the matter shall be final and conclusive on contractor. The cost of required engineering services shall be borne by Contractor and shall be deemed to have been included in the amount bid for the work.

- C. Neither the review nor approval of any plan showing the design of shoring, bracing, sloping, or other provisions for worker protection, shall relieve Contractor from its obligation to comply with Construction Safety Order Standards and Title 24 California Code of Regulations (CCR) for the design and construction of such protective work, and Contractor shall indemnify Owner and Owner's representative from any and all claims, liability, costs, actions, and causes of action arising out of or related to the failure of such protective systems. Contractor shall defend Owner, its officers, employees, and agents and Owner's representative in any litigation or proceeding brought with respect to the failure of such protective systems.
- D. Contractors must still comply with the State of California Construction Safety Orders, Article 6 - Excavations, Trenches, Earthwork. The requirements of Article 6 apply whether the excavation, trench or earthwork is less than 5', or 5' or more.
- E. Any damage to work or to adjacent structures resulting from failure of excavation walls will be the Contractor's responsibility.
- F. Bracing, forms, and rubbish shall be removed from the excavation before the backfill is placed. Where sheeting, shoring, or bracing is to remain in place, it shall be cut off a minimum of 30" below finish grade. Sheeting, shoring, and bracing to be removed shall be removed at such time as will best prevent the loosening of un-excavated material and facilitate the placing and compacting of the backfill. Sloping sides of the excavated space that could cause wedging action of the backfill against the structure shall be stepped or serrated.
- G. If steel piling is utilized, it may be withdrawn with compacting of backfill to proceed as it is removed.

3.3 TRENCH DEPTH

- A. The depth of the trench shall be in accordance with the lines and grades shown on the plans with proper allowance for bedding and thickness of pipe and for the type of fittings specified. Any portion of the trench excavated below the proper grade shall be backfilled with approved bedding material compacted to 95% relative compaction at the Contractor's expense and at the direction of the Owner or his agent. All areas of unsuitable material required by the Owner or his agent to be removed shall be replaced in

the same manner.

3.4 DEWATERING

- A. Removal and disposal shall be required of all water entering the excavation. Disposal of water shall be done in a manner to prevent damage and nuisance to adjacent properties or to the public. Sufficient pumping equipment shall be provided by the Contractor in a manner so as to maintain trenches in a dry condition during the bedding and initial backfilling of the pipe. Appropriate precautions shall be taken to prevent drainage water from entering the pipeline being constructed. If groundwater or saturated soil conditions are encountered during grading, the Geotechnical Engineer shall be notified and consulted.
- B. Water in the trench as a result of ground conditions, the Contractor's use in balling and flushing, stormwaters, broken water pipes, or from any other condition shall not be allowed to enter the existing water system under any circumstances.

3.5 ALIGNMENT AND GRADE CONTROL

- A. The grade and alignment of all new facilities shall be maintained by use of a method approved by the Engineer in advance of the construction. The proposed method shall be submitted for approval prior to commencing the work. The Engineer shall determine the adequacy of the proposed method and shall set the tolerances required for the work. The Engineer, at any time during the course of the work, may require alterations of the grade control method to conform to the required conditions of the work.
- B. Horizontal and vertical alignment shall be true to lines shown on the project plans. Any deviation must meet the approval of the Engineer.
- C. Owner shall provide a minimum of one benchmark at the construction site of the water treatment plant. Said benchmark shall serve as the project datum, and Contractor shall construct all facilities according to the project plans relative to the project benchmarks, both horizontally and vertically. Contractor is solely responsible for all construction staking on the project and for ensuring accurate lines and grades as per the project plans. Contractor shall determine appropriate limits for construction staking, and shall take responsibility for the finished location for all project elements. The Engineer may at any time check the alignment and grade of project elements from staking and benchmarks, but Engineer is in no way responsible for any defects in construction staking nor for the horizontal and vertical placement of project elements. The Contractor shall be responsible for any inaccuracies and/or deviations from the lines and grades of all project elements, and shall correct any discrepancies of any magnitude as directed by the Engineer. The Contractor shall take appropriate means to preserve, as is practicable, all stakes, bench marks and control used in setting of alignment and grade.

3.6 TRENCH BACKFILL

- A. Following completion of the initial backfill phase, approved backfill material shall be

placed and compacted to the appropriate depth, as indicated on the plans, above the top of the pipe unless otherwise approved by the Engineer. Compaction shall be by approved means. In no case shall roots, vegetable matter or otherwise deleterious material be placed in the trench backfill.

- B. Soil used to construct trench backfill should be uniformly moisture conditioned to within 3% of ASTM D1557 optimal moisture content.
- C. Trench backfill soil shall be placed in maximum 12" loose lifts prior to compacting.
- D. Finish grade materials and surfaces shall be as required by agencies having jurisdiction.
- E. Bedding zone shall be compacted to 90% of the ASTM maximum dry density. Shading, transition and intermediate zones shall be compacted to 90% relative dry density unless otherwise noted. Upper zones compaction shall be 90% in unpaved areas and 95% in all paved areas. All backfill compaction testing shall be conducted by an independent consultant at the expense of the Owner, and as directed by the Engineer or Geotechnical Engineer.

3.7 STRUCTURAL EXCAVATION AND ENGINEERED FILL

A. Structural Excavation

1. All excavation shall be done to the dimensions and levels shown on the drawings or specified herein. Excavation shall be made to such width outside the lines of the structure to be constructed therein as may be required for proper working methods, the erection of forms and the protection of the work. Where possible care shall be taken to preserve the foundation surfaces shown on the drawings in an undisturbed condition. If the Contractor excavates or disturbs the foundation surfaces shown on the drawings or specified herein without written authorization of the Engineer he shall replace at his expense such foundations with compacted gravel foundation fill or other material approved by the Engineer in a manner which will show by test an equal bearing strength with the undisturbed foundation material.
2. To suit field conditions, excavation below the depths shown may be ordered, but changes may only be made as directed. Soft, spongy, or unsuitable bearing material of any kind shall be entirely removed down to solid bearing and replaced with compacted gravel (95% maximum dry density). If relatively loose material is encountered within 5 feet of foundations, it shall be over-excavated until competent native material or rock is encountered.
3. Any water that may be encountered or that may accumulate in excavations shall be removed and kept out by pumping or other approved method. All construction shall be carried on in the dry. Water shall be removed until structures are complete to above water, safe from uplift and horizontal water pressure and the backfill has been placed. Any saturated material encountered shall be reported.
4. All excavated top soil of suitable quality for planting shall be saved and piled separately. The required amount of excavated earth shall be stored conveniently for use in back-filling and grading, but so as not to interfere with the work of

others.

5. Where indicated on the plans, excavation shall be carried below footings and floor slabs of certain structures to the depth shown, and the excavated material replaced with an engineered fill as specified herein.
6. The Contractor shall notify the Engineer when excavation is complete. No forms, reinforcing steel, concrete, or pipe shall be placed until the excavation has been approved by the Engineer.
7. Excavated material determined by the Engineer to be unsuitable, or in excess of the amounts required for backfill, shall be disposed of off the site by the Contractor at his expense.

B. Foundation Preparation for Buildings, Structures and Tanks

1. The terms engineered fill, structural fill and foundation preparation all refer to the preparation of subsurface material to support buildings, structures and tanks. All references in the plans and technical specifications to these terms shall apply.
2. The site shall be stripped of all organic material within the foundation areas. Any organic topsoil material shall be stockpiled. It shall not be incorporated into any of the embankment or structural fills.
3. Any loose, soft or saturated sub-grade soils shall be over-excavated to firm underlying materials and replaced with compacted backfill soil or aggregate base (95% maximum dry density).
4. The surface soil shall be scarified to a minimum depth of 12 inches below ground surface or to resistant rock.
5. The soil to construct fill shall be uniformly moisture conditioned to within about 2% of ASTM D157 optimum moisture content.
6. Fill shall be placed in maximum 8-inch loose horizontal lifts prior to compacting.
7. The soil shall be compacted to achieve a minimum relative compaction of 90% based on ASTM D 1557 maximum dry density. The upper 12 inches of fill in paved areas, beneath slabs and within proposed building and tank footprints shall be compacted to a minimum of 95% relative compaction.
8. All footings shall be trenched a minimum of 12 inches into competent native soil, weathered rock or compacted fill.

3.8 ROCK EXCAVATION

- A. The Contractor is advised that subsurface conditions may vary throughout the project. Bed rock may be encountered in some areas. Boulders in excess of three feet in maximum dimension may be encountered. Excavation of rocks less than 4 foot dimension in any direction shall not be classified as rock excavation nor considered extra work. Material which can be loosened with a pick, frozen materials, soft laminated shale, and hardpan, which for convenience or economy is loosened by drilling, wedging, or the use of pneumatic tools, removal of concrete pavement and retaining walls, shall not be classified as rock excavation.
- B. The Contractor shall be compensated for rock excavation based on the unit price listed in the Bid Schedule.
1. Should the Contractor's means and methods of rock excavation require additional

excavations (i.e. widening trenches to accommodate equipment), such additional costs shall be included in the bid item for rock excavation and will not be compensated separately.

2. Where no data is available as to actual presence of rock, the quantity of rock listed in the estimate is intended only as an allowance for bid purposes in the event that random rock is encountered.
3. The volume of rock in the excavation for which payment is to be made will be computed on the basis of the specified trench or excavation width and a bottom limiting plane at a level of the subgrade as shown on the applicable standard construction drawings. The upper limit for payment will be determined by one of the following methods:
 - a. The Engineer will determine a profile of rock which in his/her opinion exceeded 4' in all dimensions.
 - b. All earth and other materials capable of removal with an adequately sized excavator equipped with bucket mounted rippers shall be stripped from the upper surface of the rock and the volume will be computed by measured rock profiles.

3.9 BLASTING

- A. Blasting is not anticipated to be required for this project. However, under special circumstances due to unanticipated site conditions, blasting could be allowed.

Where approved by the District and the Engineer, the handling, transport, and usage of explosives shall be in accordance with California State General Industry Safety Orders, Group 18, and applicable local laws and regulations. Required permits shall be obtained by the Contractor and a copy furnished to the Engineer. The Contractor shall be fully responsible for any damage to the work or adjacent private property due to blasting operations. The Contractor shall also be held liable for all injury to, or death of persons caused by explosives.

Blasting shall be done with light charges and in such a manner that the material outside the prescribed neat lines will be preserved with a minimum of damage or disturbance. Whenever it is determined by the District Engineer that blasting might injure the foundation upon or against which concrete is to be placed, the District Engineer may direct that the use of explosives be discontinued and the removal of material be completed by means of pneumatic hand tools, barring or wedging. No blasting shall be done within one hundred (100) feet of any concrete which is less than seven (7) days old. The depth of holes, loading and intensity of the blasting shall be determined by the Contractor subject to the acceptance of the Engineer. Said acceptance shall in no way relieve the Contractor of his liability.

3.10 CLEAN UP

After completing all site development, the Contractor shall leave the site in a neat and clean condition, doing such finish grading as is required by the plans, or if not called for on the plans to restore the site to its finished shape and configuration. Any existing features, improvements, structures, and other facilities damaged or affected by the work

shall be replaced, repaired, or restored to their original conditions or better.

* * END OF SECTION * *

DIVISION 2 - SITE CONSTRUCTION

SECTION 02600 DRAINAGE

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Scope of work shall include furnishing and installing all drainage structures, pipes, conduits, pre-cast and cast-in-place concrete elements, connections and appurtenances as shown on the project plans and as necessary for site drainage and proper completion of the project. Precast products are specified in Section 03400 Precast Concrete. Refer also to other sections and to project plans for foundation underdrains and structure drainage systems.

1.2 RELATED WORK

- A. Section 02200 Site Preparation
- B. Section 02300 Earthwork
- C. Section 03300 Cast-in-Place Concrete
- D. Section 03400 Precast Concrete
- E. Section 15200 Pipes and Fittings

PART 2 PRODUCTS

2.1 CATCH BASINS

- A. See technical specifications in Section 03400 Precast Concrete.

2.2 DRAIN PIPE

- A. Drain pipe shall be corrugated dual walled engineered HDPE drain pipe, ADS N-12 or approved equal. Pipe shall be in the sizes and configurations as shown on the plans. Pipe shall conform to ASTM F2648 Standards.

PART 3 EXECUTION

3.1 GENERAL

- A. All drainage structures shall be installed in the location, elevation, and orientation as shown on the project plans. Drainage structures shall be installed true to lines and grades. Pipe invert elevations are critical to site drainage. Any discrepancies between the plans and field conditions shall be immediately called to the Engineer's attention and resolved prior to placing drainage structures.
- B. Drain pipe shall be placed with a uniform slope as called out on the plans with no sags nor humps permitted.

*** * END OF SECTION * ***

**SECTION 02700
BASES AND PAVEMENTS**

PART 1 GENERAL

1 SCOPE OF WORK

- A. This work includes furnishing all materials, labor, tools and equipment and installing granular, concrete, and asphaltic materials that comprise paving, surfacing for walks, roads, and yards, and appurtenances such as curbs and gutters.

2 LINES AND GRADES

- A. The Contractor shall construct all surfaced areas to lines, grades, and form as shown on the plans.

PART 2 PRODUCTS

1 AGGREGATE BASE

- A. Materials for the rock base course shall conform to the applicable requirements of Section SS-26, Class 2 Aggregate base, ¾" max., of the Caltrans Standard Specifications, latest edition (Standard Specifications) except where modified herein.

2 ASPHALTIC CONCRETE

- A. NOT USED

3 PORTLAND CEMENT CONCRETE

- A. See Division 3 Concrete for Product Specifications for Portland cement concrete.

4 ASPHALTIC EMULSION BINDER

- A. NOT USED

PART 3 EXECUTION

1 GENERAL

- A. Execution, including but not limited to all materials handling, methods of placement, compaction, use of tools, equipment, temperatures, tolerances, and all other elements of furnishing and installing aggregate bases and pavements shall conform in all ways to the provisions of the Caltrans Standard Specifications,

latest edition (Standard Specifications) except where modified herein.

2 SUBGRADE

- A. The subgrade shall conform to the depth, compaction and elevation tolerance specified for the particular surface material involved. Any unsuitable material encountered shall be removed and replaced as per Section 02300.

3 BASE

- A. After preparing the subgrade, rock base course shall be constructed to a compacted thickness as designated on the plans. Mixing of the aggregate before delivering to the work will not be required.

4 EXECUTION OF PORTLAND CEMENT CONCRETE

- A. See Division 3 Concrete. Surface finish shall be as shown on plans.
- B. Curbs and Gutters shall be of the type and dimension as shown on the plans.

* * END OF SECTION * *

**SECTION 02900
EROSION CONTROL**

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Scope of work shall include erosion control seeding, fertilizing, mulching and spreading of straw bales, wattles and silt fences on all cut and fill slopes in soil, utility trenches, or any other surface which is not going to be protected with gravel, paving, etc.
- B. No irrigation piping is required in landscaping work.

1.2 PRODUCTS

- A. **SILT FENCE** - temporary geotextile sediment barrier, entrenched into the ground and supported by posts.
- B. **STRAW WATTLES** - Straw wattles shall be made of rice straw bound in biodegradable netting into logs of 8" - 9" in diameter.
- C. **STRAW BALES** - straw bales shall be twine tied.

1.3 GRASS SEED MIXTURE

- A. A seed mixture consisting of seed with the corresponding weights shall be used:

Common Name/Botanical Name	Pounds Pure Live Seed/Acre
Idaho Bentgrass / <i>Argostis idahoensis</i>	Total application rate of 68 PLS
Blue Wildrye / <i>Elymus glaucus</i>	
California Brome / <i>Bromus carinatus</i>	

- B. The weed content shall not exceed 0.5%. Seed that has become wet, moldy or otherwise damaged prior to use will not be accepted.
- C. Contractor shall submit seed mix for approval.

1.4 FERTILIZER

- A. Fertilizer shall be furnished in original bags or other standard containers with name, weight, and guaranteed analysis of contents clearly marked thereon.
- B. Fertilizer shall be ammonium sulfate with percentages of nitrogen, phosphoric acid, and potash at 16-20-0. Fertilizers shall be uniform in composition, dry and free flowing.

PART 3 EXECUTION

3.1 GENERAL

- A. Excavated materials and imported material stockpiles shall not be placed directly on top of existing vegetation. Materials may be placed on paved areas, on sheets of fiber-reinforced plastic, or may be placed directly into trucks for removal from the site for proper disposal. To the maximum extent possible stockpiles shall be on the uphill side of trenches and excavations.

3.2 PREPARATION

- A. Contractor shall install straw wattles and silt fences where indicated on the plans.
- B. Contractor shall install perimeter dikes and swales as required.

3.3 DURING CONSTRUCTION PERIOD

- A. Install silt fences, straw wattles, and straw bales as shown on the plans and as necessary to control runoff and silt transport.
- B. Maintain silt fences, straw wattles, and straw bales: Inspect regularly; repair and replace damaged or missing erosion control elements.
- C. Do not disturb existing vegetation outside the limits of the construction zones identified on the plans.
- D. Seed and mulch as soon as areas become ready.

3.4 NEAR COMPLETION OF CONSTRUCTION

- A. Remove straw wattles and silt fences.
- B. Grade to pre-existing contours.
- C. Mulch, fertilize, and apply grass seed mixture.

3.5 SEED AND FERTILIZER MIXING AND APPLICATION

- A. Quantity of pure live seed (PLS) = (lbs. seed) x (purity) x (germination)
- B. All seed shall be mixed at the project site.
- C. The erosion control materials shall be mixed in the following proportions:

Material	Application Rate (lbs/acre)
Fiber	1600
Seed	68
Commercial Fertilizer	400

- D. The materials shall be mixed and applied in one application. The mixture shall be applied within 60 minutes after the seed has been added to the mixture.
- E. The soil shall be prepared before seeding. The Contractor shall prepare only enough ground that can be placed within 24 hours thereafter.
- F. Seeding shall be spread uniformly at the rates specified above.
- G. Seeding shall be accomplished between August 15 and October 15 unless otherwise permitted in writing by Engineer.

3.6 CLEANUP

- A. After completing all erosion control, the Contractor shall leave the site in a neat and clean condition, doing such surface finishing as is required by the plans, or if not called for on the plans to restore the site to its finished shape and configuration.

* * END OF SECTION * *

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. This section covers all plain and reinforced concrete for the project and comprises the requirements for all materials, labor, tools and equipment needed for mixing, placing and curing the concrete. This section describes the requirements for concrete including, but not limited to, materials to be used, forms and details of construction, workmanship, and measurement and payment. This section describes inserts into cast-in-place concrete work.

1.2 DESCRIPTION OF WORK

- A. Work under this section shall include, but not be limited to, furnishing and placing all materials for mass concrete and reinforced concrete, reinforcing steel and supports, expansion joint fillers, water-stops, floor hardener, bonding agents, packing and non-shrink grout, epoxy anchors; constructing and removing form work, measuring, mixing and transporting concrete; placing, conveying, and vibrating concrete; installing construction and expansion joints, removing the forms, curing and protecting the concrete, finishing the concrete; placing concrete fillets, topping and equipment pads; and testing for quality and water-tightness.

1.3 SUBMITTALS

- A. Submittals supplied by the Contractor include: samples and catalog data of materials used, a written description of the proposed forming methods, reinforcing steel shop drawings, and concrete mix design(s).
- B. The Contractor shall submit and receive approval of the proposed concrete mix design prior to pouring concrete, a copy of all load slips, and catalog information on all additives shall be included.

1.4 STORAGE

- A. Cement and aggregates to be used for concrete mixed on the job site shall be stored in such a manner as to prevent deterioration of their quality or intrusion of foreign matter. Reinforcing steel shall be stored on pallets, off the ground, and kept free of dirt and oils. All other materials, except forms, shall be stored in dry, clean containers. Any materials which have been deteriorated or damaged shall not be used and shall be removed from the job site.

1.5 LINES, GRADES AND TOLERANCES

- A. Offset lines or coordinates, and grades shall be established for the Contractor, as

necessary, for accurate location of concrete structures, all as described in the Special Conditions of this Contract. The Contractor shall, at his own expense and responsibility, transfer offset lines and coordinates, and grade and set batter boards and string lines, and make all necessary measurements and sightings, all from the construction staking provided, and all as necessary to accurately place the structures.

- B. Tolerances in any dimension shall be not more than 1/4 inch in 10 feet.

1.6 INSPECTION

- A. The Contractor shall make all material stock piles available for inspection by the Engineer. Plants used to produce ready mix concrete shall be subject to periodic inspection by the Engineer. The Contractor shall make available, for testing purposes, samples of all materials and samples of the concrete being placed.

Each phase of work shall pass inspection by the Engineer before commencing work on the next phase. The phases shall consist of, but not be limited to excavation, construction of forms, placing reinforcing steel and inserts, prior to placing concrete, placing concrete, grouting, installing anchors, finishing concrete, backfilling, and testing.

PART 2 PRODUCTS

2.1 GENERAL

- A. Materials furnished for concrete and reinforced concrete shall include, but not be limited to, concrete and its constituents, reinforcing steel and supports, expansion joint filler, water-stops, floor hardeners, curing aids, bonding agents, patching grout, non-shrink grout, and epoxy anchors.

2.2 CONCRETE

The materials furnished for concrete shall include, but not be limited to, Portland cement, water, coarse and fine aggregates, fly ash, and admixtures.

- A. Portland Cement - Portland Cement shall be Type II Modified conforming to Type II cement, as specified in ASTM C150.
- B. Water - Water for washing aggregates and for mixing and curing concrete shall be clean, free from oil, acid, alkalies, vegetable matter, or other deleterious substances.
- C. Coarse Aggregate - The coarse aggregate shall consist of clean, hard, dense, tough and durable natural gravel, crushed gravel, or crushed rock. It shall be free from oil, organic matter or other deleterious substances and shall conform to ASTM C33.
- D. Fine Aggregate - Fine aggregate shall consist of hard, durable, un-coated natural

sand or other approved material. It shall be free from oil or other deleterious substances.

- E. Fly Ash - Fly ash shall conform to ASTM A618, Class F or N, except that the loss on ignition shall be limited to 1%.
- F. Admixtures - Water-reducing agents such as Pozzoloth, WRDA, or equal shall be used in all concrete. The admixture shall conform to ASTM Specifications C494. Proportioning and mixing shall be as recommended by the manufacturer. Admixtures causing accelerated setting of cement in concrete shall not be used. Air-entraining admixtures compatible with the concrete mix shall be used, as required, as a moderate addition to the water-reducing agent, to obtain the specified percent air in the resultant concrete. The Contractor shall submit data verifying that the admixtures are compatible with the mix. Air-entraining admixture shall conform to ASTM Specification C260.

2 REINFORCEMENT

- A. Steel Bars - All steel bars shall have a deformed surface and shall conform to ASTM A615, including Supplementary Requirement S1, Grade 60, free from dirt, rust, scale, oil, and frost. No. 3 bars may be Grade 40.
- B. Epoxy-Coated Steel Bars - Where shown on the plans, bars shall be epoxy coated in conformance with ASTM A775, Section 2.02A.
- C. Welded Wire Fabric - Welded wire fabric shall be of gauge and mesh size shown on the plans and shall meet the requirements of ASTM A185 or ASTM A497 for smooth wire fabric. Wire fabric shall be free from dirt, rust, scale, oil, and frost.

3 REINFORCING SUPPORTS

- A. Reinforcement supported from form work shall rest on Class E (stainless steel protected) bar supports, as specified in "Manual of Standard Practice" by the Concrete Reinforcing Steel Institute (CRSI).
- B. Reinforcement supported from the ground shall rest on 3-inch-high precast concrete blocks not less than 4 inches square.
- C. Epoxy-coated reinforcing bars supported from form work shall rest on coated wire bar supports, or on bar supports made of dielectric materials or other acceptable materials. Wire bar supports shall be coated with dielectric material, compatible with concrete, for a minimum distance of 2 inches from the point of contact with the epoxy-coated reinforcing bars. Reinforcing bars used as support bars shall be epoxy-coated.

4 EXPANSION JOINT FILLER

- A. Filler for expansion joints shall be 1/2 inch thick pre-molded type conforming to

ASTM D1751.

5 WATER-STOPS

- A. Water-stops shall be neoprene or PVC conforming to Standard Specifications paragraph 51-1.14. Water-stops shall be of the size and type shown on the plans and shall have a hollow bulb in the center.

6 FLOOR HARDENER

- A. Compounds used for floor hardener shall be Lapidolith, non-metallic consisting of quartz aggregate, dispersing agent and Portland cement. The hardener shall be manufactured, not field mixed, and compatible with the curing method used.

7 CURING AIDS

- A. Aids for curing concrete shall be either a cover or applied spray. Covers shall be white or reflective 4-mil polyethylene, or moist burlap or rugs. Spray-applied curing compounds shall be white-pigment membrane type conforming to ASTM C309.

8 BONDING AGENT

- A. Agents used for bonding concrete fillets, topping slabs, equipment pads, or similar applications, shall be Concessive 1001-LPL, or approved equal.

9 PATCHING GROUT

- A. Grout used for patching small surface blemishes shall consist of neat Portland cement, water, and fine sand passing a No. 30 mesh sieve with an approved acrylic modifier.

10 NON-SHRINK GROUT

- A. Non-shrink grout shall be Masterflow 713 by Master Builders Co., or approved equal.

11 EPOXY ANCHORS

- A. Compounds used for poured epoxy-grouted anchors shall be Concessive Epoxy Adhesives, or approved equal. The type used for each application, as shown on the plans, shall be as recommended by the manufacturer.
- B. Systems used for injected epoxy for anchors shall be HVA adhesive anchors by HILTI Fastening Systems, or approved equal.

PART 3 EXECUTION

1 FORMING SYSTEMS

- A. The forming system used by the Contractor shall allow for proper sequencing of the work and removal of the forms without damage to the concrete. Form systems may be lumber, prefabricated wood panels, metal, or plastic-lined panels, all sound and free from any defects that will mar or detract from the surface of the finished concrete. The forms shall be treated with a nonstaining material to eliminate absorption of water and to act as a form release agent.
- B. Walls and footings below existing and final grades may use earth trench walls as forms, provided the widths shown on the plans shall be increased two (2) inches, if approved after inspection of the trenches, provided the sides are clean, even, vertical, true, and further provided the bottoms are level, clean, and without fill.

2 REINFORCEMENT

- A. The requirements for placing reinforcement shall include, but not be limited to, furnishing submittals, bending, storage and protection, placement, splicing and minimum concrete cover.
- B. Prior to starting shop fabrication or field placement, the Contractor shall submit and receive approval of reinforcing steel shop drawings. The drawings shall comply with the requirements of ACI 318, detailed in accordance with ACI SP66, and adapted to the proposed placement schedule, showing size, dimension, bending, placing, and construction joint details and placement. The Contractor shall also submit the type, size, and location of all wire and bar supports.
- C. Bending of the reinforcing steel shall be in accordance with the Concrete Reinforcing Steel Institute, Manual of Standard Practice, Chapter 7.
- D. Reinforcing steel shall be stored off the ground and protected from oil, or other deleterious materials. Epoxy-coated reinforcing bars shall be stored on protective wood cribbing.
- E. Placement
 - 1. All reinforcing bars shall be accurately cut, bent and placed as shown on the drawings; they shall be securely tied at all intersections, and shall be firmly supported in the proper locations so that placing of concrete will not cause displacement of the reinforcing, all in conformance with Concrete Reinforcement Steel Institute, Manual of Standard Practice, Chapter 8.
 - 2. Horizontal wall bars in double layer walls shall be staggered.
 - 3. In walls reinforced with epoxy-coated bars, spreader bars where required, shall be epoxy-coated. Proprietary combination barclips and spreaders used in walls with epoxy-coated reinforcing bars shall be made of corrosion-resistant material or coated with dielectric material. Epoxy-coated reinforcing bars shall be tied with plastic-, epoxy-, or nylon-coated tie wire, or other acceptable materials.
 - 4. Splices shall be placed as shown on the plans. For any splices not shown, the bars shall be overlapped a minimum of 30-bar diameters. Splices in adjacent bars shall

be staggered a minimum of 5 foot center to center. All laps forming splices shall be securely wired.

5. All reinforcement shall have proper concrete cover thickness as per the Concrete Reinforcing Steel Institute Manual of Practice. In all cases, the thickness of concrete over the reinforcement shall be not less than one and one-half times the bar diameter.

3 CONCRETE MIX

- A. Concrete shall consist of Portland cement, fine aggregate, coarse aggregate, a water reducing agent, an air-entraining agent, pre-approved additives, and water, all of which shall conform to CALTRANS Section 90 and these specifications.
- B. Concrete shall meet the minimum compressive strength or concrete class as shown on the plans. Concrete that is not assigned a minimum compressive strength or class on the plans shall comply with the minimum compressive strength or class using the types of uses described in this subsection. The allowable slump, maximum water-cement ratio, and air entrainment shall also comply with the following table:

TYPE OF USE	CLASS	(1) MINIMUM COMPRESS. STRENGTH (psi)	SLUMP (inches)	(2) MAXIMUM WATER- CEMENT RATIO	(3) ENTRAINED AIR REQUIRED*
<u>Liquid Containing Structures:</u>					
Slabs & Footings	A	3500	2 to 3	0.45	5½% ±1%
Vertical Wall Sections & Columns	A	3500	3 to 4	0.45	5½% ±1%
Mass concrete & Unformed Slopes	A	3500	1 to 2	0.45	5½% ±1%
<u>Other Structural Concrete</u>					
Slabs & Footings	A	3000	2 to 3	0.45	-----
Vertical Wall Sections & columns	A	3000	3 to 4	0.45	-----
<u>Curbs, Gutters, & Sidwalks</u>	B	2500	3 to 4	0.55	-----
<u>Thrust Blocks & Concrete Fill</u>	C	2000	3 to 4	0.60	-----

- (1) Minimum compressive strength to be attained at 28 days.
- (2) Maximum water/cement ratio by weight.
- (3) Based on 1½" maximum aggregate size. Where 1" maximum aggregate size is used, increase entrained air by ½%.

- C. Concrete shall contain the following minimum amount of Portland cement per cubic yard:

Class A	564 pounds
Class B	470 pounds
Class C	376 pounds

- D. The Contractor may, at his option, substitute up to 15 percent by weight of fly ash for the Portland Cement required herein.
- E. Grading shall be as set forth in CALTRANS Section 90. In addition, the maximum size aggregate shall be no larger than one-fifth of the narrowest distance between forms, nor larger than three-quarters of the minimum clear spacing between reinforcing bars. The maximum size aggregate grading shall be 1½inch.
- F. All concrete shall be machine mixed at the site, or delivered to the site by transit mixers. No concrete shall be placed in the work after it has begun to set. If transmit mix is used, the rate of delivery, haul time, mixing time and hopper capacity shall be such that all mixed concrete delivered shall be placed in the forms within one hour from the time of introduction of cement and water to the mixer. All concrete shall be kept continuously agitated until discharged in the hopper at the job site. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C94 and Chapter 7 of ACI 301. Plant equipment and facilities shall conform to the "Check List for Certification of Ready Mixed Concrete Production Facilities" of the National Ready Mixed Concrete Association.

4 CONCRETE PLACING

- A. Before placing concrete, all form work and reinforcing shall be cleaned of dirt and construction debris, water, rust, scale, frost or other coatings deleterious to the bond, then securely and properly fastened in its correct position, forms at construction joints re-tightened, and all bucks, sleeves, hangers, pipes, conduits, bolts, wires, etc., installed. No concrete shall be placed before the forms, reinforcing steel and all work that is to be embedded have been set, observed and approved by the Engineer. Excavations shall be kept free from water while concrete is being placed, cured and finished therein. Footing, slab and sub-grade soils must be moisture conditioned to between 75 and 90% of saturation to a depth of 24 inches a minimum of 24 hours before concrete placement. Soil shall be wetted prior to concrete placement to reduce the risk of problems caused by wicking of moisture from curing concrete. Fresh concrete shall be protected at all times from running water.
- B. Concrete shall be conveyed from the mixer to the place of final deposit as rapidly as practicable by methods which will prevent the separation or loss of the materials. The concrete shall be deposited in the forms as nearly as practicable in its final position to avoid re-handling and the use of vibrators for extensive shifting of the mass of fresh concrete will not be permitted. Fresh concrete shall not be permitted to fall from a height greater than 4 feet without the use of adjustable length pipes, tubes or double belting placed to prevent segregation of

the concrete. Mixed concrete, after being deposited, shall be consolidated until all voids are filled and free mortar appears on the surface.

- C. In vertical sections, concrete shall be deposited continuously in horizontal layers of 24 inches maximum depth so as to maintain a horizontal plastic surface until the completion of the unit. No concrete shall be deposited on concrete which has hardened sufficiently to cause the formation of seams and planes of weakness within the section.
- D. Concrete for horizontal members or sections shall not be placed until the concrete in the supporting vertical members or sections is no longer plastic and has been in place at least two hours. In all slabs, concrete shall be deposited in a continuous or monolithic operation to the full thickness of the slab. Each batch shall be dumped against previously placed concrete and not away from it, and shall not be dumped in separate piles and then worked together.
- E. The concrete in each integral part of the structure shall be placed continuously, and work will not be allowed to commence on any such part unless sufficiently inspected and approved material for the concrete is on hand, and forces and equipment are sufficient to complete the part without interruption in the placing of the concrete.
- F. With the exception of concrete placed as slope paving and aprons, and concrete placed under water (where approved), all concrete shall be consolidated by means of high frequency internal vibrators within 15 minutes after it is deposited in the forms. The vibrators shall not be attached to or held against the forms or the reinforcing steel. Vibrating shall be done with care and in such manner so as not to displace forms, reinforcement, ducts, and embedded items.

5 COLD WEATHER CONCRETE WORK

- A. Concrete shall not be mixed or placed while the atmospheric temperature surrounding the work is at or below 35 degrees F, or is expected to be at or below 35 degrees F, within 24 hours. Concrete work may be carried on during cold weather, but only with the express permission of the Engineer after approval of a plan of operation. Precautions shall be taken to see that the concrete is properly protected after pouring and during the cure period. In general, the requirements of the CALTRANS Section 90 in this regard will apply.

6 HOT WEATHER CONCRETE WORK

- A. During hot weather, proper attention shall be given to ingredients, production methods, handling, placing, protection, and curing to prevent excessive concrete temperatures or water evaporation which will impair the required strength or serviceability of the member or structure.

7 CONSTRUCTION JOINTS

- A. The Contractor shall obtain approval for joints not shown and locate them where they least impair the strength of the structure. Unless otherwise shown on the drawings, joints in walls and columns shall be at the underside of floors, slabs or grade beams, and at the top of footings or floor slabs. Place grade beams at the same time as slabs. At least two hours shall elapse after depositing concrete in columns or walls before depositing concrete in supported grade beams or slabs. As the new concrete is placed, re-vibration in tops of columns and walls is desirable.
- B. Make construction joints perpendicular to the main reinforcement.
- C. All horizontal construction joints in walls shall have a continuous wood screed strip at the outer face of the joint to form a true line. Screeds shall be removed and the joint thoroughly cleaned out before pouring the next portion of wall.
- D. Reinforcing steel and mesh shall continue across construction joints. Exposed reinforcing steel shall be cleaned of all concrete and other unsuitable coatings.
- E. Construction joints shall be made rough by chipping the entire surface, sandblasting with coarse silica sand, or hosing the surface 4 to 6 hours after the pour with a fine spray, exposing solidly embedded clean aggregate. Forms shall be scraped and cleaned of drippings, debris, etc., and dusted by means of compressed air. Surfaces of the hardened concrete shall be cleaned to the satisfaction of the Engineer and wetted as required before placing of new concrete. Just before starting the new pour, all free water shall be removed and the horizontal surfaces shall be covered with at least 4 inch thickness of concrete composed of cement and fine aggregate, omitting the coarse aggregate. Cement content of such mortar shall be increased to at least 7½ sacks per cubic yard, but not less than the approved concrete design mix.

8 EXPANSION JOINTS

- A. Install expansion joint fillers to within ½ inch below top of slab levels.
- B. Where shown, load transfer dowels shall consist of plain bars with one-half coated with an approved anti-bond coating. The coated half shall be sleeved. No other reinforcement or metal shall extend continuously through expansion joint.

9 WATERSTOPS

- A. The design and location of waterstops shall be as shown on the plans. Each piece of premolded waterstop shall be of maximum practicable length to minimize the number of end joints. Embed center bulb in the center of the joint.
- B. All joints in waterstops including but not limited to, intersections and end to end joints, shall be joined following the manufacturer's instructions. Joints shall develop effective watertightness fully equal to that of the continuous waterstop material and shall develop not less than 50 percent of the mechanical strength of

the parent section. Do not lap sections of waterstop. All joints shall be butt spliced using a heat-sealing method and in conformance with the manufacturer's instructions.

- C. Support waterstops securely against displacement by wire tie between the last rib and the end of the waterstop, or use a method specifically recommended by the manufacturer.
- D. If the joint is not watertight after construction, the joint shall be grouted by drilling grout holes to the center of the structure unit and force epoxy grout into the joint under pressure. This shall be repeated until the leak has stopped completely.

10 NON-SHRINK GROUT

- A. Use non-shrink grout to fill voids around embedded items, at locations shown on the plans, and as directed by the Engineer. Grout shall be mixed and used in accordance with manufacturer's recommendations. Exposed surfaces and edges shall be smooth, straight, even, and finished with a steel trowel.

11 EPOXY ANCHORS

- A. These anchors shall be installed in strict conformance to the manufacturer's printed instructions. Embedded reinforcing bars shall not be damaged when drilling holes for these anchors.

12 OTHER EMBEDDED ITEMS

- A. Prior to placing concrete, all required sleeves, inserts, anchor bolts and embedded items shall be in place. Give all trades whose work is related to the concrete ample notice and opportunity to introduce embedded items before concrete is placed.
- B. Position embedded items accurately and support them against displacement. Fill voids in sleeves, inserts, and anchor slots temporarily with readily removable material to prevent the entry of concrete.
- C. Anchor bolts placed in slabs, equipment pads, top of walls and similar installations, shall be held firmly in place by a plywood or similar type template to ensure accurate placement.

13 FORM REMOVAL

- A. When approved for removal, the forms shall be removed carefully to insure complete safety of the structure. For all portions of a structure supported by forms and shoring, the forms shall remain in place for a minimum of 10 days. Beam sides, columns, or other vertical forms may be removed after 24 hours, providing the concrete will not be injured and a curing method has been approved.

Do not remove supporting forms or shoring until effected members have acquired sufficient strength to safely support their weight and imposed loads. The Contractor shall assume full responsibility for safe removal of the forms.

14 CURING AND PROTECTING

The Contractor shall begin to protect the concrete immediately after placement from drying, excessively hot and cold temperatures, and mechanical injury. Measures shall be taken to keep moisture loss to a minimum until the cement has hydrated and the concrete is hard, but not less than seven days.

- A. CURING - For formed surfaces, keep the forms wet. Cool metal forms exposed to sun with water. Forms shall remain in place for seven days for curing purposes unless an approved curing compound, water cure process, or waterproof membrane is used, as specified below.
 - 1. For surfaces not formed or formed surfaces whose forms have been removed prior to the seven day requirement, immediately apply a curing compound, water cure, or waterproof membrane. The Contractor shall consult with the Engineer and receive approval of the curing method prior to placing the concrete.
 - 2. If approved for use, curing compound shall be applied to the concrete following the surface finishing operation immediately after the moisture sheen disappears from the surface, but before any drying shrinkage or craze cracks begin to appear. Water curing shall keep the surfaces of the concrete wet for a period of seven (7) consecutive days by covering with water-saturated material kept wet by means of a system of perforated pipes, mechanical sprinklers, or porous hose, or by any approved methods which will keep all surfaces to be cured continuously (not periodically) wet.
 - 3. Waterproof membrane curing shall be accomplished by first wetting the concrete surface with water using a nozzle that atomizes the flow into a mist, not a spray, until the concrete has set, then covering the concrete with a waterproof membrane. The waterproof membrane shall be a white or silver reflective material. All joints in the membrane shall be securely cemented together to provide a waterproof joint. The membrane shall remain in place for a minimum of 72 hours after being placed.
- B. PROTECTING
 - 1. During curing period, the Contractor shall protect concrete from mechanical damage, loading, shock and vibration.
 - 2. In cold weather, while curing proceeds, the Contractor shall maintain the moisture conditions, and shall maintain the temperature of the concrete between 50 degrees F and 70 degrees F for entire curing period by either heating or covering, or both.
 - 3. In hot weather, the Contractor shall take immediate steps to protect newly finished concrete from drying effects of wind and sun, and maintain temperature of the air surrounding the concrete uniform within 5 degrees F in any one hour or 50 degrees F in any 24 hour period

15 FINISHING

- A. All concrete surfaces, including precast vaults, shall be finished as shown on the plan or as follows.
 - 1. Backfilled, buried and covered surfaces shall be repaired as necessary. Repairing shall consist of cleaning, filling holes or depressions, repairing rock pockets and honeycombed areas, removing fins, bulges, offsets, and stains, and repairing any other defects. Patching mortar used in repair shall contain enough silica sand and white cement to result in a patch which, when cured, will match the surrounding concrete
 - 2. All formed concrete surfaces, including vaults, that are to remain exposed in the final product shall be formed, repaired and dressed to a level 6" below final grade. Dressing shall be as follows: All formed concrete surfaces that require final dressing shall receive a coat of mortar. The area shall be cleaned thoroughly and dampened. The dressing mortar shall be a mixture of one part Portland cement and two parts clean silica sand with enough water to form a loose paste. The dressing mortar shall be applied with a float having a resilient rubber surface. The dressing process shall create a smooth, uniform surface, both in texture and color. After taking its initial cure, the dressing mortar shall be kept damp for 48 hours. Surfaces shall be dressed prior to installing any conduits, pipe, ducts, or equipment that would interfere with the dressing process.
 - 3. Exterior slabs and walkways shall be screeded, floated and broomed. Brooming shall be perpendicular to the direction of traffic if applicable. Sidewalks and outside slabs shall be marked and scribed into rectangles of not less than 12 square feet nor more than 20 square feet with a scoring tool which will leave the edges rounded. All sidewalk and outside slab edges shall be tooled to a rounded edge.
 - 4. All inside floors, such as areas inside treatment plants, pumping plants; and tank floors, topping slabs, and equipment pads shall be screeded, floated and troweled.
- B. All exposed horizontal and vertical edges or other corners, both interior and exterior of structures, shall be chamfered 3/4 inch minimum, measured on the sides, not hypotenuse. If shown on the plans, larger chamfers shall be used for specific corners or structures.

16 CONCRETE EQUIPMENT PADS

- A. Equipment pads shall be placed over a bonding agent as soon as possible after completion of the curing period of the concrete. Contact surfaces shall be thoroughly cleaned to the degree recommended by the bonding agent manufacturer.
- B. The bonding agent shall be accurately and thoroughly mixed and applied at the manufacturer's recommended coverage rate. Mix only the amount which can be used prior to expiration of the pot life. Concrete shall be immediately placed over the fresh bonding agent before the surface takes an initial set, all as recommended by the manufacturer. Bonding agent which sets up prior to placing concrete shall be removed and a fresh coat of bonding agent applied prior to placing concrete.

- C. Concrete fillets, topping slabs, and equipment pads shall be accurately screeded to the slopes and elevations shown on the plans. Cure the concrete as specified for slabs above. Set equipment anchor bolts in pad to accommodate equipment furnished. Finish fillets the same as adjacent surfaces. Finish topping slabs and equipment pads as shown on the plans, or as specified herein.

17 QUALITY TESTING

- A. Quality testing shall be done at the Owner's expense, unless otherwise specified in the Special Conditions of this Contract. If the Contractor is required to arrange for testing, it shall be done by a certified testing laboratory and all test results shall be forwarded immediately to the Engineer. The Contractor shall cooperate with and provide any equipment or manpower necessary to assist the Engineer in testing the concrete.
- B. The Contractor may, at any time, and at his own expense, perform additional testing for purposes of quality control and shall not depend on testing by other parties for such purposes. The Contractor shall, at his own expense, perform any tests necessary to acquire the strength of the concrete for the purpose of, and shall be solely responsible for, form removal and safety of the structure.
- C. Prior to placing the concrete, each load or batch shall be tested for proper slump and air entrainment. The samples shall be taken in accordance with ASTM C 172. Slump test shall be as per ASTM C143 and air test as per ASTM C 231 or 173.
- D. The acceptable strength of concrete shall be based on compressive test specimens taken and cured in accordance with ASTM C31. A minimum of three specimens shall be taken from every 20 cubic yards of concrete placed or for each major placement during the day. The Engineer shall determine the number of specimens to be taken as he deems necessary to ensure the concrete meets the specifications. The compressive tests shall be in accordance with ASTM C39. The standard compressive test shall be 28 days.

18 WATER-TIGHTNESS

- A. Water-tightness testing shall be done at the expense of the Contractor.
- B. All concrete structures and channels which will later be subjected to hydrostatic pressure shall be tested for water-tightness. The tests shall be made prior to application of waterproof coating, if required. Testing shall consist of filling the structure with clean water to a level of 6 inches below the top. Cells adjacent to the cell being tested shall be empty and dry. Water shall be allowed to stabilize for 12 hours, refilled, then the water level shall be measured at the beginning, middle, and end of a 24-hour test period. Allowable leakage shall not exceed 1/2 percent of the contents. The Contractor shall repair any visible leaks and shall correct the cause of any test failures. The repair procedure shall be submitted to the Engineer for approval. After repairs are made, the Engineer may require

retesting of structures and/or channels which have been repaired.

19 BACKFILL

- A. Backfill around structures shall not begin until the concrete has reached sufficient strength, as determined by the Contractor, but not earlier than 7 days after the pour. All forms shall be removed, all repairs made, and all concrete shall pass inspection prior to beginning the backfill operation. The type of backfill shall be as shown on the plans.

* * END OF SECTION * *

**SECTION 03400
PRECAST CONCRETE**

PART 1 GENERAL

1.01 DESCRIPTION

- A. Scope:
Miscellaneous precast vaults per Drawings

- B. Additional Requirements Specified Elsewhere:
 - 1. Quality Control: Section 01400
 - 2. Submittals: Section 01600

1.02 QUALITY ASSURANCE

- A. Acceptable Manufacturers:
 - 1. Precast vaults:
 - a. Santa Rosa
 - b. Utility Vault
 - c. Christy
 - d. Mid-State Concrete Products
 - e. Jensen Precast
 - f. Or equal

- B. Reference Standards:
 - 1. ACI 318: Building Code Requirements for Reinforced Concrete
 - 2. PCI MNL-116: Manual for Quality Control for Plants and Production of Precast Prestressed Concrete Products
 - 3. Uniform Plumbing Code: UPC-91

1.03 SUBMITTALS

- A. Shop Drawings and Product Data:
 - 1. Design calculations with pertinent tables, charts, and definitions
 - 2. Analysis of sections where concentrated loads are applied and where boxouts are provided
 - 3. Complete layout, fabrication, and installation Drawings showing inserts and embedments
 - 4. Limitations of field cutting and modification
 - 5. If requested by Engineer, information on plant capability, productivity, certification, and details of manufacturing equipment and procedures

- B. Test Reports:
 - 1. Certified reports covering source and quality of materials
 - 2. Certified reports of compressive strength of each design mix

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Delivery and Handling:

1. Transport and handle precast concrete units with equipment to protect from dirt and damage
2. Do not place units in positions that cause overstress, warp, or twist
3. Handle by means of lifting inserts
4. Do not move from manufacturer's yard until curing is complete

B. Storage:

1. Store units off ground
2. Place stored units so that identification marks are discernible
3. Separate stacked members by battens across full width of each bearing point
4. Stack so that lifting devices are accessible and undamaged
5. Do not use upper member of stacked tier as storage area for shorter members of heavy equipment

PART 2 - PRODUCTS

2.01 MATERIALS

A. Reinforcement:

1. Prestressing strand: ASTM A416
2. Reinforcing steel: ASTM A615

B. Concrete:

1. Minimum compressive strength: 3,000 psi at 28 days
2. Cement: ASTM C150
 - a. Vaults: Type I or Type III
 - b. Interceptor and septic holding tank: Type II
3. Aggregate: ASTM C33 or C330

C. Water: Clean and free of deleterious substances

D. Accessories:

1. Bearing pads: Teflon
2. Expansion joint filler: ASTM D1752, Type I, preformed sponge rubber
3. Steel plates and shapes: ASTM A36

E. Valve Boxes

1. Christy, Model G5 or approved equal.

2.02 FABRICATION AND MANUFACTURE

A. General:

1. Use rigid, adequately braced equipment free from dents, gouges, or other irregularities that would impair quality, appearance, or performance
2. Methods and equipment in conformance with generally accepted standards for the industry
3. Manufactured by experienced manufacturer's
4. Casting surfaces: Level and free form imperfections

5. Apply parting compound to form work

6. Concrete:
 - a. Prevent segregation of materials
 - b. Continuously vibrate during casting
7. Reinforcing steel:
 - a. Maintain in proper location during casting
 - b. Cover: 3/4 inch minimum
8. Embedded items:
 - a. Locate accurately
 - b. Maintain in proper location during casting
 - c. Sufficient anchorage and embedment for design requirements

- B. Curing:
 1. Steam cured for 12 hours or fog spraying
 2. Do not remove from molds for 12 hours minimum or attainment of 3,000 psi compressive strength
 3. After removal of forms, continue curing until concrete attains specified strength
 4. Curing: Consistent and uniform for all precast elements for this project

- C. Release of Tension: Do not release pretensioning stress until the concrete has reached a compressive strength of 3,000 psi

- D. Embedded Accessories:
 1. Install plates, inserts, anchors, and other items required to be embedded at the time of manufacture
 2. Accurately position embedments in forms and fix rigidly in place
 3. Install bearing plates in exact and true position
 4. Provide lifting loops or similar devices to facilitate handling

- E. Holes and Openings:
 1. Incorporate holes and openings for items indicated on Drawings
 2. Carefully review Drawings for holes and inserts required by workers of all trades and include all that are beyond the limitations of field modification
 3. Provide saddles, headers, or other suitable supports required for the size and location of the openings

- F. Ends of Strands:
 1. Cut flush with concrete
 2. Coat or finish to prevent rusting

- G. Surface Finish:
 1. Float-finish top surfaces
 2. Formed surfaces to be uniform in color and texture
 3. Remove all fins and projections and repair all holes and other surface defects to Engineer's satisfaction
 4. Power-grind repaired areas, or areas from which fins and projections have been

removed, that will be exposed to view as required for a uniform finish

H. Shop Marking:

1. Paint or label each member in an area not to be finally exposed
2. Indicate location and position in structure in accordance with manufacturer's layout Drawings

PART 3 - EXECUTION

3.01 INSTALLATION

A. General:

1. Precast concrete units shall be installed true to the lines and grades as shown on the plans. Connections to piping shall be made with an approved water tight grout or other method as indicated on the Plans. Contractor shall install compacted and level sand or gravel bedding under precast concrete products as per the manufacturer's recommendations for each unit. Methods indicated on the drawing or specified by the manufacturer shall govern over these specifications.

* * END OF SECTION * *

**SECTION 06100
CARPENTRY**

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. This section includes specifications for minor carpentry associated with construction of the treatment building and treatment system improvements. It includes minor carpentry only.

1.2 RELATED WORK

- A. Work in this section is related to:
 - Section 03300 Cast in Place Concrete
 - Section 09000 Painting and Coatings.
 - Section 10200 Louvers and Vents
 - Division 16 Electrical and Instrumentation

1.3 STANDARDS

- A. All work under this section shall conform to the following applicable codes and standards:
 - 1. California Uniform Building Code and all standards referenced therein, as most recently adopted by Sierra County.
 - 2. 2010 California Uniform Electrical Code, 2010 California Uniform Plumbing Code, 2010 California Uniform Mechanical Code and 2010 California Uniform Fire Code.
 - 3. American Society for Testing and Materials (ASTM):
 - 4. American Wood Preservers Association (AWPA):
- B. Preservative and Pressure-Treatment Standards.
 - 1. Environmental Protection Agency (EPA).
 - 2. Federal Specifications (FS):
- C. Standards for Individual Products as noted.
 - 1. Lumber grading rules and species:
 - a. National Forest Products Association (NFoPA).
 - b. U. S. Department of Commerce, National Institute of Standards and Technology (NIST):
 - c. Product Standard PS20, American Softwood Lumber Standard.
 - d. Southern Forest Products Association (SFPA).
 - 2. Southern Pine Inspection Bureau (SPIB).
 - a. Western Wood Products Association (WWPA).
 - 3. Plywood grading rules and recommendations:
 - a. American Plywood Association (APA).
 - 4. American Wood Preservers Institute (AWPI):
 - 5. Standards for Fire-Hazard Classification for Fire-Retardant Treated Material.

6. American National Standard Institute/Hardwood Plywood and Veneer Association (ANSI/HPVA):
 7. For hardwood plywood: ANSI/HPVA HP-1, Hardwood and Decorative Plywood.
 8. U. S. Department of Commerce, National Institute of Standards and Technology (NIST):
 9. For softwood plywood: Product Standard PS1-83, Construction and Industrial Plywood.
 10. Underwriters Laboratories Inc. (UL) 723, UL Standard for Safety Test for Surface Burning Characteristics of Building Materials.
 11. Western Wood Preservers Institute (WWPI).
- D. All products provided under this Section shall meet the requirements of 2010 California Building Code and associated standards.
- E. Factory marking:
- a. Identify type, grade, moisture content, inspection service, producing mill, and other qualities specified.
 - b. Marking may be omitted if certificate of inspection is provided for each shipment.

1.4 SUBMITTALS

- A. Shop Drawings:
1. Engineered wood trusses.
 - a. Truss calculations for snow loads of 60 PSF consistent with current CBC standards bearing wet signature of a registered civil engineer licensed to practice in California.
 - b. Shop drawings showing truss configuration, all truss to truss connections and the locations of permanent bracing members required by the truss design.
 2. Product technical data including:
 - a. Acknowledgment that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions for all products specified.

PART 2 MATERIALS

2.1 GENERAL MATERIALS

- A. All materials shall be new unless otherwise specified or specifically allowed. Materials shall meet the following specifications unless otherwise indicated on the drawings.

2.2 LUMBER

- A. Lumber (for studs, plates, joists, blocking and all other framing) shall comply with dry size requirements of Product Standard PS 20-94
 - 1. All lumber shall be Douglas Fir No. 2 or better grade lumber.
 - 2. All lumber shall be grade stamped or certified.
 - 3. For treated lumber, provide SFPA #2 or better grade lumber.
 - 4. Provide thoroughly seasoned, well fabricated materials of longest practical lengths and sizes. Lumber shall be 19% maximum moisture content at the time of installation.
 - 5. Lumber shall be free of warp. Discard material which would impair the quality of work.

2.3 ROOF TRUSSES

- A. Roof trusses shall be prefabricated in accordance with design prepared by the manufacturer conforming to the design loads shown on the drawings and meeting other requirements of the California Building Code. Design drawings and calculations shall be submitted for approval before fabrication. The submittal shall bear the signature of a registered Civil Engineer licensed to practice in California. The manufacturer's drawings shall show all truss to truss connections and the location of permanent bracing members required by the truss design. Truss engineering shall account for the dapping of top chords to accommodate overhang sheathing support.

2.4 TRIM

- A. Trim: wood casings, wood base and other items of interior millwork and exterior trim shall be #1 Grade Douglas Fir or Cedar, kiln dried lumber as called out on the plans. Fascia board and miscellaneous exterior wood trim: Grade 1 kiln dried Doug Fir or Hem Fir. (Back-prime prior to installation.)

2.5 PLYWOOD

- A. Plywood: Plywood interior wall panels shall be APA Grade CCX, Group 1, Exterior adhesive, smooth sanded one side. Thickness shall be as indicated on drawings.
- B. Roof and exterior wall sheathing shall be plywood or OSB with thickness and ratings as indicated on the drawings.

2.6 CAULKING

- A. Caulking shall be high quality paintable elastomeric joint sealant caulk meeting ASTM C-920 Grade NS Class 25 or better.

2.7 PRESERVATIVE TREATED MATERIAL

- A. Preservative treated material:

1. Treated lumber shall conform to AWPA C-2 Standards.
 2. Treated plywood standard: AWPA C27.
 3. Use only water-borne preservative CCA or ACZA.
 4. Preservative specification: AWPA P-5
 5. Where possible, pre-cut material prior to treatment.
- B. Fascia Board and Miscellaneous Exterior Wood Trim: Kiln Dried Fir (Back-prime prior to installation).

2.8 BUILDING WRAP

- A. For each gable end of the buildings underneath the siding. Vapor barrier shall be: spunbonded polyolefin, non-woven, non-perforated, weather barrier based on Dupont™ Tyvek® Homewrap® and related assembly components. Accessories shall be seam tape Dupont™ Tyvek® Tape as distributed by Dupont Building Innovations, Fasteners, Sealants, and Adhesives as distributed by Dupont; or approved equal.

2.9 ROOF FELT

- A. Building paper shall be 30 pound asphalt saturated felt. Federal Specifications HH-F-185 Type II, Class A.

2.10 INSULATION

- A. Insulation shall be batt insulation of the R-value shown on the drawings.

2.11 ANCHORAGE AND FASTENERS

- A. Anchorage and Fastening Materials: Provide proper type, size, material and finish for each application as indicated on the drawings or as necessary for proper installation of products installed herein, in sizes, quantities and design strengths sufficient to draw and hold products and materials rigidly and permanently in place. All nails shall be hot-dipped galvanized. All bolts, nuts, washers and fasteners of every kind shall be hot dipped galvanized or stainless steel. Structural wood framing connectors shall be Simpson Strong-Tie or approved equal.

2.12 EXTERIOR SIDING

- A. Where applicable, exterior siding shall be as called out on the drawings and as specified in Section 07412 of the Technical Specifications.

2.13 ROOFING MATERIALS

- A. See Section 07412

PART 3 EXECUTION, ERECTION AND INSTALLATION

1 PREPARATION

- A. Contractor shall verify measurements, dimensions and shop drawing details before proceeding.
- B. Contractor shall coordinate with subcontractors and verify locations of furring, nailers, blocking, grounds, equipment anchors and supports, conduits, block-outs and all other related structural, mechanical, plumbing, HVAC and electrical elements of the project, and shall make accommodations for their proper installation as work progresses.
- C. Contractor shall ensure that work surfaces are free of unsuitable material, sharp projections, or irregularities that could puncture, damage, or reduce the utility of construction materials.

2 WORKMANSHIP

- A. All carpentry, framing, sheathing, roofing and painting shall be done in a workmanlike fashion, shall be true to lines and grades, and shall be neat and clean in appearance.
- B. All connections shall be made tight. Bolts shall be tightened on installation, and re-tightened prior to covering.
- C. All materials shall be clean and dry at the time of installation. No wet materials shall be incorporated into the work. No foreign material, dirt or debris shall be incorporated in the work.

3 FRAMING

- A. Erect wood framing members in accordance with the California Building Code and NDS. Contractor is responsible for the safety of the building and workers during construction shall design and provide adequate shoring and bracing during construction and shall comply with applicable safety regulations.
- B. Wood sills on concrete shall be foundation grade pressure treated lumber. Sills shall be bolted to concrete foundation with 5/8" steel bolts with a minimum embedment of 7" into concrete unless more stringent requirements are indicated on the drawings. Install a minimum of 2 bolts per section of plate, maximum spacing of 6 feet on center, with one bolt located not more than 12 inches from the end of the piece. Bolts shall have nuts and plate washers. Plate washers shall be a minimum 2" square by 3/16" thick.
- C. All stud walls shall be sized as indicated on the drawings with a standard stud spacing of 16" o.c. No splicing of studs will be permitted. All stud walls shall have a double top plate. Joints in lower top plate Accommodations be made over

a stud. All top plates shall be full width of studs and lapped at corners, and with a minimum plate lap of 4 feet.

- D. Except where more stringent construction is shown on the drawings, wood construction shall comply with CBC Chapter 23A, Division IV, conventional light frame construction provisions, as a minimum.
- E. All framing work shall be plumb and true to lines and grades. Members shall be cut and fit accurately. Connections shall be made tight and true. All nailing shall be as per California Building Code as a minimum. Wood shall be pre-drilled as necessary for bolts and connectors to prevent wood splitting. All connection hardware shall be installed with the appropriate hardware and connectors as specified by the manufacturer.
- F. No structural members shall be cut, notched, or otherwise penetrated unless specifically called for. Provide blocking, framing and supports for openings and as appropriate for support or accommodation for mechanical, electrical or HVAC equipment.

4 SHEATHING

- A. Where applicable, install wall sheathing with joints over center of girts or blocking.
- B. Provide blocking at unsupported plywood sheet edges.

5 ROOFING MATERIALS

- A. Install per manufacturer's recommendations and local building code requirements.

** END OF SECTION **

SECTION 08700

HARDWARE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Contractor shall furnish and install all finish hardware including screws, bolts, and fasteners of suitable size and strength to anchor hardware in place for heavy duty use and long life.

1.02 RELATED WORK

- A. Work in this section is related to:

1.03 STANDARDS

- A. ANSI A115 Hardware Preparation, A 123.1
- B. Hollow Metal Manufacturer's Association (HMMA) recommended standards for hollow metal doors and frames.
- C. Metals doors, frames, locks and accessories shall be manufactured and installed in accordance with the Steel Door Institute (SDI) Standards, and applicable ANSI standards and ASTM material standards as referenced by SDI.

1.04 SUBMITTALS

- A. Contractor shall provide shop drawings for door hardware including hardware locations and reinforcements, anchorage and fastening methods.
- B. Contractor shall provide a schedule of finish hardware for the doors and hardware templates for doors showing exact locations and reinforcing requirements. Hardware shall be approved prior to door and frame construction.

PART 2 MATERIALS

2.01 GENERAL

- A. All hardware shall comply with applicable fire and building codes.

2.02 HARDWARE SCHEDULE:

The following schedule of hardware represents the quality of hardware to be provided. Substitutions will be allowed but must be of similar quality and be approved through the submittal process.

1. Hinges: Heavy duty, Stainless steel, Ball bearing, Stanley or equal.
2. Lock Not Required.
3. Door Lever: Schlage S51PD-SAT commercial door lever
4. Surface Closer: Not Required
5. Floor Stop: Kick Down
6. Door Sweep: NGP 200NA
7. Threshold: Aluminum, ADA style
8. Rain Drip strip: Not Required
9. Weather Stripping: Not Required

B. Provide silencer at all doors not weather stripped.

PART 3 INSTALLATION

3.01 GENERAL

- A. The Contractor shall install finish hardware as required. The hardware shall be fitted prior to the painting and then removed and painting completed before final installation of the hardware.
- B. Finish hardware shall be neatly and properly installed and cleaned upon completion.

3.02 FABRICATION OF DOORS FOR COMPATIBILITY

- A. The Contractor shall be responsible for the proper fabrication of doors and frames to receive all approved hardware. Hardware shall be installed as per approved submittals.

3.03 WORKMANSHIP

- A. Workmanship shall be best quality. All finished doors and hardware shall conform to SDI standards. All doors shall swing freely and shall close evenly and smoothly with no rubbing nor gaps in excess of SDI tolerances. All hardware shall operate smoothly and all keys shall operate without stress or need for jiggling.

**** END OF SECTION ****

SECTION 09900

PAINTS AND COATINGS

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Provide and install coatings on all exposed surfaces, as indicated herein, and as indicated in these Specifications and on the Drawings.

1.2 RELATED WORK

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. 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 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. All products shall be stored in their original containers with the product labels intact. Products shall be unopened except when in use.
- C. Store products in a neat, orderly fashion. Protect products from damage. Protect storage

area from damage from stored products.

1.5 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: Contractor shall 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 in contact with potable water shall comply with NSF Standard 61.
- D. Coatings Manufacturer Recommendations: Coatings installer shall follow all recommendations of the coatings manufacturer regarding storage, handling, surface preparation, application of coatings, re-coat times, environmental conditions during storage, preparation and application of coatings, and all other coatings manufacturer recommendations.

1.6 WARRANTY:

- A. 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 the 1-year warranty.

PART 2 MATERIALS

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, Contractor shall submit equivalent paint systems.

COATING TYPE	DESCRIPTION	TNEMEC SERIES
Masonry Filler	Waterborne Cementitious Acrylic designed for application on porous surfaces such as rough-faced concrete masonry units.	Series 130, Envirofill
Masonry Coating	Modified Waterborne Acrylate designed for application on porous surfaces such as rough-faced concrete masonry units.	Series 156, Envirocrete
Epoxy	Polyamidoamine Epoxy designed for use on steel or other ferrous metals.	Series N69, Hi-Build Epoxoline II
Polyurethane	Aliphatic Acrylic Polyurethane designed for exterior weathering, abrasion and corrosion resistance.	Series 73, EnduraShield
Coal Tar Epoxy	Polyamide Epoxy Coal-Tar designed for corrosion resistance, one coat application for immersion and underground conditions.	Series 46H-413, High-Build Tneme-Tar
Alkyd Primer	Alkyd primer to seal wood surfaces and provide uniform surface prepared for top coat of Alkyd, Latex or Acrylic-Epoxy.	Series 36, Undercoater
Acrylic-Epoxy	Waterborn Acrylic Epoxy. Fade, stain, abrasion, chemical, moisture and UV resistant, suitable for use over Alkyd primer on wood substrate in both interior and exterior applications. Satin finish.	Series 113, H.B. Tneme-Tufcoat

2.2 COLOR

- A. Color pigments shall be 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.
- C. 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. Coating installer shall prepare all surfaces to be painted in strict accordance with coating manufacturer's recommendations. All surfaces shall be clean and dry.
- B. Ambient conditions at the time of coating shall be consistent with those conditions (temperature, humidity, etc.) as specified by the coatings system manufacturer.

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 vent openings, HVAC registers, vents, motor vents, and other areas where airflow is critical to proper operation.

3.3 APPLICATION

- A. Contractor shall ensure that all edges and grooves and surfaces of difficult access are properly coated. Some surfaces may require pre-coating prior to installation. Painting and carpentry contractors shall coordinate such that all areas of work receive adequate painting and coating as work progresses.
- B. Paint all exposed surfaces not specifically excluded in 3.03.C, below. Provide and install Coatings in accordance with the following Table:

COATINGS SYSTEMS TABLE

COATING SYSTEM NO.	SURFACE TO BE COATED	PRIMER COATING	NO. OF PRIMER COATS	PRIMER COAT THICKNESS (EACH COAT)	FINISH COATING	NO. OF FINISH COATS	FINISH COAT THICKNESS (EACH COAT)
100	Concrete Masonry Units	Masonry Filler	1	70 SF/Gal Application Rate	Masonry Coating	2	130 SF/Gal Application Rate
200	Wood	Alkyd Primer	1	350 SF/Gal Application Rate	Acrylic-Epoxy	1	135 SF/Gal Application Rate
300	Exposed Ferrous Pipe Systems and Exposed Steel Items	Epoxy	2	4-6 MDFT	Poly-urethane	1	2-3 MDFT
301	Exposed, Non-metallic Pipe Systems (ONLY IF NOTED ON PLANS)	Epoxy	1	350 SF/Gal Application Rate	Poly-urethane	1	350 SF/Gal Application Rate
302	Immersed Ferrous Pipe Systems and Steel Items	Epoxy	1	4-6 MDFT	Epoxy	1	4-6 MDFT
303	Immersed Non-metallic Pipe Systems (ONLY IF NOTED ON PLANS)	Epoxy	1	350 SF/Gal Application Rate	Epoxy	1	350 SF/Gal Application Rate
304	Buried Ferrous Pipe and Steel Items	None			Coal Tar Epoxy	1	16-20 MDFT
305	Aluminum Surfaces in Contact with Concrete	Epoxy	1	4-6 MDFT	None		
	Pumps and Pre-coated items	Touch up factory applied coatings as per manufacturer's recommendations.					

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. Does not include steel water storage tanks. See Section 13200 for coating systems for steel water storage tanks.
 6. Non-Metallic Pipe: Polyvinyl Chloride, Chlorinated Polyvinyl Chloride, Fiberglass Reinforced Plastic, High Density Polyethylene. Non-metallic pipe shall typically be left UN-COATED unless specifically designated on drawings.
 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.
- C. Surfaces Not Requiring Painting or Coatings: Unless otherwise stated or shown below or in other sections, the following areas or items will not require painting or coating:
1. Concrete surfaces.
 2. Reinforcing steel.
 3. Buried ductile iron pipe and fittings with factory applied bituminous coating
 4. PVC and other non-metallic pipe and tubing.
 5. Copper, bronze, brass, Monel, aluminum, chromium plate, and stainless steel surfaces, except where:
 - a. Required for electrical insulation between dissimilar metals.
 - b. Aluminum and stainless steel are embedded in concrete or masonry, or aluminum is in contact with concrete or masonry.
 - c. Color coding of equipment and piping is required.
 6. Pipe unions or portions of piping systems where painting would make disassembly difficult or impossible.
 7. Pre-finished electrical, mechanical and architectural items such as motor control centers, switchboards, switchgear, panel boards, transformers, disconnect switches, HVAC equipment enclosures, ductwork, acoustical tile, cabinets, louvers, and wall panels.
 8. Electrical conduits.
 9. Cathodic protection anodes.
 10. Insulated piping and insulated piping with jacket will require prime coat only.
 11. Fiberglass reinforced plastic (FRP) surfaces with an integral ultra-violet resistant colored gel coat do not require painting, provided the color is as selected.
 12. Glass, plexiglass or other transparent or translucent material intended to allow passage of light.
 13. Civil/site materials such as asphalt, gravel, rock, chain-link fence, and landscaping do not require coatings.

3.4 RE-COATING:

- A. Coating installer shall observe all requirements of the coatings' manufacturer regarding re-coat times and practices.

3.5 PAINT LOG

- A. Coating installer shall keep a paint log including:
1. 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 coating manufacturer representative if applicable.
 - 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.
 2. Paint log shall be kept on-site and shall be signed on a daily basis, for any day when coating work is performed, by the supervisor of the coatings field crew.
 3. Any painted surface which was not recorded in the paint log shall be stripped, re-prepared, and re-coated at the Engineer's discretion.

3.6 WATERPROOFING

All interior and exterior block surfaces which are not painted shall be coated with a clear waterproof sealer equal to Prime A Pell H₂O, from Chemprobe Technologies, Inc. in accordance with manufacturer's directions and in conformance with these specifications.

3.7 WARRANTY INSPECTION

- A. If requested by the owner, 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 Owner and 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 re-coating 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.

3.8 CLEANUP

- A. The Contractor is responsible for all cleanup of painting and coating operations including proper disposal of all dust generated in surface preparation, all coatings residue, thinners, cleaning rags, extra product, and any rubbish, used containers, masking material and debris of any kind. Contractor shall remove any over spray and

restore, repair or replace all surfaces impacted by over spray.

**** END OF SECTION ****

**SECTION 11050
MISCELLANEOUS EQUIPMENT**

PART 1 GENERAL

1.1 REQUIREMENT

A. NOT USED

PART 2 PRODUCTS

2.1 EXHAUST FANS AND ACCESSORIES

- A. A corrosion resistant shutter mount exhaust fan shall be installed near the floor of the chlorine tank enclosure in the water treatment building as shown on the drawings. The fan shall have a minimum of 1 speed (± 524 cfm), 120V, 60Hz, 1 phase, and have a totally enclosed air-over motor enclosure, fiberglass frame, epoxy coated steel guard, and fiberglass reinforced polypropylene propeller. The exhaust fan shall be a Dayton model #1BLH6, or approved equal.

2.2 INTAKE VENT LOUVER AND DAMPER

- A. Intake vent in the chlorine tank enclosure of the water treatment building shall be a thin line 12"x12" aluminum louver with blades at 45° angle, hidden mullions, aluminum bird screen as manufactured by Ruskin model #ELF211, or approved equal. The intake vent shall include a gravity damper which opens when exhaust fan is operating. Damper shall be heavy duty backdraft damper, aluminum frame and blade, and corrosion resistant. Damper shall be Grennheck HB-110 or approved equal.

2.3 FIRE EXTINGUISHER

- A. The new main filter room and the existing mechanical/chemical room shall be provided with a fire extinguisher as shown on the drawings. The fire extinguisher shall be filled with dry Foray® powder to combat Class A, B, or C fires. The extinguisher shall be a 10 pound unit with a hose and include brackets for mounting.

** END OF SECTION **

SECTION 11210

PUMPS AND PUMP SYSTEMS

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Work included in this section: Furnish and install all materials, make all mechanical, structural and electrical connections and perform all labor necessary for the complete, tested, and operational installation of the finish water booster pump system as shown on the plans. Systems shall include pumps and motors, and all accessories and appurtenances for completely functional pump systems. Work shall be coordinated with manifold pipes, valving, motor control and electrical systems as shown on the drawings, as specified in other sections of these contract drawings, and as necessary for successful completion of the project.

1.2 RELATED WORK

- A. Work related to this section includes:

Section 11280	Valves and Appurtenances
Section 15200	Pipes and fittings; and
Division 16	Electrical and Instrumentation

1.3 STANDARDS

- A. All materials, and workmanship, installation and start-up shall be in conformance with industry standards related to the work at hand, These standards shall include all applicable standards of AWWA, ANSI, ASME, ASTM, UL, NSF, the California Building Code and NSF 61 for potable water.

1.4 SUBMITTALS

- A. Submittals required under this Section shall be in accordance with Special Conditions.
- B. Shop Drawings: Submit shop drawings for approval of all pumps, pump systems and related equipment specified in this section.
1. Certified shop and installation drawings showing the pumps, motors, controllers, inlets, outlets, manifolds and valves.
 2. Data regarding pump characteristics and performance. The data shall include performance curves, based on actual shop test, for head, capacity, efficiency, and horsepower.
 3. Motor data and motor performance curve showing torque, current, KW input, KW output, efficiency, and power factor.
 4. Engineering calculations for column shaft and bearing loading and deformation.
 5. Manuals: Furnish manufacturer's installation, lubrication, operation and maintenance manuals, bulletins, and parts lists. Operation and maintenance manuals shall be

provided.

1.5 QUALITY ASSURANCE

- A. All materials and workmanship new, of superior quality and shall be in accordance with all applicable standards of AWWA, ANSI, ASTM and ASME

1.6 WARRANTY

- A. The manufacturer shall warrant all components of the pumps and appurtenances be fully functional and to operate under the service conditions as represented and all conditions as specified.
- B. The manufacturer shall warrant all components of the pumps and appurtenances to be free of defects in materials and workmanship for a period of one year from the date of acceptance of the work.

PART 2 MATERIALS

2.1 PLANT FINISH WATER BOOSTER PUMP SYSTEM

- A. In-Line Centrifugal Pump With Integrated Variable Speed Drive
 - 1. Furnish and install circulator pumps as per plans and pump schedule.
 - 2. The pump, electric motor and integrated variable speed drive (VSD) shall be designed and manufactured by a single manufacturer. The manufacturer shall have unit responsibility. Pump units shall be Grundfos Model TP 50-160/2 U-G-A-BUBE or approved equal.
 - 3. Pump shall have a minimum shut-off head of 45 ft and be able to produce 100 gpm at 20 ft of head.
- B. Pump
 - 1. The pumps shall be of the single stage, in-line design with suction and discharge port flanges of identical diameter.
 - 2. The head-capacity curve shall have a steady rise in head from maximum to minimum flow within the preferred operating region
 - 3. The pumps shall have the following features:
 - a. The pump housing shall have a stainless steel/teflon neck ring to minimize recirculation and increase pump efficiency.
 - b. The impellers shall be laser welded stainless to obtain maximum efficiency. Cast impellers and composite material shall not be acceptable. The impellers shall be secured to the shaft with a split cone and a nut.
 - c. The suction and discharge flanges shall be tapped and drilled (1/4" NPT) to allow gauge installation on the pump.
 - d. The pump shall have unbalanced mechanical seal. The mechanical seal shall be manufactured by the same manufacturer. The seal faces shall be tungsten carbide/carbon with EPDM rubber bellows.
 - e. Pump Construction.
 - i. Pump housing and motor stool - Cast iron EN-JL-1040 (A 48 Cl

30B)

- ii. Impellers, rotor can, rotor cladding - 304 Stainless Steel
- iii. Shaft - 431 Stainless Steel
- iv. Coupling - Cast iron, 2 piece rigid coupling
- v. Coupling guard - 04 stainless steel
- vi. Vent screw – Brass

For open loop applications pump housing and motor adapter shall be bronze.

- f. All pumps shall be tested per ISO 9906 Annex A. Test certificates are not required.
 - g. Pump housing and pump adapter shall be electro coated high corrosion resistance and paint shall be cured at minimum 200°C.
- C. Motor
- 1. Each motor shall be of the asynchronous squirrel cage design and tested with the pump as one unit by the same manufacturer.
 - 2. The motor enclosure shall be TEFC.
 - 3. The motor insulation shall be Class F with temperature rise of Class B.
- D. Integrated variable speed drive.
- 1. The VSD) shall be designed and manufactured by the same manufacturer. The VSD shall be factory installed on the motor.
 - 2. The VSD enclosure class shall be IP44.
 - 3. The VSD shall have the human interface options of;
 - a. Control panel on the VSD face
 - b. Infrared remote control
 - c. Building Automation Systems via LonWorks (with optional converter unit)
 - 4. The VSD shall be able controlled by the signals from a single sensor. The sensor shall be supplied by other. The acceptable sensors signal is 4 to 20 mA.) to 20 mA or 10-10 Vdc signals are also acceptable. The field set up of the VSD shall show units of the sensor. (ie °F , GPM ,psi etc.)
 - 5. VSD shall allow one digital input and one set point input.

2.2 PLANT WATER BOOSTER

- A. The booster pump system for WTP water shall include pump, motor, pressure tank and pressure based pump controls. The plant booster system will supply water for the eye wash and drench hose station, hose bib and sample station. Pump system shall be DuraMAC Booster Pump – Light Commercial, Model 17040C035PC2 as manufactured by A.Y. McDonald Mfg. Co. or approved equal.
- 1. Pump
 - Pump must be able to produce a minimum 40 psi boost above inlet pressure at a shut-off head and a minimum of 20 psi at a flow rate of 25 gpm. Pump impellers and pump casing shall be stainless steel.

2. Motor
Motor shall be TEFC single phase, 1 HP, 230 VAC, 60 Hz.
3. Accessories
 - a. Pump system shall include minimum 2 gallon pressure tank.
 - b. Pump system shall include pressure gauge with 0 – 100 psi range.
 - c. Pump system shall include on-board pump controller capable of starting and stopping the pump based on operator defined set points.

PART 3 INSTALLATION

3.1 GENERAL

- A. Equipment and accessories shall be installed in accordance with approved written procedures submitted with the shop drawings, and as indicated on the drawings, secure in position and alignment, and neat in appearance. All mechanical, structural and electrical connections shall be made in accordance with all relevant industry standards, with clean lines, good workmanship, and such that the system will withstand all anticipated pressures, temperatures and operating conditions.
- B. Pump Phasing
Project phasing requires that the treatment plant be able to produce water until such time that the new pump system is installed treatment plant approved. Contractor shall submit detailed phasing plan in conjunction with the project schedule demonstrating a viable strategy that accomplishes project objectives.

3.2 INSPECTION AND TESTING

- A. After installation but prior to acceptance of the pump equipment, each unit shall be given a running test during which it shall be demonstrated to the Owner and Engineer its ability to operate within vibration limits as set forth in the Hydraulics Institute Standards, and without overheating and meet the performance data listed herein. Tests shall include electrical, head and discharge measurements sufficient to duplicate the head-discharge and efficiency curves submitted with the shop drawings.
- B. Submit a test plan to the Engineer for approval prior to final performance tests.
- C. Two weeks after completion of tests, the Contractor shall submit the Pump Performance Test results showing satisfactory performance of each unit.
- D. Any defects revealed by the test shall be corrected at the Contractor's expense and the tests shall be repeated until satisfactory results are obtained.
- E. The Contractor shall furnish all labor, piping, equipment, pressure gauges and materials necessary for conducting the tests, including necessary clean water. Contractor shall coordinate with District regarding disposal of pump test water.

**** END OF SECTION ****

SECTION 11240
CHEMICAL FEED SYSTEMS

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Work Included: Furnish and install all materials and perform all labor necessary for the installation of the chemical feed equipment for the water treatment system including chemical storage, feed pumps, tubing, injection systems, and other equipment for a complete installed, tested and operational liquid chemical feed system, in accordance with the Plans and Contract Documents.

1.2 RELATED WORK

- A. Section 11200 Water Treatment Equipment
- B. Section 15200 Pipes and Fittings

1.3 STANDARDS

- A. All products and materials shall be in conformance with AWWA Standards. All materials in contact with water shall be NSF 61 certified.

1.4 SUBMITTALS

- A. Submittals for all equipment and products under this Section are required.
- B. Shop Drawings: Submit shop drawings for approval of the chemical pump units and related equipment specified in this section.
- C. Manuals: Furnish manufacturer's installation, lubrication, operation and maintenance manuals, bulletins, and parts lists.

1.5 QUALITY ASSURANCE

- A. Acceptable Manufacturers:
 - 1. Chem Tech XPV
 - 2. Approved Equal.

1.6 SERVICE CONDITIONS

- A. Indoor application
- B. Receiving water pressure 20 psi max.
- C. Chemicals: Listed concentrations represent products as delivered. Solutions strengths may be diluted in field where appropriate:

- D.
1. Sodium Hypochlorite: NaOCl 12.5% Concentration

PART 2 MATERIALS

2.1 GENERAL

Chemical feed system for each chemical shall include chemical storage, mixers, foot valve with suction strainer, diaphragm pump, discharge tubing and conduit if specified, and injection/check valve assembly and any other appurtenances for a fully functional chemical feed system. Pumps shall be mounted within limits of suction lift.

2.2 CHEMICAL FEED PUMPS

- A. Liquid chemical feed pumps shall be peristaltic style pump designed for the chemicals to be injected and rated for the service conditions.
- B. Provide 2 chlorine pumps - 1 installed, and 1 as a spare.
- C. Pumps shall deliver:
 1. Sodium Hypochlorite solution: 17 gpd @ 25 psi
- D. Pumps shall have a suction lift of not less than 10 feet dry.
- E. Pump rate manually adjustable for a turndown ratio of 100:1.
- F. Metering pumps shall be rated for continuous duty.
- G. Pumps shall be designed for 120 VAC power supply.
- H. Pumps shall have electronic control with 4-20 mA, Hall-effect or dry-contact pulse input.
- I. Housing shall be totally enclosed chemical and corrosion resistant plastic.
- J. Provide 2 replacement tube kits and one KOPkit maintenance kit.

2.3 Accessories

- A. Suction Tubing
 1. Minimum 6 feet per chemical metering pump.
 2. Diameter sized for respective pump connection.
 3. Provide foot valve, strainer and weight collar.
- B. Injector Assemblies
Injector assemblies shall be provided with injection spring, check/back-pressure valve, quills and O-rings of materials compatible with chemical to be injected. Adjacent to injection quill a 1/2" PVC ball valve shall be installed.
- C. Provide chemical resistant shelf/shelves to support metering pumps above solution tanks. Furnish and install secure mounting brackets for pumps.
- D. Misc. Accessories
Provide pulsation dampeners, pressure gauges, relief valves, back pressure/anti-siphon valves and isolation valves as shown on the drawings and typically installed with specified system.
- E. Chemical Feed Tubing
 1. All tubing shall be as per manufacturer's recommendation for chemical application, feed rate, tube length and pressures. Tubing shall be clear PVC or translucent PE as recommended.

2. All tubing and conduits shall be secured in place to prevent movement under all conditions. All tubing shall be full length from pump outlet to injector assembly.

2.4 CHEMICAL SOLUTION TANKS

- A. Provide graduated chemical solution tanks sized as shown on the drawings for each chemical.
- B. Tank shall be anchored to the wall with eye ring and mounting straps.
- C. Provide a spill containment pallet configuration of sufficient size to hold the vessel as shown on the drawings. Containment pallet(s) shall be Ultra SpillDeck Bladder Systems or approved equal.

2.5 SAFETY EQUIPMENT

- A. An emergency combination drench hose and eye wash unit shall be installed near the chemical room of the water treatment building as shown on the drawings. The eye wash unit shall be a wall-mounted type with drench hose. The drench hose and eye wash shall be constructed of corrosion resistant material and shall comply with ANSI Z358.1 standards. The unit shall be wall mounted, have twin aerated spray outlets, a stay-open valve, 12-foot recoiling hose. The combination drench hose and eye wash unit shall be a Speakman® Model #SE-925-TEW, a Guardian Model #G5014, or approved equal.

2.6 SPARE PARTS

- A. One set of any special tools required for maintenance and dismantling.
- B. Repair kits for each pump as specified.

2.7 STARTUP CHEMICALS

- A. Owner shall provide startup volumes of 12.5% sodium hypochlorite as necessary

PART 3 EXECUTION

3.1 GENERAL EXECUTION

- A. General arrangement and location of piping, tubing, equipment, etc. are shown on project Plans. Contractor shall make any minor adjustments to most efficiently execute chemical feed system.
- B. Contractor shall coordinate with other contractors or subs as necessary to provide any special forming, recesses, chases, etc. and provide wood blocking, backing and grounds as necessary for proper installation of chemical feed equipment.
- C. Contractor is responsible for proper placing of conduits, sleeves, bracing, hangers and supports related to this work.

- D. Contractor is responsible for installing appropriate mounting brackets, restraints, braces, etc. to fully support and brace all facilities as subject to Seismic Zone 3 loadings.
- E. All piping, conduits and runs shall be installed level, plumb, in neat alignment, and true.
- F. All chemical feed solution tanks, pumps and tubing shall be labeled with the chemical they deliver. The tubing shall be labeled in both the chemical feed room and in the mechanical equipment room.

3.2 TESTING AND STARTUP

- A. Upon completion, all chemical feed systems shall be tested, pressure tested, and checked for full functionality.
- B. Contractor shall be responsible for chemical feed startup. Initial set points for chemical feed rates shall be established through coordination with system operator. Contractor shall provide training to Owners personnel on operations and maintenance of chemical feed system.

**** END OF SECTION ****

**SECTION 11280
VALVES AND APPURTENANCES**

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. This section includes technical specifications for all valves and appurtenances to be furnished and installed in the project as shown on the plans, and as necessary for quality completion of the project, whether shown on the plans or not.

1.2 RELATED WORK

- A. Section 11210 Pumps and Pump Systems
- B. Section 15200 Pipes and Fittings

1.3 STANDARDS

- A. All materials included in this section shall be new, quality materials and shall conform to all applicable specifications of ASTM and AWWA Standards. All materials in contact with potable water shall be certified as compliant with NSF Standard 61.
- B. All installation, methods and workmanship shall conform in all respects to the above referenced standards as applicable and to the product manufacturer's recommendations.

1.4 SUBMITTALS

- A. Submittals for all equipment and products under this Section are required.
- B. Furnish manufacturer's installation and operation manuals for all products.

PART 2 MATERIALS

2.1 GENERAL

- A. All materials in contact with water shall be certified to NSF/ANSI Standard 61. All valves shall conform to their respective AWWA Standards.

2.2 BALL VALVES

- A. Water Service
Except as otherwise indicated or specified, all above ground valves 3" or smaller shall be ball valves. Ball valves for water service shall be of a "lead free" design meeting NSF 61 standards and approved for use in the State of California. Ball valves shall be a full port design with threaded inlet/outlet, 316 SS trim. Valves shall be as manufactured by Nibco, Watts or approved equal.

- B. Chemical Service
 - 1. Full port, not smaller than ID of Schedule 80 PVC
 - 2. PVC or CPVC construction
 - 3. Teflon seats
 - 4. Seals compatible with chemical application.

2.3 CHECK VALVES

- A. Check valves on pump discharge shall be wafer-style silent check valve with cast or ductile iron body and stainless steel seat and internal spring. Valves shall be rated for 200 psi operating pressure. Valves shall be certified to NSF/ANSI Standard 61. Valves shall be Val-Matic Silent Check Valves or approved equal.
- B. Check valves 2" and smaller shall be bronze silent check with teflon seat and brass disk, pressure class 150. The check valve shall be as manufactured by Watts and be a Model 600 Maxi-Flo check valve, or approved equal. Valves shall be of a "lead free" design meeting NSF 61 standards.
- C. Check valve for water storage tank bypass shall be swing check style check valve with cast or ductile iron body with fusion bonded epoxy coating and lining. Valve shall be rated for 250 psi operating pressure. Valve shall be certified to NSF/ANSI Standard 61. Valve shall be Val-Matic Swing-Flex Check Valve or approved equal.

2.4 PRESSURE SUSTAINING VALVE

- A. Pressure sustaining valve at the water storage tank shall be a 4-inch, globe style, angle pattern, flanged ClaVal Model 50-90 or approved equal. Valve shall be hydraulically operated pilot controlled. Valve shall be 150 class ductile iron body with epoxy lining and coating. Valve shall have standard pilot system materials. The valve shall have a 0 to 75 psi adjustment range.

2.5 FLOW METERS

- A. Flow meters shall have local display for flow rate (gpm) and totalizer along with 4-20 mA output to system PLC.
- B. Magnetic Flow Meter
 - 1. Magnetic flow meters shall be flanged and include a ductile iron or welded steel NSF61 epoxy coated body. Accuracy shall be $\pm 1\%$ between 10% and 100% of max flow. Meters shall include rate (gpm) and totalizer (gal x 1000) displays. All external bolts shall be made of bronze or stainless steel. The main case shall withstand a working pressure of 175 psi without leakage, seepage in the castings, or distortion affecting the free and accurate operation of the measuring unit. The factory sealed register shall be electronically driven and shall be equipped with a low flow leak detection symbol and with a reverse flow notification symbol. The

register shall be programmed to read in U.S. gallons per minute. The meter shall be Master Meter Octave ultrasonic meter, or approved equal.

2.6 SAMPLE LINE THROTTLING VALVE

- A. Throttling valves on sample lines to monitoring equipment shall be 1/2-inch PVC globe style needle valves as manufactured by Asahi or approved equal. (Item MG-27516 as supplied by USA Bluebook or equal.)

2.7 GATE VALVES

- A. Gate valves for buried installations, 3-inches and larger, shall comply with AWWA C515 with stainless steel stem and stem nut; ductile iron gate and body; EPDM rubber seat bonded to wedge/disc. Gate valves shall open with counter clockwise rotation of the operating nut. Buried valves and valves located in vaults shall have non-rising stem with 2-inch operating nut, turning counterclockwise to open. All surfaces shall be fusion bonded epoxy coated after machining. No exposed metal surfaces shall exist.

2.8 BUTTERFLY VALVES

- A. Butterfly valves shall conform to the requirements of AWWA C 504. Butterfly valves in treatment room shall be lever-or gear and handwheel operated, flanged or wafer style valves. All butterfly valves shall be heavy-duty ductile iron body with resilient seat permanently bonded to valve body. Valves shall be rated for 200 psi. Valves shall be shop lined and coated with fusion bonded epoxy coating. Coating system shall be NSF-61 approved. Butterfly valves shall be Henry Pratt, M&H, Mueller, or approved equal.

2.9 ELECTRIC VALVE ACTUATORS

- A. Electric valve actuators for the automatic high turbidity bypass valves shall be either spring return or battery backup fail-safe electric actuators. Actuators shall operate on 120 volt AC. Actuators shall be corrosion resistant, NEMA 4X construction with die cast aluminum housing and cover and be powder polyurethane coated. Actuators shall have visual position indicator, heater and thermostat, and manual override with handwheel. Electric valve actuators shall be Triac FSE Series, BFS Series, or approved equal.

2.10 PRESSURE GAUGES

- A. Pressure gauges shall be mounted as shown on the Plans. Pressure gauges shall be 4.5" Ashcroft Duragauge style 1279 or approved equal. Gauges shall be glycerin filled and include isolation valves. Ranges for gauges shall be such that normal operating pressures are in the mid-range of each gauge and shall be verified during the submittal process.

2.11 AIR RELEASE VALVES

- A. Air release valves shall be provided at high points in the piping and plumbing systems. Air release valves for indoor use shall be automatic continuous active units rated for 200 psi and shall be A.R.I. Automatic Air Release Valve model "SEGEV" S-050 or approved equal.

2.12 ANTI-SIPHON HOSE BIBS

- A. Anti-siphon hose bibs shall be Woodford Model 17 freezeless wall faucet with anti-siphon or approved equal.

PART 3 INSTALLATION

3.1 GENERAL VALVE ASSEMBLIES

- A. Pipeline valve assemblies shall be installed in accordance with the manufacturer's recommendations, AWWA C600, and these technical specifications. Valves shall be laid in sequence with adjacent pipe and fittings. Pipe ends shall be cut where required to create a tight, flush fit against the valve shoulder.
- B. All buried valves shall be furnished with valve boxes in accordance with details shown on the Plans. The box and extensions shall be centered over the valve operating nut and perpendicular to the valve centerline. The box and extensions shall be placed so as not to transmit any shock or stress to the valve or adjacent pipe. Backfill shall be carefully tamped around each valve box and extension to the undisturbed trench face.

** END OF SECTION **

**SECTION 11200
MONITORING AND CONTROL EQUIPMENT**

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Work described under this section includes furnishing, installing and providing startup services for instrumentation and monitoring equipment to be added to the proposed treatment facility. Work includes installation of turbidimeters, chlorine residual analyzers.
- B. Provide field interconnecting wiring, including any necessary conduits and conductors for a complete and operational system.
- C. Provide Start-up Services and Operator Training in accordance with Part 3, Installation.

1.2 RELATED WORK

Work related to this section includes

Section 11240	Chemical Feed Systems
Section 11280	Valves & Appurtenances

1.3 STANDARDS

- A. All materials and workmanship, installation and startup shall be in conformance with industry standards related to the work in question. Applicable standards may include standards of AWWA, ASME, ASTM, NSF, California Building Code and California Water Works Standards for surface water treatment.

1.4 SUBMITTALS

- A. Provide complete technical submittals of proposed equipment including product data, shop drawings, and control logic as applicable. Provide manufacturers equipment literature for all components incorporated as part of the filtration system, including but not limited to:
 - 1. Chlorine residual analyzer

PART 2 MATERIALS

2.1 EQUIPMENT

A. Monitoring Equipment

- 1. Process Turbidimeters – Contractor shall reinstall existing turbidimeters.

System shall include:

- a. Raw Water
- b. Combined Filter
- c. Turbidimeters may share controllers where feasible.

- 1. Chlorine residual analyzer

Provide chlorine residual analyzer in the water treatment plant building. Free chlorine residual analyzer system shall include a reagent-free chlorine sensor and analyzer with continuous pH correction. System shall be a Hach CLF10 sc with SC200 controller or

approved equal. System shall monitor free chlorine residual, pH and temperature on a continual basis. System shall be mounted on a stainless steel back panel and include the sample conditioning kit with needle valve assembly. System shall include the additional output module to allow for sending pH and temperature to the PLC via a 4-20 mA signal. System shall include one membrane replacement kit for each unit.

B. PLANT CONTROL

1. Plant Control Panel/SCADA System

Contractor shall provide and coordinate the installation of a PLC based SCADA control system. Contractor's attention is directed to the **Control System Block Diagram shown on Sheet E5** of the Drawings for a list of all devices to be controlled and/or monitored by the SCADA system. Contractor shall be responsible for submitting manufacturer's literature for all devices to be monitored or controlled by the SCADA system to the system manufacturer so as to verify compatibility once on site.

System shall have capabilities of generating graphs, spreadsheet reports, and alarms for flows, tank levels, chlorine residual, turbidity and plant status. Alarm status shall be conveyed via phone.

System shall be delivered with descriptive label clearly indicating connection points for all field equipment. System shall include Uninterruptible Power Supply (UPS) which will provide for an extended period of control during power outages.

Contractor shall be responsible for coordination of all programming required for a complete and operable system. Following initial startup and testing, the system shall be operated for a period of at least 1 month following which any adjustments to control logic, alarms, etc may be made at no additional cost to the owner.

System shall be configured so as to be able to generate custom reports for purposes of reporting to regulatory agencies.

a. WTP Booster Pump System

Plant operation shall be managed through an on-screen HOA control feature which will function to start, run at variable speeds, and stop the booster pump system. In Auto mode, the booster pump system will operate based upon set points in the storage tank. Booster pump(s) will start and stop based on a user defined set points in the tank. The pump VFDs will be operated in order to pace the system demand as measured by tank level. In addition, at times when the storage tank is not calling for water, the booster pump system will start and stop based on user defined set points in the WTP break tank.

b. Raw Water Bypass Valves

Under normal system operations, Bypass Valve 1 (filter influent valve) shall remain open and Bypass Filter 2 (discharge to waste) shall remain closed. In the event of a high raw water turbidity event, the system shall close Bypass Valve 1

and open Bypass Valve 2, and notify the operator. Once raw water turbidity returns to a user defined set point, the system shall return to normal operation. In the event of a power failure, the system will automatically “fail-safe” into bypass mode, and once power is restored, automatically return to normal operation.

- c. Chlorine Residual
User defined set points for high or low chlorine residual shall cause the plant to shut down by closing the plant effluent valve, and notify the operator. Return to service shall require alarm acknowledgment by system operator.
- d. Treated Water Turbidity
A user defined set point for high treated water turbidity shall close the plant effluent valve and notify the operator. Return to service shall require alarm acknowledgment by system operator.
- e. Raw Water Turbidity
A user defined set point for high raw water turbidity shall close the plant effluent valve and cause the bypass valves to go into bypass mode. Once raw water turbidity has returned to an acceptable level- determined by the operator, plant shall automatically return to normal operation.
- f. Storage Tank Level
A “high high” water storage tank level shall stop the booster pump system and notify the operator. A “low low” level shall notify the operator but leave the plant in normal operation.
- g. Filter Level
A low filter level shall stop the WTP booster pumps and notify the operator.
- h. Break Tank Level
A “high high” break tank level shall stop the booster pumps and notify the operator. A “low low” level shall notify the operator but leave the plant in normal operation. If there is no call for water from the storage tank then a “low” break tank level shall start the booster pump system and a “high” level shall stop the booster pump system.

2.2 WARRANTY

Contractor shall furnish a warranty covering all equipment and workmanship to be free of physical or operational defects and be able to meet performance specifications for a period of one year from acceptance of project.

PART 3 INSTALLATION

3.1 GENERAL

- A. Systems shall be installed in accordance with manufacturer’s recommendations and in general conformance with the Contract requirements.

3.2 CONNECTIONS

- A. Connections: All mechanical, plumbing and electrical connections shall be made to connect the various mechanical and electrical elements of the project. Contractor shall be responsible for providing all mounting hardware, adapters and miscellaneous equipment necessary for providing such connections so as to achieve a complete and operable system.

3.3 STARTUP

- A. Contractor shall supply technical services including:
1. Pressure testing all components of the system;
 2. Demonstrating successful performance of the system;
 3. Cycling the system through all operational phases;
 4. Training Owner's personnel in operating each component of the system;
 5. Demonstrating and training in adjustments of all set points and cycles in the PLC;
 6. Adjusting all set points and cycles to optimize performance of the system.
 7. Adjustment of chemical feed equipment for optimized system performance.
- B. Contractor shall supply detailed Operations and Maintenance Manuals for all components for the system.
- C. **WARRANTY**
Contractor shall furnish a warranty covering all equipment and workmanship to be free of physical or operational defects and be able to meet performance specifications for a period of one year from acceptance of project.

**** END OF SECTION ****

SECTION 15200 PIPE AND FITTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

This specification includes materials and methods for the construction water piping and fittings used in the construction of the water treatment system and pumping facilities, including process piping and yard piping. This shall include pipes and fittings and appurtenances. Pipe type and pressure class are as specified on the project plans and include schedule 40 and 80 and C900 PVC, ductile iron pipe (DIP), galvanized steel pipe, welded steel pipe, copper water pipe, ABS drain pipe, and polyethylene (PE) pipe. Control valves, check valves, meters and related mechanical equipment and appurtenances are specified in Section 11280 of these technical specifications.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 03400 Precast Concrete Products
- B. Section 11200 Water Treatment Equipment
- C. Section 11210 Pumps and Pump Systems
- D. Section 11240 Chemical Feed Systems
- E. Section 11280 Valves and Appurtenances

1.03 SUBMITTALS

- A. Submittals for all equipment and products under this Section are required.
- B. Furnish manufacturer's installation and operation manuals for all products.

1.04 QUALITY ASSURANCE

- A. All materials included in this section shall be new, quality materials and shall conform to all applicable specifications of ASTM and AWWA Standards. All materials in contact with potable water shall be certified as compliant with NSF Standard 61.
- B. All installation, methods and workmanship shall conform in all respects to the above referenced standards as applicable and to the product manufacturer's recommendations.

PART 2 MATERIALS

2.01 GENERAL

Pipe materials and joining methods and materials shall be as designated on the project plans.

2.02 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. PVC Schedule 40 and Schedule 80 pipe - Small diameter PVC pipe used for water service shall be solvent welded and conform to ASTM D1784 and ASTM 2241. Outside diameter (OD) pipe shall be manufactured to iron pipe size (IPS) equivalent. All PVC Schedule 80 pipe shall be manufactured from a Type I, Grade I Polyvinyl Chloride (PVC) compound with a Cell Classification of 12454 per ASTM D1784. The pipe shall be manufactured in strict compliance to ASTM D1785, consistently meeting and/or exceeding the Quality Assurance test requirements of this standard with regard to material, workmanship, burst pressure, flattening, and extrusion quality. The pipe shall be manufactured in the USA, using domestic materials, by an ISO 9001 certified manufacturer. All pipe shall be stored indoors after production at the manufacturing site until shipped from factory. This pipe shall carry the National Sanitation Foundation (NSF Std. 61) seal of approval for potable water applications.
- B. Schedule 40 and 80 Fittings are to be manufactured from PVC material which meets or exceeds the requirements of ASTM D-1784, cell classification 12454B, Type 1, Grade 1. All solvent cements used, to conform to ASTM D-2564, listed by NSF for potable use applications. Welding rod used in the manufacture of the above fittings, shall conform to ASTM D-1784, cell class 12454B for PVC
- C. Dimensions - All sizes of PVC Schedule 40 & Schedule 80 pipe shall be manufactured in strict accordance to the requirements of ASTM D1785 for physical dimensions and tolerances. Each production run of pipe manufactured in compliance to this standard, shall also meet or exceed the test requirements for materials, workmanship, burst pressure, flattening, and extrusion quality defined in ASTM D1785.
- D. PVC C 900 and C 905 pipes and fittings shall conform in all ways to AWWA Standards C 900 (Polyvinyl Chloride water distribution pipe in sizes 4-inch through 12-inch with integral bell and spigot joints) and AWWA C 905 (Polyvinyl Chloride water distribution pipe in sizes 14-inch through 24-inch with integral bell and spigot joints). Pressure class shall be as called out on the drawings. The bell shall consist of an integral thickened wall section with a factory installed elastomeric seal. The wall thickness in the bell section shall conform to the requirements of Section 6.2 of ASTM D3139 "Standard Specifications for Joint for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
- E. Pipe, fittings and elastomeric seals shall meet the requirements of ANSI/NSF 61.
- F. PVC 900 and 905 pipe shall be manufactured to cast iron outside diameters (CIOD) in accordance with AWWA C900 and C905.
- G. Elastomeric Seals shall meet the requirements of ASTM F477 "Standard for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

2.03 DUCTILE IRON PIPE AND FITTINGS

- A. Ductile iron pipe shall be centrifugally cast, meeting the requirements of AWWA C151 as most recently adopted, with cement mortar lining in accordance with the latest

revision of ANSI/AWWA C104/A21.4. Ductile iron pipe shall have a Pressure Class Rating of 350 psi. Pipe joints shall be flanged, push-on or mechanical. Gaskets for pipe joints shall comply with the provisions of AWWA C111. Polyethylene encasement is not required for ductile iron pipe.

- B. Ductile iron pipe and fittings shall have minimum 350 lb flange connections and shall conform in all respects to ANSI/AWWA C115/A21.15-99 and C110/A21.10-98 standards as appropriate and shall have a cement mortar lining in accordance with ANSI/AWWA C104/A21.4-95. Ductile iron pipe shall utilize restrained joints where required in lieu of thrust blocks. Restraint systems shall be manufactured by the same manufacturer as the pipe.
- C. Ductile iron pipe fittings such as tees, angles, reducers, etc., shall conform to AWWA C-110 or AWWA C153. Pressure class rating shall be 350 psi. Fittings shall be ductile iron with cement mortar lining. Rubber gasket joints for fittings shall conform to AWWA C111.
- D. Restrained push-on gaskets (i.e. field-lok) are not allowed.

2.04 GALVANIZED STEEL PIPE AND FITTINGS

- A. All galvanized steel pipe and fittings shall be in conformance with ASTM A53 Standard Specifications for Pipe, Steel, Black and Hot Dipped Zinc Coated, Welded and Seamless, as appropriate for galvanized seamless and/or welded steel pipe. Pipe and fittings shall conform to these standards in materials, fabrication, dimensions, wall thicknesses, coatings, and thread patterns.
- B. All pipe, fittings, and pipe joint compounds and all materials in contact with potable water shall be in compliance with NSF Standard 61 for use with potable water.
- C. All pipe and fittings shall be installed in the configuration shown on the plans, and shall be supported and restrained with pipe clamps and braces as necessary to prevent movement of any kind.

2.05 COPPER WATER PIPE

- A. Copper water service pipe shall be installed in the sizes and locations as shown on the plans. Interior copper water pipe shall be Copper tube, Type K, hard-drawn temper, wrought -copper fittings, solder joints. All copper pipe and fittings shall be in conformance with ASTM B88 standards.

2.06 ABS PIPE AND FITTINGS

- A. Acrylonitrile Butadiene-styrene (ABS) schedule 40 plastic drain, waste and vent pipe and fittings shall conform in all ways to ASTM D2661 and ASTM D 1527. ABS pipe and fittings shall be joined with solvent cement conforming to ASTM D 2235.

2.07 WELDED STEEL PIPE AND FITTINGS

- A. All pipe and fittings shall be installed in the configuration shown on the plans, and shall be supported and restrained with pipe clamps and braces as necessary to prevent movement of any kind. Pipe shall conform in all respects to AWWA C200 Standard for Steel Water Pipe 6 In and Larger, as most recently adopted. All welded steel fittings shall conform to AWWA Standard C 208. All field welding of steel water pipe shall conform to AWWA C206. Elbows and bends shall be smooth radius fittings. Exterior coating shall be tape coating system as per AWWA C214 or as approved by Engineer. Interior Coating shall conform to one of the methods specified in C200 Section 4.5.

2.08 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

- A. **Materials**
HDPE pipe shall conform to ANSI/AWWA C906, PE code designation 3408, except as modified herein. This pipeline material shall be IPS DR 17 (Class 100) for pipe sizes 4 inch and 6 inch.

H.D.P.E. pipe shall be furnished with cast iron equivalent outside diameters (D.I.P.S.)

H.D.P.E. pipe sections shall be supplied in 40 or 50 foot laying lengths. Pipe cut for closures shall be machined or otherwise rendered suitable for inserting into and making a tight joint with a coupling or fitting. At least 90% of pipe furnished shall be standard 40 or 50-foot lengths, except that shorter lengths may be required for horizontal and vertical curves, as described for installation elsewhere in this section.

Pipe shall be supplied with plain ends suitable for butt fusion or couplings. Restrained joints at ductile iron fittings, such as Tee's and valves, shall be accomplished by using fusion welded flanges with cast iron backup rings or fusion welded MJ ends with a protruding hub design for positive restraint.

Continuous lengths of H.D.P.E. will normally utilize butt fusion welding. Mechanical couplings and electro fusion couplings shall only be used with prior owner approval or as shown on the approved plans.

Each section of H.D.P.E. pipe shall be clearly marked with the nominal size and OD base (for example, 8-DIPS), type of pipe, dimension ratio number (for example, DR 11), AWWA Pressure class (for example, PC160), AWWA Designation Number (AWWA C906, code designation 3408), the manufacturer's name or trademark and production record code.

- B. **Joining of HDPE Pipe**
Heat Fusion Joining. Joints between plain end pipes and fittings shall be made by butt fusion. Joints between the main and saddle branch fittings shall be made using saddle

fusion. The butt fusion and saddle fusion procedures used shall be procedures that are in accordance with ASTM F2620. The contractor shall ensure that persons making heat fusion joints have received training in the recommended procedure. The contractor shall maintain records of trained personnel, and shall certify that training was received not more than 12 months before commencing construction. External and internal beads shall not be removed.

Butt Fusion of Unlike Wall Thickness. Butt fusion shall be performed between pipe ends, or pipe ends and fitting outlets that have the same outside diameter and are not different in wall thickness by more than one Standard DR, for example SDR 13.5 to SDR 17, or SDR 11 to SDR 13.5. Transitions between unlike wall thickness greater than one SDR shall be made with a transition nipple (a short length of the heavier wall pipe with one end machined to the lighter wall) or by mechanical means or electrofusion. SDR's for polyethylene pipe are 7.3, 9, 11, 13.5, 17, 21, 26, 32.5 and 41.

Heat Fusion Training Assistance. Upon request and at the requestor's expense, training personnel from the Distributor shall be made available.

Joining by Other Means. Polyethylene pipe and fittings may be joined together or to other materials by means of (a) flanged connections (flange adapters and back-up rings), (b) mechanical couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another material, (c) MJ Adapters or (d) electrofusion. When joining by other means, the installation instructions of the joining device manufacturer shall be observed.

ID Stiffener and Restraint. A stiffener shall be installed in the bore of the polyethylene pipe when an OD compression mechanical coupling is used and when connecting plain end PE pipe to a mechanical joint pipe, fitting or appurtenance. External clamp and tie rod restraint shall be installed where PE pipe is connected to the socket of a mechanical joint pipe, fitting or appurtenance except where an MJ Adapter is used.

2.09 MECHANICAL COUPLINGS

- A. Mechanical couplings for connection of dissimilar water pipe materials, for connection of water pipes with different outside diameters, or for field closures of plain end pipe shall be cast iron couplings with a minimum pressure rating of 175 psi, and shall meet the requirements of AWWA C219. Couplings shall be shop coated with a durable, corrosion-resistant NSF approved paint. All couplings shall be furnished with zinc plated, chromate protected steel bolts and nuts. Couplings shall be Romac Style 501 series, Dresser Style 38, 62, 162, or equal and shall be made for the pipe size and materials to be connected.

2.10 FLANGED ADAPTERS

- A. Flanged adapters without restraint shall be cast iron Romac FCA501, or approved equal.

2.11 RESTRAINED FLANGE ADAPTER

- A. Restrained flange adapters shall be EBBA Iron Series 2100 or approved equal.

2.12 MECHANICAL JOINT RESTRAINT

- A. Joint restraint for mechanical joints shall utilize Romac GripRings or approved equal.

2.13 DIELECTRIC UNIONS

- A. Dielectric unions shall be used for all connections between dissimilar materials. Dielectric unions shall be Epcoc EA series.

2.14 PIPE SUPPORTS

- A. Pipe supports shall be installed to adequately brace all above ground piping from movement, and shall be installed where necessary to do so and at any locations shown on the drawings. Pipe supports for pipes 2" and larger shall be Standon Model S92 Saddle Support and model S89 Flange Support, with threaded vertical adjustment, as manufactured by Material Resources, Hillsboro, OR (503-693-0727), or approved equal.
- B. Pipe supports and braces for pipes and tubing less than 2" and secured to the floor or wall shall be non-metallic pipe clamps in notched channel systems, as manufactured by Unistrut, or approved equal.

2.15 WARNING TAPE

- A. Warning tape shall be detectable type with a 5 mil minimum, overall thickness. The tape shall have a 50 gauge solid aluminum foil core laminated between two layers of inert plastic film. The tape shall be 3-inches wide with a minimum tensile strength of 100 pounds per 3-inch wide strip. The tape shall be APWA color coded (Blue) and bear a continuous printed message in permanent black letters on one side "CAUTION WATER LINE BURIED BELOW" or words of a similar nature.

2.16 LOCATING CABLE

- A. Pipeline locator wire shall be No. 14 AWG solid copper wire with THWN-2 insulation. Splice connectors shall be rated for wet location/direct burial installation. All splices shall be covered with heat-activated shrink wrap tubing or electrical tape.

2.17 PIPE INSULATION

- A. Exterior exposed piping shall be protected from freezing with black tubular polyethylene foam pipe insulation, pre-molded for proper pipe size, as manufactured by Thermwell or equal. Exterior of pipe insulation shall be wrapped with plumber's tape.

PART 3 INSTALLATION

3.01 PIPES AND FITTINGS

- A. All pipe and fittings shall be installed in the configuration shown on the plans, and shall be supported and restrained above ground with pipe clamps and braces and below ground with thrust blocks or restrained joints as called out on the project plans and/or as necessary to prevent movement of any kind under all anticipated service conditions and pressures.
- B. All pipe installation shall be as per the manufacturer's recommendations for the pipe material used. All fittings shall be installed and secured with flanged or threaded connections or as shown on the drawings. All proper hardware, gaskets and appurtenances for each fitting shall be as recommended and supplied by the fitting manufacturer. All new materials shall be used.
- C. All trenching shall conform to trench detail as shown on the plans. All pipe bedding, trench backfill and finishing shall be in accordance with trench details as shown on the plan and shall be as per the pipe manufacturer's recommendation for the pipe material being installed.
- D. All AWWA C900 and C905 Pipe shall be installed in accordance with AWWA C605 "Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water" and in accordance with the manufacturer's directions and recommendations.

3.02 THRUST RESTRAINT

- A. All pipe and fittings shall be properly restrained against horizontal and vertical movement due to internal pressure and pressure changes. Contractor shall utilize mechanical restraints, restraint joints, bracing, and/or thrust blocks to provide all necessary bracing and restraint to protect piping from movement in all service conditions. Method of restraint may be specified on project plans. If method of restraint is not specified on the plans, Contractor shall verify with Engineer appropriate restraint method.

3.03 FLUSHING, TESTING AND DISINFECTION

- A. As a condition of acceptance of the completed water system, the Contractor shall flush, test and disinfect the new water pipelines and valves. The authorized representative of the Engineer and District shall be present during the performance of all such work. In no case shall there be placement of permanent pavement prior to successful completion of the tests.
- B. Prior to hydrostatic testing and disinfection, the Contractor shall thoroughly flush all piping to remove sand, grit, fluids, construction waste, etc.

- C. Pressure and leakage testing of the completed water pipeline section shall be in accordance with AWWA C605 except as modified herein. Minimum test pressure shall be 125 pounds per square inch in the lowest section but shall not exceed the design pressure limit for any pipe. The test pressure shall not vary by more than +/- 5 psi for the duration of the test. The minimum duration of the test shall be 2 hours. After installation of all thrust blocks, a minimum time shall elapse before testing; 36 hours for high-early-strength concrete and 7 days for Class C concrete. No pipe installation will be accepted if the leakage is greater than that determined by the formula:

$$L = \frac{S D \sqrt{P}}{148,000}$$

L = Allowable leakage in gallons per hour.

S = Length of pipe tested in feet.

D = Nominal diameter of the pipe in inches.

P = Average test pressure during the leakage test in pounds per square inch.

Pipelines that fail to pass the prescribed leakage test will be considered defective work and the Contractor shall determine the cause of the leakage, shall take corrective measures necessary to repair the leaks in a manner acceptable to the Engineer, and shall retest the pipelines. This procedure shall be repeated until the Contractor can certify to the Owner that the entire system has passed the testing.

- D. Disinfection - Following satisfactory testing, the new pipeline shall be disinfected by the Contractor in accordance with AWWA C651, except as modified herein.
1. The duration of disinfection shall be 48 hours.
 2. An initial coliform bacteria test meeting the requirements of the California Department of Health Services shall be made at Contractor's expense by a licensed water laboratory prior to the inclusion of any facility into the operating system. Positive bacteria test results will necessitate continued retesting at Contractor's expense until negative results are achieved.

**** END OF SECTION ****

DIVISION 16 - ELECTRICAL

SECTION 16010

GENERAL REQUIREMENTS, ELECTRICAL

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. All general provisions of the Contract Documents apply to all work specified in this Division 16 Electrical.
- B. Furnish all necessary labor, materials, equipment and incidentals required to install a complete and operational electrical system according to the intent of this specification and the accompanying drawings, whether itemized or not.
- C. Examine the specification and drawings for mechanical equipment and provide all starters, circuit breakers, switches, pushbuttons and appurtenances, which are not specified to be with the mechanical equipment. Erect all electrical equipment not definitely stated to be erected by others, furnish and install conduit, wire and cable and make connections required to place all equipment in complete operation.
 - 1. Where mechanical and process equipment is provided with specialty protective relays, the relays shall be incorporated into the controls at no additional cost to the Owner.
- D. The general extent of the electrical work includes, among others, the furnishing and installing of the following items:
 - 1. Complete circuiting and connections for all motors, including their remote control and indicating devices.
 - 2. All supports, bases, anchors, sleeves, hangers, conduit seals, and the like, all electrical work shown and/or specified, not particularly mentioned above.
 - 3. Complete grounding system.
 - 4. Significant documentation, including submittal, instruction, operations and maintenance manuals.
 - 5. Very significant field services including pre-start-up check-out, testing, calibration, start-up, radio testing and training.
 - 6. Conduit, Fittings and Conductors.

7. Light Fixtures and Accessories.
 8. SCADA server.
 9. Control Panel including the PLC and communication equipment.
 10. Transfer switch and standby engine-generator.
 11. Telemetry pedestal and metering pedestal
 12. Instrumentation.
 13. Power, control, alarm, and instrumentation wiring for all equipment specified in sections 11000, 15000, 16000 and 17000.
- E. Throughout this Contract, provide protection for materials and equipment against loss or damage in accordance with provisions elsewhere in these Contract Documents. Throughout this Contract, follow manufacturer's recommendations for storage. Protect everything from the effects of weather. Prior to installation, store items in clean, dry, indoor locations. Store in clean, dry, indoor, heated locations items subject to corrosion under damp conditions, and items containing electrical insulation, such as transformers, conductors, motors, and controls. Energize all space heaters furnished with equipment. Provide temporary heating, sufficient to prevent condensation, in transformers, switchgear, switchboards, motors, and motor control centers, which do not bare space heaters.
- F. Following installation, protect materials and equipment from corrosion, physical damage, and the effects of moisture on insulation. When equipment intended for indoor installation is installed at the Contractor's convenience in areas where it is subject to dampness, moisture, dirt, or other adverse atmosphere until completion of construction; ensure that adequate protection from these atmospheres is provided that is acceptable to the Construction Manager. Cap conduit runs during construction. Energize all space heaters furnished with equipment.
- G. All temporary wiring for the motors and equipment shall have disconnect means, overcurrent protection, and conduit or metal wireways as required by the National Electrical Code, except that jacketed flexible cables may be exposed on equipment.
- H. Provide an experienced field supervisor to monitor work progress and to attend regular project meetings. Reference the General Conditions for specific requirements.
- I. Removal of Salvaged Material: Use reasonable care in removing salvaged electrical material to avoid all unnecessary damage. Handle equipment to be removed and salvaged with special care to avoid damage of any nature. Repair any unnecessary damage to

salvaged equipment at the Contractor's expense. Deliver all such material to the OWNER's storage area, and neatly stockpile as directed.

- J. The Contractor shall secure the services of a qualified systems integrator (SI) to provide equipment and services associated with the motor control center, control panels, programmable logic controllers and instruments. Review the specific requirements throughout Divisions 16 and 17 with due diligence.
- K. The work includes significant documentation, engineering, start-up services and training. Review the specific requirements throughout Divisions 16 and 17 with due diligence.
- L. Provide temporary power during construction. Pay for equipment rental, fuel, power, etc. Remove temporary facilities after completion of construction.

1.2 CODES AND STANDARDS

- A. All Work shall conform to the following codes:
 - 1. National Electrical Code - 2014 Edition
 - 2. NFPA 70E – Electrical Safety
 - 3. NFPA 101 - Life Safety Code - Latest Edition
 - 4. Uniform Building Code - Latest Edition
 - 5. Local Electrical Code
 - 6. NETA Standards for Testing
 - 7. Any additional codes effective at the job site
- B. The Contractor shall furnish without extra charge any additional material and labor which may be required for compliance with these laws, rules, and regulations, even though the work is not mentioned in these particular specifications or shown on the drawings.
- C. The Contractor shall apply and pay for all permits required by any of the legally constituted public authorities for the installation or construction of the work included under this Division. The Contractor shall arrange and pay for any inspections or examinations so required and deliver certificates of all such inspections to the Engineer. When these specifications call for materials or construction of a better quality or larger sizes than required by the above mentioned rules and regulations, the provisions of the specifications shall take precedence.

1.3 QUALITY OF MATERIALS

- A. All electrical materials used on this project shall be new and free from defects.
- B. All electrical materials used on this project shall conform where applicable, to the following standards, unless otherwise noted:
 - 1. NEMA - National Electrical Manufacturers Association
 - 2. ANSI - American National Standards Institute
 - 3. UL - Underwriters Laboratories, Inc.
- C. Each type of material shall be of the same manufacturer and quality throughout the work.

1.4 SUBSTITUTIONS

- A. Specific brand names and catalog numbers are used to describe materials in order to establish standards of performance and quality or to match existing equipment. Refer to Section 01340 regarding the procedure for submitting substitutions.
- B. The decision of the Engineer shall govern as to what is equal to the item specified. Equality will be judged on the basis of the following:
 - 1. Conformance with description or performance required.
 - 2. Equal in quality.
 - 3. Comparable in appearance and artistic effect where these are considerations.
 - 4. Comparable operation, maintenance and performance.
 - 5. Equal in longevity and service under conditions of climate and usage.
 - 6. Conformance with space allocations and requirements for operations from mechanical or electrical services provided without necessitating changes in details and construction or related work.
 - 7. Compatible with existing equipment.
- C. If the Engineer considers it necessary, tests to determine the quality of the proposed materials shall be made, at the expense of the Contractor, by an unbiased laboratory, satisfactory to the Engineer.
- D. Any material, article, or method judged by the Engineer equal to that specified will be approved, provided the Contractor submits a single written request, in triplicate, to the Engineer, within 45 days after contract award, with the following information for each item:
 - 1. Name of manufacturer or supplier.

2. Trade or brand name.
 3. Type, model, style, and/or catalog number.
 4. Size or capacity rating.
- E. The Contractor assumes full responsibility for including complete, correct data in this one request and shall also attach completely referenced diagrams descriptive and technical data sheets for the Engineer's determination of equality or suitability of appearance of any substitution item. Only one such request may be submitted. The Engineer's rejection of any substitute shall automatically require the Contractor to furnish the specified item without further discussion or delay.

1.6 MATERIAL, EQUIPMENT AND SHOP DRAWING SUBMITTALS

- A. Submittals shall be prepared in accordance with General Conditions, Section 01340.
- B. The following information shall be clearly marked on each shop drawing, catalog data sheet, specification sheet, etc. submitted:
1. Project Title.
 2. Date.
 3. Submitted By.
 4. Identification of item represented.
- C. Shop drawings shall be drawn to scale or completely dimensioned and shall give all information required to completely describe the item. Shop drawings of speed control switchboards, panels, and motor control centers shall all be submitted on 11" x 17" or 24" x 36" size sheets at one time. 8-1/2" x 11" sheets will not be accepted. Drawings shall show front views, plan views, elementary wiring diagrams and numbered terminal blocks. Drawings shall be submitted for existing equipment requiring modifications as called for on drawings.
- D. The Contractor shall carefully check all his shop drawings for compliance with this Specification and the Plans.
- E. In the event that certain shop drawings are rejected by the Engineer, they will be so noted and returned to the Contractor for resubmittal. Resubmittals are to be made within 14 days.
- F. If the shop drawings show variation from the contract requirements because of standard shop practice or other reasons, the Contractor shall make specific mention of such variations in order that if acceptable, suitable action may be taken for proper adjustment of the Contract. The Contractor will not be relieved of the responsibility for executing the work in accordance with the Contract, even though the shop drawings have been reviewed.

- G. The Engineer's review of shop drawings will be for general design and arrangement only, and shall not relieve the Contractor from responsibility for errors of any sort in shop drawings or schedules. The Contractor shall verify all dimensions and job site conditions affecting the work, and shall be responsible for furnishing and installing the proper materials required by the Contract, whether or not indicated on the shop drawings.
- H. Work requiring shop drawings shall not be started before receipt of the Engineer's written approval.
- I. Provide complete interconnection wiring diagrams. Interconnections drawings shall show for each piece of equipment and all wiring between all devices, panels, cabinets, terminal boxes, control equipment, motor control centers and any other devices and equipment including equipment provided in other Divisions of the Specifications as well as equipment provided by the OWNER. Each interconnection diagram shall show the following as a minimum: each conduit number, wire label, wire color code and terminal number, as actually installed; each motor, starter, cubicle, disconnect, switch, panel, cabinet, instrument, device, and all other equipment; and grounding points.
- J. Commercial Warranties: Pursuant to the General Provision of the contract, prior to final payment, the Contractor shall furnish to the Engineer a listing of all manufacturers of their materials and equipment. The list of these warranties must include the time period of each warranty, i.e. 6 months, 1 year, and the like. One copy each of those warranties whose time period exceeds 1 year shall be submitted with the listing.
- K. Submit a single complete package for all products on the following list:
 - 1. Panelboards, Motor controllers and VFDs with all related components.
 - 2. Conduit, fittings, supports, conductors, vaults and boxes.
 - 3. Disconnects, receptacles and switches.
 - 4. Controls including programmable logic controller, communication equipment and antenna.
 - 5. Light fixtures, devices and Accessories.
 - 6. Transfer Switch, Standby Engine-Generator and Accessories.
 - 7. SCADA server
 - 8. Instrumentation - Complete.
 - 12. Pedestals and telemetry equipment.

1.7 OPERATION AND MAINTENANCE MANUALS:

- A. The CONTRACTOR shall provide three (3) hard copies of an Operation and Maintenance manual and a pdf file on a cd disk prior to completion of the Work. The hard copy manuals shall be bound and covered and be 9 inch by 12 inch in size. Provide a table of contents and

one section for each item of equipment specified herein. All pages shall be nearly assembled and fit within the manual cover.

- B. For each section provide the following information, as applicable:
1. An itemized list of all data provided.
 2. Name and location of the manufacturer, the manufacturer's local representative, the nearest suppliers, and spare parts warehouse.
 3. Recommended installation, adjustment, start up, calibration, and troubleshooting procedures.
 4. Recommended lubrication, lubrication intervals, and an estimate of yearly quantity needed.
 5. Recommended step-by-step procedures for all modes of operation.
 6. Complete internal and connection wiring diagrams.
 7. Recommended preventive maintenance procedures and schedule.
 8. Complete parts lists, by generic title and identification number, with exploded views of each assembly.
 9. Recommended spare parts and special tools.
 10. Disassembly, overhaul, and reassembly instructions.
 11. All approved shop drawing information pertinent to facility operation and maintenance.
 12. Equipment calibration data, calibration sheets including equipment/instrument description.
 13. Approved submittal information.
 14. PLC program with notes and operation description with setpoint table.
- C. Record (as-built) submittal information covering all Contractor supplied equipment.
- D. As-built drawings, containing complete wiring diagrams, shall be submitted with the Operation and Maintenance manuals described above.
- E. As built [Contract Document] Drawings shall be marked with red pencil to show electrical work revisions and actual routes of embedded or buried conduit, which may differ from the Drawings. Refer to the General Conditions for additional requirements.
- F. Test results/reports shall be contained within the Operation & Maintenance manual and shall be placed under each respective equipment item tested.

1.8 AS BUILT RECORD DRAWINGS

- A. The Contractor shall keep an accurate legible record of all changes and conduit relocations made during construction and shall make up a separate legible record copy of Contract Drawings at completion of the project. A working copy of as-built drawings shall be maintained on site at all times during construction.

1.9 INTERPRETATION OF DRAWINGS

- A. Any error or omissions of detail in either the drawings or the specifications shall not relieve the Contractor from correctly installing all materials necessary for complete and operating electrical system.
- B. The Contractor shall inspect the site and verify all measurements and conditions and shall be responsible for the correctness of same. No extra compensation will be allowed because of differences between work shown on the drawings and measurements at the site.
- C. The electrical drawings are diagrammatic, but shall be followed as closely as existing conditions and work of other contractors will permit. All deviations from the drawings required to make the work conform to structures as constructed, and to the work of others, shall be made at the Contractor's expense.
- D. The Contractor shall examine the civil, structural, mechanical, architectural and manufacturer's drawings for the various equipment in order to determine exact routing and final terminations for all conduits and cables. Conduits shall be stubbed up as near as possible to equipment enclosure.

1.10 LOCATIONS AND ENCLOSURES

- A. Provide equipment, materials, and wiring methods suitable for the type of locations in which they are located.
- B. Definitions of types of locations and types of enclosures to be provided:
 - 1. Dry locations: All indoor areas that do not fall within the definitions below for wet, damp, hazardous, nor corrosive locations and which are not otherwise designated on the drawings. Provide NEMA 1A or NEMA 12 enclosures.
 - 2. Wet locations: All locations exposed to the weather, whether under a roof or not, unless otherwise designated on the drawings. Provide NEMA 3R enclosures
 - 3. Damp locations: All indoor [or outdoor] spaces wholly or partially underground, or having a wall or ceiling forming part of a channel or tank, over or near water areas, or any area subject to water spray, unless otherwise designated on the drawings. Provide NEMA 4X (316 SS) enclosures.
 - 4. Corrosive location: Areas where chlorine or sulfur dioxide gas under pressure, sulfuric acid or liquid polymer are stored or processed. Provide NEMA 4X (non-metal) enclosures.
 - 5. Below grade locations: All electronic or otherwise equipment sensitive to moisture or flooding shall be mounted in a NEMA 6P rated enclosure.

1.11 MATERIAL AND EQUIPMENT INSTALLATION

- A. All equipment shall be located and installed so that it will be readily accessible for operation and maintenance. The OWNER reserves the right to require minor changes in location of outlets or equipment, prior to roughing in, without incurring any additional costs or charges.
- B. All electrical equipment and appurtenance facilities, which are separately mounted or anchored, shall be so installed as to be in conformance to all requirements of the Uniform Building Code, latest edition, both for vertical and seismic loading. Provide housekeeping pads for floor or pad mounted equipment.
- C. Follow the manufacturer's installation recommendations unless otherwise indicated. Keep copy of the manufacturer's installation instructions available on the job site for review at all times.

1.12 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, partitions, 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.

1.14 UTILITY COORDINATION

- A. Coordinate the new electrical service at the tank site.
 - 1. The Contractor shall pay all costs for utility work shown on the Plans and described in the Specifications. The Owner will pay all fees charged by PG&E for new service. The Contractor shall coordinate the completion of forms, even where the Owner is filling out the majority of the form. The Contractor is responsible for providing trenching, conduit, concrete encasement, risers, transformer pads, pullropes, poles, pull sections and meter sections per PG&E requirements. The Contractor is responsible for coordinating inspections, site visits and all paperwork to completion.
- B. Provide temporary power during construction. Remove temporary power equipment at end of the project.

1.15 INSPECTION

- A. The Contractor shall cooperate with the Engineer and shall provide assistance at all times for the inspection of the electrical work. Remove covers, operate machinery, or perform

any reasonable work, which in the opinion of the Engineer, will be necessary to determine the quality or adequacy of the work.

- B. If any material does not conform with these specifications the Contractor shall, within three days after being notified by the Engineer, remove the materials from the premises.
- C. Work shall not be closed in or covered before inspection and approval by the Engineer. Cost of uncovering and making repairs where uninspected work has been closed in shall be borne by the Contractor.

1.16 SUPERVISION AND WORKMANSHIP

- A. The Contractor shall employ a competent electrical foreman on the job throughout the entire period of construction to see that his work is carried on without delay and completed as rapidly as possible.
- B. Before the start of construction and in conjunction with the schedule of other Contractors, the Electrical Sub-Contractor shall furnish to the Engineer a tentative construction schedule showing the order of the work, the motor control center shop drawings submittal dates, scheduled manufacturing dates, and the anticipated delivery dates.

1.17 COOPERATIVE WORK WITH OTHERS

- A. The Contractor shall cooperate with others, with due regard to their work, towards promotion of rapid completion of project. If any cooperative work must be altered due to lack of proper supervision of such, or failure to make proper provision in time by Contractor, then he shall bear expense of such changes as necessary to be made in work of others.
- B. Labor and materials, including templates, sleeves, anchors, concrete inserts and the like shall be furnished in ample quantities at such times as necessary to ensure uninterrupted progress of work.
- C. Contractor shall cease work at any particular point temporarily and transfer his operations to such points or execute such portions of work as directed, when in the judgment of the Engineer it is necessary to do so.

PART 2 PRODUCTS

2.1 ANCHORS AND FASTENERS

- A. Fasteners and anchors for securing equipment to walls, floors and the like shall be galvanized steel. When fastening to walls, floors, and the like, provide capsule anchors, not expansion shields. Size capsule anchors to meet load requirements.

- B. Where seismic calculations have been submitted and approved, provide recommended fasteners and anchors.
- C. Where manufacturer provide specialty braces to meet seismic requirements for their equipment, install the braces per the manufacturers' recommendations.

2.2 EQUIPMENT IDENTIFICATION

- A. Switchboard and motor control center components, starters, control panels, internal control panel components, all disconnect switches and circuit breakers, transformers, push buttons, controls, instruments, boxes, etc. shall be properly identified with a descriptive nameplate. Nameplates shall be made of 1/6 inch laminated plastic with black background and white letters. Size of letters shall be 1/4 inch high, minimum. Letters shall be machine engraved. All nameplates shall be screw mounted with oval head machine screws tapped into metal. Adhesive material shall not be used. Every cubicle in the motor control center shall be provided with a nameplate with 1/2" high lettering.

2.3 SPARE PARTS, CONSUMABLE ITEMS, AND TOOLS

- A. The contractor shall supply all spare parts prior to functional acceptance test. All parts shall be sealed in plastic bags and delivered to the site in a heavy-duty plastic storage box.
- B. In addition to spare parts described elsewhere in these Specifications, provide:
 - 1. Fuses. Provide 20 percent of each size and type used rounded to the next whole number, but no less than three of each size and type.
 - 2. Indicating Lamps. Provide 20 percent of each size and type used rounded to the next whole number, but no less than 10 of each type.

PART 3 EXECUTION

3.1 CLEANING

- A. After all other work has been accomplished motor control centers, starters, panelboards, and all other electrical equipment shall be cleaned of all dust, dirt, grease, plaster, paint or other marks, by the Contractor. All switchboards and motor control centers shall be "touch-up" painted to match original colors.

3.2 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 Specification operate safely and meet the requirements of these Specifications: reference the General Conditions, Specification Section 1010,

Division 16 and Division 17. The Contractor shall provide labor, instruments, and other material to complete the tests.

1. Perform the Operational Readiness Test and Functional Acceptance Test.
2. Perform independent testing services for the electrical system prior to Functional Acceptance Test.
3. Perform other specific test required by Specification Sections in Divisions 16 and 17.
4. Perform support activities for the final facilities, described throughout the Specifications (i.e. additional factory and field testing).

B. Independent Testing Services

1. The Contractor shall provide the services of an independent testing service. The independent testing service shall certify the electrical equipment and installation.
2. Testing methods shall be in accordance with NETA standards for Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
3. As a minimum, the main switchboard, main service disconnect, ground fault detection equipment, solid-state breakers, transformers and ground system shall be tested.
4. Certified test results shall be submitted for review.

C. Operational Readiness Test (ORT)

1. Point-to-Point Wire Check. 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. Perform a 750 volt megger test on all 600 Volt class control and power wiring. The Engineer shall be notified at least 1 week prior to the insulation test so that the testing maybe witnessed.
3. Motor Test. Submit test data showing (for every motor): Perform a winding resistance check of each phase. Amperes in each phase with motor loaded; motor nameplate amperes; Thermal overload element rating and catalog number. At time of test record voltage at switchboard for all three phases. Check for correct rotation of mechanical equipment.
4. Control System Test. Test the PLC hardware, terminations and control strategy and enter all setpoints. Refer to Section 17330, SCADA and Controls for additional specific testing requirements.
5. Communication System Test. Test the communication systems.
6. Generator Testing. Test the onsite power generation system, including the standby engine generator and transfer switch.

D. Functional Acceptance Test (FAT)

1. The Contractor shall perform the FAT after he has delivered written notice to the Engineer that the ORT has been completed.
2. The Contractor shall inform the Engineer at least 2 weeks prior to the FAT so that the Engineer may witness the test.
3. 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.
4. If any equipment or system fails the FAT, the Contractor shall correct the problem and shall repeat the test until it is successful.
5. The FAT shall be performed in the presence of the Engineer.

E. Final System Testing

1. Provide resources and personnel, on site, as necessary, to support the effort required to complete testing of the facility in a timely manner.
2. Resources include testing equipment, two way radios and tools.
3. Personnel include an electrician and a control system start-up technician.

3.3 TRAINING

- A. The Contractor shall provide eight man-hours for general training of the operation of the electrical and control systems to OWNER personnel.
- B. Instructions shall consist of the functional description of each piece of equipment, including calibration and setting of set points. Demonstration of the operation of each system shall be included.
- C. The Contractor shall provide all manuals and study materials required for the training of OWNER personnel.

3.4 WARRANTY

- A. The Contractor shall leave the entire electrical system in proper working order and shall, at his own expense, replace any work, material, or equipment furnished by him which develops defects within one year from the date of acceptance.
- B. The PLC supplier shall have a staff of experienced personnel available to provide service on 2 working days notice during the warranty period. Such personnel shall be capable of fully testing and diagnosing the hardware and software delivered; and of implementing corrective measures.

- C. If the PLC supplier fails to respond in 2 working days, the OWNER at its option will proceed to have the warranty work completed by other resources; the total cost for these other resources shall be reimbursed in full by the Contractor. The use of other resources, as stated above, shall not change or relieve the Contractor or supplier from fulfilling the remainder of the warranty requirements.
- D. Prior to "final acceptance", the Contractor shall furnish to the Engineer a listing of warranty information for all manufacturers of materials and equipment used on the project. The listing shall include the following:
1. Manufacturer's name, service contact person, phone number, and address.
 2. Material and equipment description, equipment number, part number, serial number, and model number.
 3. Manufacturers warranty expiration date.
 4. Completed test forms.

****END OF SECTION****

SECTION 16110

RACEWAY AND FITTINGS

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. The work under this section includes all equipment, labor and material necessary to furnish and install a complete raceway system including fittings, boxes and supports.
- B. Raceway shown in the schedule with multiple conduits shall be used for installing different types of conductors; for example power (120, 208, 240 and 480 VAC) conductors in the first conduit, control (discrete 24 and 120 VAC) conductors in the second and signal (analog 4-20 mA, 24 VDC and other instrumentation) conductors in the third.

1.2 QUALITY ASSURANCE

- A. All raceway shall comply with applicable standards of the Underwriter's Laboratories, Inc.
- B. Conduits, entering the bottom of pad mounted equipment under enclosure structural members design to be flush with the pad, shall be removed, reworked and reinstalled properly, so the conduit enters the manufacturer's recommended conduit area, unobstructed. These modifications to conduit and pad shall be at the Contractor's expense.
- C. Do not cut, bend or deform, switchboard, motor control center, control panel or equipment enclosure steel to accommodate conduits.

1.3 SUBMITTALS

- A. The Contractor shall submit, in accordance with the requirements of Section 16010 the following materials and information:
 - 1. A list of materials to be furnished, the name of the suppliers and the date of delivery of materials to the site.
 - 2. Catalog data sheets and manufacturer's information all equipment described in this Specification Section.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and equipment to project site in manufacturer's original packaging with labeling showing product name, brand, model, project name, address, and Contractor's name. Store in a location as agreeable with Site Engineer, secure from weather or accidental damage.

PART 2 PRODUCTS

2.1 CONDUIT

A. Rigid Steel Conduit (RSC)

1. Rigid steel conduit shall be hot dip galvanized on the exterior and may be zinc or enamel on the interior.
2. Couplings, locknuts, and all other fittings shall be hot dip galvanized. All couplings and locknuts shall be of the threaded type only.
3. Bushings for standard weight rigid steel conduit shall be non-metallic for 1 inch and smaller. For conduits larger than 1 inch, insulated metallic bushings shall be used.
4. Provide large radius elbows and LBs when entering existing buildings, pedestals and enclosures.

B. Plastic Coated Rigid Steel Conduit (PCRSC)

1. Plastic coated rigid steel conduit and fittings shall be hot dip galvanized prior to the plastic coating. The galvanized surfaces shall be coated with an epoxy-acrylic primer before plastic coating. The plastic coating shall be applied by the dip method. Minimum thickness of the exterior coating shall be 40 mils. The interior of conduit and fittings and all male threads shall be coated with 2 mils of urethane. PCRSC shall be manufactured by Rob Roy, Ocal or equal.
2. Couplings, locknuts, and all other fittings shall be hot dip galvanized and plastic coated. All couplings and locknuts shall be of the threaded type only. All couplings shall have longitudinal ribs 40 mils in thickness. Condulets shall be supplied with stainless steel screws. All screws shall be encapsulated in plastic.
3. Enclosure sealing hubs shall be similarly coated and be manufactured by Meyers type or equal.
4. Bushings for standard weight rigid steel conduit shall be non-metallic for 1 inch and smaller. For conduits larger than 1 inch, insulated plastic coated metallic bushings with grounding connection, where required, shall be used.
5. All damaged coatings shall be repaired according to the manufacturer's instructions.

C. Flexible Metallic Conduit (Flex)

1. Flexible metallic conduit shall be hot dipped galvanized steel.
2. Neoprene jacketed flexible metallic conduit shall be used in all damp or weatherproof locations where flexible conduit is required.
3. Fittings for flexible metallic conduit shall be hot dipped galvanized or sheradized, squeeze type. Fittings which use a screw to bind against tubing will not be accepted. Fittings for neoprene jacketed flexible conduit shall be of the screw in type.

D. Flexible Non-Metallic Conduit (NMFlex)

1. Flexible non-metallic conduit and fittings shall be heavy duty PVC. Conduit shall consist of PVC spiral surrounded by flexible PVC.
2. Flexible non-metallic conduit shall be liquid tight and fittings shall be corrosion resistant with stainless steel retaining rings. Provide sealing gaskets at all threaded connections. NMFlex shall be manufactured by Thomas and Betts or equal.

E. Polyvinylchloride Conduit (PVC)

1. PVC Conduit shall be rigid heavy weight type, Schedule 40 when encased in concrete or schedule 80 when exposed or not encased in concrete. PVC conduit shall be supplied complete with PVC fittings. PVC conduit shall be manufactured by Carlon or equal.

F. Electrical Metallic Tubing (EMT) is not allowed on this project.

2.2 CONDUIT SUPPORTS

- A. Pipe hangers for individual conduits shall be factory made, consisting of a pipe ring and threaded suspension rod. The pipe ring shall be malleable iron, split and hinged, or shall be spring-able steel. Rings shall be bolted to or interlocked with the suspension rod socket.
- B. Pipe racks for groups of parallel conduits shall be constructed of galvanized structural steel preformed channels of length as required. Racks or channel shall be suspended on threaded rods and secured with nuts above and below the cross bar or bolted to concrete walls with stainless steel anchors.
- C. Pipe straps shall be the two piece bolted type. Pipe straps shall be coated to be compatible with the conduit (and coating) installed.
- D. Conduit support components shall be manufactured by Unistrut, B-line or equal

2.3 CAST BOXES

- A. Cast boxes shall be galvanized, threaded, cast malleable iron. Cast boxes shall be manufactured by Appleton, Feraloy, Crouse-Hinds, type FS or FD, or equal. Hub arrangements on threaded fittings shall be the most appropriate for the conduit arrangement required in each case to avoid unnecessary conduit bends and fittings.
- B. Use plastic coated cast boxes with plastic coated conduit.

2.4 UNDERGROUND VAULTS, PULLBOXES AND HANDHOLES

- A. Provide underground vaults, pullboxes and handholes, where shown on drawings or required by length of conduit runs. Underground vaults and pullboxes shall be pre-fabricated concrete type shall be manufactured by Christy Concrete Products, Brooks or equal. All pullboxes shall have standard brass holddown bolts and hardware. Vaults and boxes located in paved areas or other areas over which vehicles normally may travel shall have traffic covers. All covers shall be labeled appropriately, i.e. ELECTRICAL, SIGNAL, TELEPHONE, etc... Provide cable supports in vaults and large boxes. Cable supports, saddles, arms, and racks mounted in pullboxes shall be manufactured by Underground Devices or equal.

2.5 WIRE GUTTERS

- A. Wire gutters shall be NEMA 4 with neoprene gaskets on the hinged doors or removable covers. Box and gutter sizes, metal thickness, and installation details shall comply with the National Electrical Code. Wire gutter shall be manufactured by Hoffman or equal.

2.6 DUCT SEAL

- A. Duct seal shall be non-hardening compound designed for sealing between conduit and electrical cable. Duct seal shall be manufactured by O.Z., Gedney DUX or equal.

PART 3 EXECUTION

3.1 INSTALLATION

- A. General. Unless otherwise specified or indicated, wiring shall consist of insulated conductors installed in raceways of the types indicated. Provide pullboxes or conduit bodies in addition to those shown on the Drawings to limit the number of bends as required by the NEC.
 - 1. Minimum size conduit installed on this project shall be 3/4 inch.
 - 2. Use the following types of conduit for the locations listed, unless indicated otherwise:
 - a. Use galvanized rigid steel conduit (GRS) for all exposed, dry locations.

- b. Use plastic-coated steel conduit (PCRSC) outdoors in wet and damp locations, and below grade for direct-buried conduit where sand encased.
- c. Use rigid polyvinyl chloride (PVC) conduit for concealed locations, for embedded conduit and conduit installed below grade in concrete encased duct banks, except use plastic coated steel conduit (PCRSC) at least 5 feet on both sides of penetrations through building footings and outside walls, under equipment mounting pads, where embedded in exterior light pole foundations, and where conduit changes from underground to exposed or from embedded to exposed.
- d. Use liquidtight flexible metal conduit (flex) with steel fittings 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.
- e. Electrical metallic tubing (EMT) shall not be used on this project.

B. Conduit Installation

1. Conduit system installation shall meet or exceed the requirements of the 2014 NEC. Raceways shall be concealed or exposed, as indicated, and shall be at least 6 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. 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. Do not install crushed or deformed raceways. Avoid traps in raceways where possible. Take care to prevent the lodging 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 dust tight conduit seals until the time for pulling wires. In block walls, do not run conduit in the same horizontal course with reinforcing steel.
2. Install bushings on the ends of all conduits, except where conduits terminate in threaded hubs on cast boxes or cabinets. Provide plastic inserts where conduits terminate in threaded holes in cast boxes. 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.
3. All conduit supports, fasteners, and accessories for metal conduit shall be galvanized steel.
4. 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.
5. Install and equip conduit, boxes, and fittings installed outdoors or in other wet or damp locations so as to prevent water from entering the conduit. Provide sealing hubs. Do not run conduit in equipment foundation pads.
 6. Provide a suitable seal inside each conduit or raceway entering buildings and structures, raceways entering boxes and enclosures in wet or hazardous location. Empty ducts and conduits shall be identified at both ends and shall be capped and provided with a 1/8-inch-minimum nylon cord, unless noted otherwise.
 7. The Contractor shall run a mandrel through all unexposed conduits immediately prior to wire or pullstring installation to ensure conduits are clear of debris and foreign objects.
 8. For PVC conduit, use factory-made ells where applicable. Use approved heating methods for forming all other bends (less than 12 degrees). Provide expansion joints as required or 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.
 9. 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. Where slabs are on grade, install conduit beneath the slab and not in the slab. Where ells are required to penetrate floor slabs, the ells shall be galvanized rigid steel conduit.
 10. Where conduit size is 4 inches or less, final connection to motors, motor heaters, wall- or ceiling-mounted fans and unit heaters, 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 to 36 inches, unless otherwise approved by the Engineer.
 11. Flexible conduit shall never be used as a ground. 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.
 12. Exposed conduit shall be neatly installed parallel to or at right angles to the structural members.
 13. Exposed conduit stubbing up through the floor into the bottom of exposed panels, cabinets or equipment shall be lined up, properly spaced and shall be straight and plumb. Conduits shall be installed at sufficient depth below the floor to eliminate any part of the bend above.
 14. Maintain at least 12 inches of separation between conduits carrying power and instrumentation cables.
 15. Provide a suitable seal inside each conduit or raceway entering buildings and structures, raceways entering boxes and enclosures from chemical storage rooms.

Seal inside the conduit with oakum or suitable plastic expansible compound to prevent passage of insects, rodents, gasses, and liquids.

16. Where flexible equipment chords are utilized for final connection to equipment use a compression type seal fitting. Crouse-Hinds CGB or equal.

C. Underground and Embedded Conduit

1. In general, trenches with two or more underground conduits shall be red concrete-encased PVC conduits (duct bank). In general, a single underground conduit in trench shall be sand encased PVC coated rigid steel conduit (PCRSC). Conduit under concrete slabs and foundations may be PVC conduit with PVC coated rigid steel conduit transitions and risers. Underground conduits provided for utility company cabling shall meet the requirements of the serving utility
2. Except as otherwise indicated, underground and embedded conduit shall be 24 inches deep, 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.
3. Separate parallel runs of four or more conduits in a single trench or embedded duct bank 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.
4. Groups of conduit shall be arranged substantially as shown on the Drawings, but minor changes in location or cross sectional arrangement 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.
5. All underground conduit shall be mandrelled prior to pulling wires/cables

D. Trenching and Backfill

1. Unless otherwise noted, conduit shall have a minimum cover of 24 inches. Trench bottoms shall be free of rocks and other hard objects. For direct buried cable and when rocks that cannot be removed are encountered at the trench bottoms, sand bedding material shall be used for a depth of 3 inches below the conduit. In any case, bedding material shall be used for the zone 6 inches above the direct burial conduit.
2. Bedding material shall contain no rocks larger than 3/4 inch in diameter and shall be free from roots and debris.
3. Where conduit trenches are located in roads or in structural backfill, the compaction requirements shall be as required by the agency that has jurisdiction 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 as required by the Specifications.

4. 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.
5. Conduit trenches in paved or improved areas shall be installed and backfilled before the area is paved or improved.
6. 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. Unless covered by other sections of the Specifications, paving shall be replaced in accordance with the original paving Specifications.
7. All existing improvements damaged as a result of the Contractor's operation shall be reconstructed by the Contractor at no cost to the Owner.

E. Penetrations

1. Penetrations may be cast in place or run through blockouts or holes, except where waterproof penetrations are required. Dry pack with nonshrink 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, or equal.

F. Boxes

1. Provide each outlet in the wiring or raceway systems with an outlet 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. Boxes must be accurately placed for finish, independently and securely supported by manufactured box hangers. Fixture outlets shall be located symmetrically.
 - a. Install cast boxes outdoors, in wet or damp locations, with exposed

conduit and with embedded and buried conduit. Cast boxes installed with threaded conduit shall have threaded hubs. Cast boxes installed with PVC or plastic coated conduit shall be similarly coated.

- b. Boxes in concealed conduit systems, other than in cast-in-place concrete and exterior faces of walls or where weatherproof devices are required, shall be galvanized or cadmium plated steel.
2. Underground pullboxes shall be sized by contractor in accordance with NEC. Underground pullboxes shall be precast concrete type as shown on the Drawings complete with steel traffic covers, extension rings and concrete bases. Entire box shall be sealed to prevent entrance of mud and rainwater. Conduits shall enter box horizontally, not vertically. Conduit entry shall be grouted in place with approved insulated bushings. Seals shall be installed in conduits around conductors to prevent water from entering the conduit system.
3. Unless otherwise shown on the Drawings, 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. Where boxes are flush mounted in walls, if not embedded in concrete, the hole shall be no larger than required to receive the box. Set flush-mounted sheet steel boxes flush with the finished surface, providing them with suitable extension rings or plaster covers as required. Mounting hardware in industrial areas shall be galvanized.

3.2 ELECTRICAL CONTINUITY

- A. The entire electrical raceway system shall form a continuous metallic electrical conductor from service point to every outlet and shall be grounded by connection to the main service ground.
- B. Rigid steel conduit shall have threads filled with conductive sealant before screwing into fittings.
- C. A ground wire shall be installed in all conduits.

3.3 CONDUIT IDENTIFICATION

- A. All conduits containing power, controls, feeders, alarms, instrumentation and communication wiring shall be identified at each end, transitions from underground or above ground and in pullboxes and vaults. Labels shall be permanent, waterproof, legible, non-metallic and attached with nylon fastener or stainless steel wire. Manufactured by Thomas & Betts, Panduit, or equal.

- B. All conduits shall be labeled with type, number and destination. The conduit type and number shall be separated from the destination with a slash (/). Conduit tags shall be where they can be read without having to open instruments and instrument cabinets.
- C. Conduit shall be designated with an alpha character prefix denoting the predominant type of wiring in the conduit:

- A "P" for power.
- A "S" for instrumentation
- A "C" for control
- A "G" for grounding.
- A "X" for spare.
- A "D" for data and communication
- A "T" for telephone.

Control wire shall include 120 VAC and 24 VDC discrete PLC inputs and outputs.

Conduit numbers shall be two to four alphanumeric characters in length based upon the conduit schedule.

3.4 TRENCH SETTLING

- A. If at any time during a period of one year dating from the date of final acceptance of the project, there shall be any settlement of conduit trenches, the Engineer may notify the Contractor to immediately provide additional fill and to make such repairs or replacements in paving, planting, or structures, as may be deemed necessary at the Contractor's expense.

3.5 TRENCHING:

- A. Verify the location of all existing cables, conduits, piping, and other equipment in or near the areas to be trenched, prior to starting trenching. Repair any equipment damaged during trenching. Trenches shall not be left unattended unless the area is fenced or barricaded to restrict entry to the area. Call an Underground Service firm before trenching.

3.7 TESTING

- A. After installation has been completed, Contractor shall conduct tests required by Section 16010, General Requirements, Electrical.

****END OF SECTION****

SECTION 16120

WIRE AND CABLE

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required to install wire and cable for a complete operable electrical system as shown on Drawings.

1.2 QUALITY ASSURANCE

- A. All wire and cable shall comply with applicable standards of the Underwriter's Laboratories, Inc.
- B. Conductors, including insulation, cabling, jacket, filler, shielding, covering, and testing, shall meet applicable requirements of IPCEA and NEC.

1.3 SUBMITTAL

- A. Submit complete description of all power, signal, communication and instrumentation cables including name of the manufacturer, type of insulation, type of conductor, and size and catalog number of control, instrument signal cables.
- B. The Contractor shall submit, in accordance with the requirements of Section 16010 the following materials and information:
 - 1. A list of materials to be furnished, the name of the suppliers and the date of delivery of materials to the site.
 - 2. Catalog data sheets and manufacturer's information all equipment described in this Specification Section.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and equipment to project site in manufacturer's original packaging with labeling showing product name, brand, model, project name, address, and Contractor's name. Store in a location as agreeable with Site Engineer, secure from weather or accidental damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS LABELING

- A. Electrical conductors shall be delivered to the job site plainly marked or tagged on 24 inch centers as follows:
 - 1. Underwriters Laboratories Label
 - 2. Gauge
 - 3. Voltage
 - 4. Kind of Insulation
 - 5. Name of Manufacturer
 - 6. Trade Name
- B. Conductor labels shall be white PVC tubing with machine printed black marking. Tubing shall be sized to fit conductor insulation. Adhesive strips are not acceptable.
- C. Labels shall be manufactured by Panduit, Thomas & Betts, or equal.

2.2 POWER AND CONTROL CONDUCTORS

- A. Insulation for all conductors shall be rated at 600 Volts.
- B. All wiring shall be type XXHW or THWN/THHN unless shown otherwise.
- C. All conductors shall be sized for operation at 75 degrees C maximum operating temperature.
- D. Unless specifically noted otherwise herein, all conductors for general wiring shall be a minimum of 98% conductivity, stranded, soft drawn copper. Aluminum or aluminum alloys are not acceptable.
- E. 120 Volt control conductors may be #14 AWG, and shall be stranded.

2.3 SPECIALTY CABLES

- A. Instrumentation signal cables shall be of the type used for process control with twisted shielded pairs (TSP) of triads with PVC jacket an overall shield over the multiple pairs or triads. Two conductor (pair) cable shall have black-clear insulation, three conductor cable shall have black-red-clear insulation. The instrumentation cable shall be rated 600 Volts at 60 degrees C or better. The size of the instrumentation cable shall be AWG No. 18 with seven strands minimum. All instrumentation cables shall be UL listed. Shield shall be an aluminum-backed synthetic material providing 100-percent shielding, with a copper drain wire. The cable shall be rated 90 degrees C minimum. Twisted shielded pair (TSP)

cable shall be manufactured by Belden, Alpha or equal.

- B. Telephone Cable (TIC) shall consist of 2 to 12 pairs with 24 AWG conductors of soft bare copper. Conductors shall have thermoplastic compound insulation and shall be color coded per the telephone industry standards. The entire cable assembly shall have an outer jacket of black polyethylene that is resistant to abrasion, moisture, weather and environmental cracking. Cable shall be suitable for installation in conduit or direct burial and shall be manufactured by Alpha, Belden or equal.
- C. Data cable (Cat 6) shall consist of 4 bonded pairs, each pair shielded, with 23 AWG conductors of soft bare copper and drain wire. Conductors shall have thermoplastic compound insulation and shall be color-coded per the telephone industry standards. The entire cable assembly shall contain a foil shield and have an outer jacket of black polyethylene that is resistant to abrasion, moisture, weather and environmental cracking. Cable shall meet the requirements for Category 6 data transmission cable, be suitable for installation in conduit or direct burial and shall be manufactured by Alpha, Belden or equal. Data outlets shall be rated Category 6 shielded. Termination methods shall be similarly rated.
- D. Coaxial Cable (Coax) Cable shall be sized for length of run and application. Cable shall be suitable for installation in conduit and outside in free air, exposed to the elements: it shall be watertight. The cable shall be manufactured by Times Microwave, Series LMR or equal.
- E. Other specialty cables shall be provided by the manufacturer of the equipment or instrument they connect to.

2.4 PULLING LUBRICANT AND ROPES

- A. Wire pulling lubricant shall be "Flax-soap", "minerallac" or equal.
- B. Pullropes shall be 3/16" stranded nylon rated for 800 lbs.

2.5 CONNECTION

- A. Motor connection and splice kits shall be 3M series DB or equal.
- B. Wire nuts for joints, splices and taps for conductors #8 and smaller shall consist of a cone shaped expandable coil spring insert, insulated with a teflon or plastic shell. Threaded or crimp types will not be accepted. All wire nuts shall be taped. Use "Skotchlock", "Hydent", or equal.
- C. Lugs and connectors for conductors #6 and larger shall be compression types of one piece tubular construction with flat rectangular tongues. Two hole lugs shall be used for sizes 4/0 and larger. Fittings for copper conductors shall be tin-plated copper.

- D. Electrical tape shall be UL approved plastic.
- E. Splices shall not be installed in raceway. Splice wires in approved boxes or condulets only.

2.6 GROUNDING WIRE

- A. Ground wires, number 1/0 AWG or larger shall be tinned stranded bare copper cable. All smaller ground wires shall be insulated with green color insulation.

PART 3 EXECUTION

3.1 CLEANING

- A. All debris and moisture shall be removed from both new and existing raceways, boxes, and cabinets before installing wire or cable.

3.2 PULLING

- A. No oil, grease or similar substances shall be used to facilitate the pulling in of conductors. Use a specifically approved wire pulling compound.
- B. No wire or cable shall be pulled in until all construction, which might damage insulation or fill conduit with foreign material is completed.
- C. Wire shall be pulled into conduits with care to prevent damage to insulation, using basket pulling grips to avoid slipping of insulation on conductors. Nylon rope or other "soft" surfaced cable must be used for pulling in conduits other than steel.

3.3 CONNECTIONS

- A. Use a kit for motors with #8 and larger feeder conductors.
- B. Joints, splices and taps in dry locations for feeder conductors #10 and smaller shall be made with twist-on connectors suitably sized for the number and gauge of the conductors.
- C. Furnish and install proper lugs in all panelboards, pedestals and gutters as required to properly terminate every cable. Where paralleled conductors, or conductors of large size are to terminate on a breaker, a short length of copper cable (of capacity of the breaker) shall be connected to the breaker, and the proper compression type lug installed to connect this cable to the feeder cable. The cutting of cable strands to fit the breaker will not be permitted.

- D. Only crimping tools approved by the manufacturer of the terminals or lugs shall be used.
- E. Uninsulated lugs and wire ends shall be insulated with layers of plastic tape equal to insulation of wire. Wire in pedestals, panels, cabinets, pullboxes and wiring gutters shall be neatly grouped together with cable ties or other methods acceptable to the Engineer.
- F. In underground location, joints, splices and taps shall be insulated by the "Skotchcast" epoxy-resin method. In-line splices may be insulated by approved waterproof "shrink tube" method. Splices shall be made if specifically approved by the City (on a case by case basis).
- G. In panels, pullboxes, gutter, etc. conductor shall be neatly fanned out and tagged with wire markers. Conductors installed as part of this project but for connection to equipment to be installed in the future shall be 50% longer than the estimated final connection length, neatly coiled and sealed for storage in the equipment=s respective pullbox.
- H. At outlets, junction boxes, pullboxes, fittings, etc., conductors shall be looped or pigtailed to extend at least six inches without splice beyond such wiring enclosures, and where used, pigtails added to loops for connection to fixtures or devices shall be at least six inches long.
- I. Conduit shall be capped during construction by means of manufactured conduit seals or caps to prevent entrance of water or debris, and shall remain closed until ready for use
- J Splices shall not be installed in raceway. Splice wires in approved boxes or condulets only.
- K. In general, avoid splices on all cables run into the wet well. All terminations shall be on terminal blocks in an appropriate enclosure.

3.4 COLOR CODING AND LABELING

- A. Color Coding of Low-Voltage Building Wire: Provide color coding throughout the entire network of feeders and circuits (600 volts and below) as follows:

<u>Phase</u>	<u>120/208(or 240) Volts</u>	<u>277/480 Volts</u>
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Gray
Ground	Green	Green

1. AC control wire shall be red or pink.
 2. DC control wire shall be light blue or violet.
 3. DC power supply wires shall be red. DC analog signal wires shall be black if positive and white (or clear) if negative. DC system signal commons shall be white.
 4. Equipment grounds shall be green.
- B. In addition to color coding, all power, control, and alarm wiring shall be numbered and identified by means of wire markers at all switchboards, MCCs, panelboards, auxiliary gutters, junction boxes, pull boxes, receptacle outlets, light outlets, manholes, disconnect switches, and circuit breakers. These markers shall correspond to numbers on shop drawings and wiring diagrams. Wire markers shall consist of machine engraved numbers applied by an approved marking device. Provide Brady heat shrink labels or equal.
1. All individual conductors shall be labeled origin, destination and sequence number. The information shall be separated by slashes (/). The origin and designation shall be designated with the names shown on the Contract Documents. The sequence number shall be a unique sequential number for that particular cable run. At the PLC wire labels shall include the rack, slot and terminal number.
 2. Multi-conductor cables shall be labeled origin, destination and sequence number. The information shall be separated by slashes (/). The origin and designation shall be designated with the names shown on the Contract Documents. The sequence number shall be a unique sequential number for that particular cable run. Twisted shielded cables shall be considered multiconductor cables.

3.5 SEALING CONDUCTORS IN CONDUITS

- A. All conduits containing conductors shall be sealed as the conduit enters motor control centers, pull boxes and vaults. Power conductor, control conductors, and instrumentation conductors shall be bundled and supported separately and independently in pullboxes.
- B. All conduits entering chemical storage rooms shall be sealed.

3.6 TESTING

- A. After installation has been completed, Contractor shall conduct tests required by Section 16010, General Requirements, Electrical. Contractor shall furnish necessary instruments and personnel required for testing.

****END OF SECTION****

SECTION 16150

MISCELLANEOUS ELECTRICAL EQUIPMENT

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required, and install, complete ready for operation, and field test the miscellaneous electrical equipment as shown on the Drawings and/or specified herein.
- B. Provide utility metering equipment as described in the Specifications and shown on the Drawings. Provide and install all service entrance equipment, cabinets, vaults, pads, pull boxes, raceways, risers, supporting structures, conduit, concrete encasement, pullropes and conductors as required by the serving utilities.

1.2 QUALITY ASSURANCE

- A. All equipment and components shall comply with applicable standards of the Underwriter's Laboratories, Inc.
- B. Provide enclosures suitable for the type of location in which they are located per Specification Section 16010, General Requirements, Electrical

1.3 SUBMITTAL

- A. The Contractor shall submit, in accordance with the requirements of Section 16010 the following materials and information:
 - 1. A list of materials to be furnished, the name of the suppliers and the date of delivery of materials to the site.
 - 2. Catalog data sheets and manufacturer's information for all equipment covered by this Specification Section.
- B. Submit metering equipment and devices to the utility company in compliance with their requirements.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials and equipment to project site in manufacturer's original packaging with

labeling showing product name, brand, model, project name, address, and Contractor's name. Store in a location as agreeable with Site Engineer, secure from weather or accidental damage

PART 2 PRODUCTS

2.1 TERMINAL BLOCKS

- A. Terminal blocks shall be side entry, snap-in type for mounting on DIN rail. End clamps and end cover plates shall be provided to hold terminal blocks in place. All components shall be rated for 600 Volts.
 - 1. Terminal blocks shall be manufactured by Phoenix, Entrelec or Allen-Bradley with appropriate accessory components.
- C. At each starter, control panel, motor control center and switchboard, terminate all alarm, control, and any other wiring at identified numbered terminal blocks. AC and DC terminals shall be separated. Power terminal blocks shall be separated from controls and instrumentation terminal blocks. Provide a ground terminal point for each cable shield. Stacked terminal blocks will not be accepted.
- D. Fuses shall be incorporated into the terminal blocks when not shown on a door or panel face. Fuse blocks shall include blown fuse indicator and be disconnecting type. Fuse blocks shall be manufactured by Phoenix, Allen-Bradley or Entrelec.
- E. Provide 20% spare terminal, but not less than ten points with each terminal block.

2.2 RELAYS

- A. Control relays shall be plug-in type with hold-down clamps and led indicators, unless noted otherwise. Plug-in relays shall be UL listed, 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 percent of rated coil voltage. Coil burdens shall be not greater than 1.5 watts for DC coils or 2.6 VA for 60-Hz coils. The relays shall be IDEC RR Series, or equal.
- B. Machine tool type relays shall be rated B300. Machine tool relays shall be manufactured by Allen-Bradley, Cutler-Hammer, Square D or equal.
- C. Time delay relays with required ranges up to 180 seconds shall be enclosed and shall operate properly at any voltage within plus or minus 15 percent 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. Time delay relays shall be manufactured by Idec RTE series, or equal.

- D. Phase/Power Failure Relays (PFR) shall detect phase over voltage and under voltage conditions. Provide an adjustable drop out setting and an adjustable time delay on drop out. Phase failure relays shall be manufactured by Diversified, Timemark or equal.

2.3 WIRING DEVICES

- A. Light switches shall be specification grade and shall be manufactured in accordance with UL 20. Switches shall be single pole, rated for 20 amps at 277 VAC. Switches shall be Hubbell 1221, Leviton 1201-2, or equal.
- B. Receptacles shall be duplex and rated 20 amps at 120 VAC, 2 pole, 3 wire, NEMA type 5-20R and specification grade. Receptacles shall be Hubbell, Leviton or equal, GFI type where shown on the Plans.
- C. Device cover plates shall be suitable for the environment in which they are installed. Stainless steel cover plates inside and weatherproof covers outside. Where weather protection is required with a plug in the receptacle, clear plastic bubble covers shall be provided.

2.4 DISCONNECTS

- A. Heavy duty, motor rated switches fused or non-fusible as indicated on the Drawings, shall be provided as required. General duty switches will not be allowed. Switches shall have "Quick-break" actuating mechanisms and shall be enclosed as required by the conditions of installation. The cover shall be interlocked with the switch such that the enclosure cannot be opened with the switch in the "on" position. The "on" and "off" positions shall be clearly marked by the manufacturer. The switch shall be capable of being locked in the open position. Provide enclosures suitable for the specific type of location in which they are installed. Disconnect switches shall be manufactured by Cutler-Hammer, Square D or equal. Disconnect switch enclosures shall meet the requirements of Specification Section 16010-1.10.

2.5 UTILITY MONITORING EQUIPMENT

- A. Provide, conduit, pullboxes, ground rods, risers, meter enclosures, service disconnects and weatherhead per the utility company's requirements.
- B. The electric service meter/current transformer compartment shall be arranged as shown to meet the electric utility company requirements. Provide neutral bar for grounding 240/120 volt single phase, three wire service. Provide guard over power company watt-

hour meter with hinged access cover that has a hasp for utility company padlock. Provide wire and lugs for service entrance as required by utility company.

- C. The meter enclosure shall be UL listed and shall be equipped with a metering socket and shall meet the requirements of the serving utility company. Nema 3R. Metering equipment shall be manufactured by B-Line, Tesco, IEM, Circle AW, Cutler-Hammer, Square D or equal.

2.6 AUTOMATIC TRANSFER SWITCH

- A. The electrically operated, mechanically held, transfer switch shall be mounted and wired as shown on the Drawings.
- B. The transfer switch shall be 240/120 Volt, single phase, 60 hertz, three pole, with solid neutral operation in ambient temperatures of 40 to 100 degrees F. The transfer switch shall be double throw, actuated by a electrical operator connected to the transfer mechanism. The transfer switches shall be rated for all classes of load, both inductive and non-inductive, at 600 Volts, and tungsten lamp load not to exceed 30 percent of the continuous rating at 600 Volts. The transfer switches shall be designed, built, and tested to close on an inrush current up to and including 20 times the continuous rating of the switch without welding or excessive burning of the contacts. The transfer switch shall be capable of 50 operations at 6 times the continuous rating and capable of enduring 6000 operations at two times rated current, at a rate of six per minute, without failure. The electrically operated transfer switch shall have a withstand current rating that is equal to or exceeds 22,000 Amperes RMS symmetrical at 240 Volts.
- C. The controls shall direct the operation of the transfer switch. The ATS panel's sensing and logic shall be controlled by a built-in microprocessor for maximum reliability, minimum maintenance, and inherent digital communications capability. The control panels shall be connected to the transfer switch by an interconnecting wiring harness. The harness shall include a keyed disconnect plug to enable the control panel to be disconnected from the transfer switch for routine maintenance. The control panels shall be completely enclosed with a protective cover and be mounted separately from the transfer switch unit for safety and ease of maintenance Sensing and control logic shall be provided on plug-in printed circuit boards. Interfacing relays shall be industrial grade plug-in type with dust covers.
- D. The voltage of each phase of the normal source shall be monitored, with pickup adjustable from 85% to 100% and dropout adjustable from 75% to 98% of pickup setting. Repetitive accuracy of all settings shall be +/- 2% or better over an operating temperature range of -20°C to 70°C. Voltage and frequency settings shall be field adjustable in 1% increments without the use of tools, meters or power supplies.
- E. A time delay shall be provided to override momentary normal source outages and delay all

transfer and engine starting signals. Adjustable from 0 to 3 seconds. A time delay shall be provided on transfer to emergency, adjustable from 0 to 5 minutes for controlled timing of transfer of loads to emergency. A time delay shall be provided on retransfer to normal, adjustable from 0 to 30 minutes. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable. Also, provide bypass switch. A time delay shall be provided on shutdown of engine generator for cool down, adjustable from 0 to 60 minutes.

F. Other Features

1. A set of DPDT gold-flashed contacts rated 10 Amps, 32 VDC and shall be provided for a low-voltage engine start signal with the ATS. The start signal shall prevent dry cranking of the engine by requiring the generator set to reach proper output, and run for the duration of the cool down setting, regardless of whether the normal source restores before the load is transferred. Also provide a "commit/no commit to transfer" selector switch to select whether the load should be transferred to the standby generator if the normal source restores before the generator is ready to accept the load.
2. A momentary-type test switch shall be provided to simulate a normal source failure.
3. Terminals shall be provided for a remote contact, which opens to signal the ATS to transfer to emergency and for remote contacts, which open to inhibit transfer to emergency and/or retransfer to normal.
4. Auxiliary contacts, rated 10 amps, 480VAC shall be provided consisting of one contact, closed when the switch is connected to normal source and one contact closed, when the switch is connected to emergency source. Provide auxiliary contacts with the ATS. These contacts will be wired to the PLC/RTU.
5. Indicating lights shall be provided, one to indicate when the switch is connected to normal source and one to indicate when the switch is connected to emergency source.
6. Terminals shall be provided to signal the actual availability of the normal and emergency sources, as determined by the voltage sensing pickup and dropout settings for each source.

E. Automatic transfer switch shall be manufactured ASCO 7000 Series or equal.

2.7 OVERCURRENT PROTECTIVE DEVICES

- A. Circuit breakers shall be of the proper type and rating for each application. They shall be molded case, thermal-magnetic, with inverse time characteristic response - temperature compensated. Motor circuit protectors shall be similar to circuit breakers except with adjustable magnetic trip and no thermal trip. The fault current interrupting rating shall not be less than that shown on the Drawings (65,000 ASYM minimum). Provide auxiliary contacts were shown on the Drawings. Circuit breakers having a frame size of 225 Amps or less shall be molded case type with thermal magnetic non-interchangeable, trip free units. Thermal magnetic molded case circuit breakers shall be Cutler-Hammer Series C

K-Frame Type HFD, or equal. The interrupting capacity of all main, feeder and branch circuit breakers shall be rated for a minimum of 65,000 RMS symmetrical Amps at operating voltage.

1. Circuit breakers feeding motors starters shall be molded case instantaneous only motor circuit protector unless shown otherwise on the Drawing. Motor circuit protectors shall be rated for 600 VAC. Motor circuit protectors shall be Cutler-Hammer Series C Type HMCP, or equal. The interrupting capacity of all motor circuit protectors shall be rated for a minimum of 65,000 RMS symmetrical Amps at operating voltage. The CONTRACTOR is responsible to provide correct motor circuit protector size, trip rating and setting for all installed equipment.
 2. Provide shunt trips where shown on the Drawings.
 3. Circuit Breakers shall be manufactured by Eaton, Allen-Bradley, Square D or equal.
- B. Panelboard circuit breakers shall be bolt on type unless noted otherwise. Multiple pole breakers shall be manufactured as a single unit. Use of "tandem" circuit breakers or "two in the space normally occupied by one" will not be acceptable. The fault current interrupting rating shall not be less than that shown on the Drawings (10,000 ASYM minimum).
- F. Enclosed circuit breakers shall be as indicated on the Drawings and as required by Section 16010. The enclosures shall have been manufactured specifically for the type of circuit breaker provided and shall be UL listed.
- G. Fuses shall be provided for all fuse holders as shown on the Drawings and specified herein. They shall be current-limiting, non-renewable as indicated on the Drawings - Fusetron or Limitron type manufactured by Bussman or equal. Provide at least 3 spare fuses for each size and class of fuse used.

2.8 PANELBOARDS

- A. All panelboards shall comply with applicable standards of the Underwriter's Laboratories, Inc. (UL) and shall be UL listed. They shall be manufactured and tested in accordance with the applicable sections of the latest editions of NEMA PB-1, UL-67, and the NEC.
- B. Panelboards shall be of a type and rating as shown on the Drawings. They shall be dead front with hardware for accepting molded case bolt-on circuit breakers of the maximum size allowable in each space. The entire assembly including circuit breakers shall be rated for not less than the available short circuit current shown on the Drawings (22,000 Amps symmetrical when not otherwise indicated).
- C. Branch circuit connections to the main buses shall be of the distributed phase type as indicated on the panel schedules. Circuit numbering shall be labeled as indicated. Main buses and branch circuit straps shall be copper or electrical grade aluminum with tin or

copper plating. Unplated aluminum current carrying parts will not be accepted. Solid neutral and ground buses shall be provided as required in each panelboard. A separate isolated ground bus shall be provided where shown on the Drawings.

- D. Panelboards shall be manufactured by Allen-Bradley, Cutler-Hammer, Square D or approved equal.
- E. For copper feeder conductors, mechanical or compression lugs, listed for use with copper conductors, may be used. All lugs (main and branch) shall be UL listed for use with 75 degree C wire.
- F. Enclosures shall be suitable for the conditions encountered. Enclosures shall be surface or flush mounted as indicated. Panelboards shall be suitable for the location in which they are installed. Install NEMA 1 enclosures in dry locations (indoors) and NEMA 3R/12 in wet locations (outdoors). NEMA 3R panels which are not factory gasketed against dust will not be acceptable. Panelboards installed in motor control centers shall utilize the MCC manufacturer's standard enclosure design.
- G. A removable panelboard circuit directory with plastic cover shall be provided on the door.

2.9 MOTOR CONTROLLERS

- A. Size per applicable Electrical Codes. Accept the minimum NEMA size shall be size 1. Where a combination starter is required, use a type with circuit breaker disconnecting device unless shown otherwise.
- B. Running Overload Protection: An overload relay shall be installed in each ungrounded motor circuit leg. They shall be sensitive to motor current only, have inverse time characteristics, and be of the manual reset type with a reset button operable from the outside of the starter enclosure. They shall be temperature compensated type. Select the overload relay heaters as required by the applicable Electrical Code only after the actual nameplate data for the motor has been determined.
- C. Provide and install all control devices not otherwise provided for. This includes specifically: control transformers, pilot devices, push buttons and selector switches, auxiliary contacts, etc., which are required to be mounted on or within the starter enclosure. Each starter contactor shall be provided with at least one extra N.O. auxiliary contact.
- D. All motor starters shall be installed in enclosures suitable to the conditions and provided with a nameplate identifying the equipment controlled.
- E. Provide phase failure relays for motor loads over 25 horsepower.
- F. Provide and install any specialty relays required by the various pump manufacturers at no

extra cost to the Owner.

- G. Starters shall be manufactured by Cutler-Hammer, Square D, Allen-Bradley or approved equal.
- H. Where mechanical or process equipment is provided with a specialty protective relay, the relay shall be incorporated into the motor controls at no additional cost to the Owner.

2.10 VARIABLE FREQUENCY DRIVES

- A. All variable frequency drives shall be designed for the service intended and shall be of rugged construction and of ample strength for all stresses, which may occur during fabrication, transportation, erection, and continuous or intermittent operation. All equipment shall be adequately braced and anchored and shall be installed in a neat and workmanlike manner. Appearance and safety, as well as utility, shall be given consideration in the design of details. All components and devices installed shall be standard items of industrial grade, unless otherwise noted, and shall be of sturdy and durable construction suitable for long, trouble free service.
- B. On this project, the VFDs are specified with the pump motors, integral to the pump motors.
- C. Where mechanical or process equipment is provided with a specialty protective relay, the relay shall be incorporated into the motor controls at no additional cost to the Owner.

2.11 SMOKE DETECTOR

- A. Smoke Detector (S) shall be conventional type, Fire Marshall approved, 120 VAC powered with contact output: manufactured by Siemens: DT Series, or equal.

2.12 INTRUSION SWITCH

- A. Outer door type intrusion switches shall be the industrial grade, magnetic type with stainless steel armored cable designed for door mounting and allowing for a 3-inch gap distance. The intrusion switches shall be as manufactured by Sentrol 2500 Series, George Risk Industries 200 Series or equal.

2.13 ENCLOSURES

- A. Provide NEMA rated enclosures where shown on the drawings, required by these Specifications or required by the NEC. Enclosures shall be Hoffman, Circle AW or IEM.

2.14 PEDESTALS

- A. Furnish and install all equipment as shown on drawings in a low profile 48 inch high

MAXIMUM, U.L. listed weatherproof, vandal resistant, NEMA 3R, pedestal style switchboard and instrument enclosures. Enclosure shall consist of a TESCO or Meyers sections with dead front interior and hinged gasketed exterior doors. Outer enclosure shall be constructed of 12 gauge hot dipped galvanized steel. Doors shall be equipped with 316 stainless steel handles with 3-point roller bearing latches and hasps for owner padlocks. Concrete base with anchor bolts to meet applicable seismic requirements shall be provided.

- B. Provide fluorescent panel light, door switch, GFCI receptacle, PFR power fail relay, strip heater, thermostat and heat shield (if required). All openings shall be sealed to prevent entrance of insects and rodents. Finish shall be polyester dry powder, electrostatically applied and baked on at 380 deg. F. Color shall be white interior doors and light brown (camel) exterior. The painting process shall include five stages of metal preparation using dip tanks as follows: 1) Alkaline cleaner, 2) Clear water rinse, 3) Iron phosphate application, 4) Clear water rinse, and 5) Inhibitive rinse to seal phosphated surfaces. All bussing and wire shall be copper. All wire shall be stranded with locking spade pressure connectors and labeled with clip-on permanent plastic wire markers. All circuit breakers and dead front mounted devices (lights and switches) shall be equipped with engraved nameplates.
- C. The enclosure shall be compartmentalized such that the programmable pump controller and power sections are isolated from each other. The compartments containing the programmable controller and power sections shall be separated by barriers behind the inner dead front door. Doors shall be hinged on the same side and shall open to greater than 90 degrees. All dead front latches are 1/4 turn adjustable with 1/8" thick latching dog and knurled knob.
- D. Thermostatically controlled heating and cooling systems shall be provided, if required, and as approved by the Engineer to maintain suitable climate conditions within the control panel as required to provide proper operation of the panel and to comply with the Drawings and Specifications.
- E. A ground bus shall be provided in the service equipment. It shall be connected to the grounding electrode system by exothermic welded stranded copper grounding conductors. Screw type lugs shall be provided for connection of equipment grounding conductors.
- F. Provide interior lighting for each pedestal. The luminaries shall be the size and type normally supplied with the specified spaces. As a minimum, the luminaries shall be a 15 to 30 watt rapid start fluorescent strip type fixture with warm white lamps. A lens or guard shall be furnished and installed over each lamp. The fixture ballasts shall be capable of providing reliable starts with ambient temperatures down to 30 degrees. Ballast noise shall not exceed 50 dBA.
- G. Provide a receptacle in each pedestal section. Receptacles shall be of specification grade and of NEMA configuration and rated 2 pole, 3 wire grounding, 20 amperes, 125 volts. All external and dead front receptacles shall be installed on ground fault interrupter circuits "GFCI".

- H. The electric service meter compartment shall be arranged as shown to meet the electric utility company requirements. Provide neutral bar for grounding. Provide guard over power company watt-hour meter with hinged access cover that has a hasp for utility company padlock. Provide wire and lugs for service entrance as required by utility company. The pull section and utility compartments shall be accessible only by the utility company. A lightning arrestor shall be provide to protect the panel equipment from lightning and utility power surges.
- I. Provide a meter base, test perch with test by-pass and other materials, as required by the electric utility which will provide service to the facility, for installation of metering equipment and attachment of service conductors. See Specification Section 16450 for additional requirements.

2.15 SURGE PROTECTION DEVICE

- A. The surge protection devices (SPD) shall be designed to protect all AC electrical circuits and connected equipment from destructive, damaging or disruptive effects of lightning induced transients, normal utility load switching activities and internal generated transients. The SURGE suppression device shall be parallel configured, solid state, voltage clamping components demonstrating threshold suppression characteristics. Clamping components shall be metal oxide varistors. All suppression devices shall be encapsulated and mounted in a NEMA RATED enclosure. The unit shall be rated for 120 KA per phase and 60 KA per mode minimum. The device shall have all normal mode (L-L and L-N) and common mode (L-G and N-G) circuit paths protected with suppression components. The device shall be rated for 240/120 V, single phase systems, shall include a remote alarm form C contact. The device for the facility service entrance shall be installed in accordance with the manufacturer's recommendations. The manufacturer shall provide a ten year warranty. The SPD unit shall be manufactured by Square D, Eaton, Leviton, Liebert or equal.

2.16 LIGHTING

- A. Lighting fixtures should be provided as scheduled, however; fixtures of similar design, having equivalent mechanical characteristics and virtually identical luminous intensity distributions and luminances over the angles of interest (in at least the perpendicular and parallel planes), may be submitted for approval. Sufficient photometric and mechanical data must be provided with the submittal for a substitute fixture to allow for meaningful comparison with the specified item. A sample of any or all substitute lighting fixtures may be required to be furnished to the Engineer for physical evaluation to determine the acceptability of the substitute item. When making substitute fixture submittals, allow sufficient time for this process.
- B. Fluorescent fixtures shall be provided with internally protected, class "P", high power factor, low heat, ballasts with ballast factors of not less than .85 when operated with 3' or 4' T-8

lamps. Unless specifically noted otherwise on the Drawings, fluorescent fixtures shall utilize integrated circuit type electronic ballasts designed for extreme cold temperatures.

2.17 PILOT DEVICES

- A. Indicating pilot lights shall be LED, low voltage transformer operated, with integral push to test button. Pilot lights shall be rated NEMA 4/4X and be 30.5 mm in diameter. Pilot lights shall be manufactured by Eaton, Square D or equal.
- B. Selector switches and pushbutton switches shall be heavy duty type and match pilot lights. Switches and pushbuttons shall be rated NEMA 4/4X and be 30.5 mm in diameter. Switches and pushbuttons shall be manufactured by Eaton, Square D or equal.
- C. Running time meters shall be non-reset, 0-99,999.9 hour range, 120 VAC manufactured by Eaton, Square D or equal.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Equipment installation, including supports, anchors, and restrainers, shall meet the requirements specified in Section 16010, General Requirements, Electrical.
- B. Install freestanding equipment in accordance with the manufacturer's recommendations. Secure freestanding equipment rigidly to floors or mounting pads with anchor bolts, expansion shields, or other approved means. Install wall mounted equipment in a similar manner, plumb, with appropriately sized anchors.
- C. Lighting fixtures shall be installed as indicated on the Drawings. Provide all brackets, hangers, poles, masts, bases and other hardware as may be required for each particular condition of installation.

3.2 TRAINING

- A. A factory trained service technician shall instruct operating personnel in the operation, maintenance and adjustment of the systems and installation. The training shall be four hours in length.

3.3 TESTING

- A. After installation has been completed, Contractor shall conduct tests required by Section 16010, General Requirements, Electrical.

****END OF SECTION****

SECTION 16279

STANDBY ENGINE GENERATOR - PROPANE

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. This Section covers the work required to furnish, install, start up, test, and document a propane fired standby engine generator, including enclosure, fuel system, starting system, cooling system, exhaust system, control system and other items required for a complete operating system as shown on the Drawings and as specified herein.
- B. The Contractor is responsible for securing all the required permits with the local air board.

1.2 UNIT RESPONSIBILITY

- A. The CONTRACTOR shall cause the supplier of the standby generator to take unit responsibility for the entire standby generator system, including all of the items specified in this Section, and to provide a complete and operable system, which meets all requirements of these Contract Documents. The standby generator supplier shall be responsible for the selection, design, manufacture, and testing of the equipment specified herein, and to ensure complete compatibility of the elements of the standby generator system with one another and with other equipment in the facility.

1.3 GENERAL

- A. The standby generator shall be an engine-driven generator set rated to serve continuously during interruption of prime power. Speed shall not be greater than 1,800 rpm. The set shall operate on propane fuel, shall be liquid cooled, and shall be suitable for installation and operation in outdoors.
- B. Each unit shall consist of an engine directly connected to a generator and mounted on a steel base, and shall include all necessary engine and generator auxiliaries, accessories, and controls required to provide electrical output as specified herein. Minimum required accessories and controls include a controls and alarm panel, remote monitoring and alarm panel, sound attenuating weatherproof enclosure, external water jacket heater, batteries, and battery charger. The unit shall be the product of a supplier regularly engaged in the assembly of generator sets. The component parts of the unit shall be the products of firms regularly engaged in the manufacture of these parts. All materials shall be new and of current manufacture.

- C. The supplier of the generator set and the manufacturers of the component parts shall have service and spare parts facilities located within 200 miles of the installation that can provide regular service, inspection, spare parts, and emergency service.
- D. Departures from Drawings. Submit to the Engineer, in writing for review, details of any 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.

1.4 SUBMITTALS

- A. Submit material or equipment data in accordance with the Specification Section 16010, General Requirements, Electrical.
- B. In addition to the general requirements, the submittals shall include the following:
 - 1. Bill of Materials. A listing shall include all of the panels, racks, instruments, components, and devices provided under this Section.
 - 2. Equipment list tabulating all components furnished, followed by the manufacturer's name, manufacturer's model number, and a cross-referenced to its location on the Shop Drawings.
 - 3. Drawings and descriptive (catalog) data and brochures of each item of equipment.
 - 4. Dimensional drawings and weights of each item of equipment.
 - 5. Certified foundation and anchor bolt plans for all floor-mounted equipment.
 - 6. Propane engine data.
 - a. Manufacturer
 - b. Model
 - c. Revolutions per minute (rpm)
 - d. Rated capacity brake horsepower (bhp)
 - e. Make and model of governor
 - f. Piston displacement (cubic inches)
 - g. Guaranteed fuel consumption rate at full load, 3/4 load, 1/2 load.
 - 7. Generator data:
 - a. Manufacturer
 - b. Model
 - c. Rated kVA
 - d. Rated kW
 - e. Voltage

- f. Temperature rise above 40 degrees C ambient
 - g. Detailed generator sizing calculations.
 - h. Generator efficiency, including excitation losses at 80-percent power factor at full load, 3/4 load and 1/2 load.
8. Engine-generator unit and accessories:
- a. Weight of skid-mounted unit
 - b. Overall length
 - c. Overall width
 - d. Overall height
9. Generator circuit breaker:
- a. Catalog data
 - b. Recommended trip settings for all adjustable settings
 - c. Short-circuit interrupting ratings
10. Electrical Drawings
- a. Complete elementary and connection diagrams of all electrical circuits and devices, including generator winding data and connection diagrams. Include battery charger and water jacket power requirements.
 - b. Complete drawings and descriptive data, both mechanical and electrical, for control panels.
11. Manufacturer's certificate of satisfactory installation is required for work under this Section.
12. Satisfactory voltage dip [starting] calculations.
13. Testing procedures, syllabus of training and a schedule.

1.5 OPERATING AND MAINTENANCE MANUALS

- A. The CONTRACTOR shall provide 3 hard copies plus one pdf file on disk of an Operation and Maintenance manual prior to completion of the Work. The manual shall be a bound and covered and be 9-inch by 12-inch in size. Provide a table of contents and one section for each item of equipment specified herein. All pages shall be neatly assembled and fit within the manual cover.
- B. For each section provide the following information, as applicable:
1. An itemized list of all data provided.
 2. Name and location of the manufacturer, the manufacture's local representative, the nearest suppliers, and spare parts warehouse.
 3. Recommended installation, adjustment, start up, calibration, and troubleshooting procedures.
 4. Recommended lubrication, lubrication intervals, and an estimate of yearly quantity needed.
 5. Recommended step-by-step procedures for all modes of operation.
 6. Complete internal and connection wiring diagrams.
 7. Recommended preventive maintenance procedures and schedule.
 8. Complete parts lists, by generic title and identification number.
 9. Recommended spare parts and special tools.
 10. Disassembly, overhaul, and reassembly instructions.
 11. All approved shop drawing information pertinent to facility operation and maintenance.

1.6 WARRANTY

- A. The work and equipment covered in this Section shall be guaranteed for a period of 1 year minimum from the date of acceptance thereof against defective materials, design, and workmanship.

1.7 START-UP SERVICES

- A. A manufacturer/supplier's representative shall be present at the job site for a minimum of four separate visits of one man-day each, travel time excluded, for assistance during construction, equipment startup, and testing. Included in the four site visits shall be a minimum of:
1. One site visit of one half man-day for assistance during installation
 2. One site visit of one half man-day for assistance during system startup
 3. One site visit of one half man-day for testing
 4. One site visit of one half man-day for training of Owner Personnel.

1.8 PERFORMANCE REQUIREMENTS

- A. As a minimum, the standby generator systems shall have the following continuous ratings (as used herein, the term "continuous" shall mean for the duration of a utility company power outage at the facility):
1. Rated 25 KW (minimum) at 0.8 pf at 7000 feet above seal level.
 2. 240/120 Volts, single phase, three wire plus ground
 3. 60 Hz
 4. Not to exceed safe operating temperatures when operating at full load in an ambient temperature of 50 degrees C.
 5. The generator shall be capable of starting (in five steps) and running two 5 HP induction motors with a NEMA code letter F with VFD motor controllers (steps 2 and 3) with 7 KW other station loads (step 1, including lighting, fans, etc.) with less than a 12.0 percent voltage dip on each step. Provide an engine and generator combination capable of meeting the voltage dip requirements.
 6. The standby generator system maximum time for recovery to rated frequency shall be 10 seconds after full-rated load is applied in one step.
 7. Under steady-state conditions, after a maximum of 3 minutes of operation the standby generator system long-time frequency drift shall not exceed 0.5 Hz.
 8. Under steady-state conditions, after a maximum of 3 minutes of operation the standby generator system voltage regulation shall be better than 2 percent for any load between no load and full load.

1.9 TECHNICAL REQUIREMENTS

- A. The standby generator system shall include generator status and alarm dry contact outputs rated 5 Amps at 120 Volts, 60 Hz, non-inductive. The fuel system shall include similarly rated contacts.
- B. All alarm and status contacts shall be brought out to terminal strips and numbered and identified on a wiring diagram and be compatible with the PLC/SCADA system.
- C. Remote monitoring and alarm panel.

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 equipment approved by NFPA and UL 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.

- 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 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 MECHANICAL ASSEMBLY

- A. The standby generator set shall consist of an industrial propane fired engine and single-bearing generator mounted on a structural steel skid-type base assembly with lifting holes and accessory mounting provisions. The engine and generator shall be coupled together through a flexible metallic coupling, which permits alignment of the two units. The couplings shall be properly guarded to prevent injury to personnel.
- B. The standby generator skid shall incorporate a mounting configuration to accommodate nominal uneven floor surfaces without imposing misalignment forces on the engine or generator.

2.4 ENGINE

- A. The engine shall be propane fired, liquid cooled with an integrally mounted radiator and fan, and shall operate satisfactorily on propane at the installed elevation. Provide regulator and fuel valves.
- B. The engine shall be rated for continuous operation under a constant load equal to the generator-set rating plus the load of all connected accessories.
- C. The engine speed shall be controlled by an isochronous governor.
- D. The engine shall be provided with crankshafts, which shall be statically and dynamically balanced and fully counterbalanced. Crankshafts shall be drilled for full-pressure lubrication to all bearings. All crankshaft bearing surfaces shall be hardened. There shall be one more main bearing than there are crankshaft throws. Intake and exhaust valves shall be heat-resistant alloy steel with stellite-faced exhaust valve inserts.
- E. The engine shall receive a prime coat and two coats of industrial paint suitable for the intended use.
- F. The engine shall be equipped with a pressurized lube oil system and a full-flow filter system consisting of an oil pickup strainer located upstream of a replaceable filter.

- G. Engine air intake shall be provided with a dry air cleaner of adequate capacity to effectively remove dirt and abrasives from the combustion air. The dry-type filter shall be arranged for easy removal and replacement of the filter element.
- H. All exposed rotating parts of the engine shall be provided with guards for protection of personnel.

2.5 ENGINE COOLING SYSTEM

- A. The engine shall be cooled by means of an engine-mounted radiator with pusher-type fan and shall be sized to maintain safe operation at 50-degree C maximum ambient temperature, with the engine at full load. The engine cooling system shall be filled with a solution of antifreeze with corrosion inhibitor as recommended by the engine manufacturer. An external water jacket heater (120 VAC) shall be provided to maintain the engine water at 35 degrees C at all times the engine is not running. Jacket water heater shall be provided with isolation valves. If a different configuration is required to meet the manufacturer's standards and/or this Specification, power distribution changes shall be made at no cost to the Owner.
- B. Radiator fans shall be rated for a maximum static pressure restriction of 0.50 inch water column:

2.6 ENGINE STARTING SYSTEM

- A. The engine shall be started automatically by a 12 volt dc electric starting system with positive engagement drive.
- B. Provide a heavy-duty lead-acid storage battery set. The battery set shall be of sufficient capacity to provide for continuous 1-1/2 minutes total cranking time at 20 degrees F without recharging. The batteries shall be provided with a battery tray and batteries shall be secured.
- C. A current-limiting automatic 2-rate, temperature compensated, UL listed battery charger shall be furnished to automatically recharge batteries. It shall include overload protection, silicon-diode full-wave rectifiers, voltage surge suppressors, dc ammeter and voltmeter with plus or minus 2 percent accuracy, and fused ac input. The ac input voltage shall be 120 volts, 60 Hz. Rated output of the battery charger shall be no less than 10 amperes dc. The charger shall include an autoboot circuit to equalize the batteries after an AC power failure or low battery voltage condition.

2.8 ENGINE EXHAUST SYSTEM

- A. The engine exhaust system shall include an exhaust silencer, gas-proof and seamless stainless steel flexible exhaust connection, exhaust outlet piping, and a raincap. An exhaust condensation trap with manual drain valve shall be provided.

- B. All exterior components of the exhaust silencer shall be fabricated of aluminized steel and coated with high heat resistant silicone aluminum paint. Guards shall be provided in accordance with State safety requirements to protect personnel from accidental contact from the exhaust manifolds, turbochargers, exhaust pipe, etc. A rain cap shall be provided for the exhaust piping tip.
- C. Exhaust silencers shall be manufactured by Cummins-Onan, Kohler or equal.

2.9 ENGINE INSTRUMENTS

- A. The engine instrument or operator panel indication shall include oil pressure, coolant water level and a water temperature.

2.10 GENERATOR

- A. The generator shall be heavy-duty industrial type, single-bearing synchronous type with PMG, brushless exciter, and shall be suitable for standby duty under the conditions specified. The generator shall meet all applicable NEMA standards for standby generator, including temperature rise and short-circuit ratings.
- B. Both stator and rotor, along with other applicable components, shall be protected with 100-percent epoxy impregnation and an overcoat of resilient insulating material to reduce possible fungus and/or abrasion deterioration. The unit shall be designed for 105°C maximum temperature rise at full load.
- C. The generator shall be suitable for use in a solidly grounded system. The neutral shall not be grounded at the generator.
- D. Provide an output circuit breaker, rated as shown on the Drawings, in a separate enclosure.
- E. The voltage regulator shall be of the solid-state type. Voltage level adjustment shall be provided to allow adjustment within plus or minus 0.5 percent.

2.11 CIRCUIT BREAKERS

- A. The circuit breakers shall be integral with the standby generator and shall be provided in a NEMA 1 enclosure. The circuit breakers shall be of the indicating type providing ON, TRIPPED, and OFF positions of the operating handle. Breakers shall be labeled. Include provisions for padlocking the circuit breakers in the OFF position. Interlock enclosure to prevent opening the cover with the circuit breakers in the ON position, and provide defater mechanisms. The circuit breaker shall be quick-make, quick-break, with thermal-magnetic action. Provide one breaker for the generator and one for the load bank.

2.12 ENCLOSURE

- A. The standby engine generator shall be housed inside a weatherproof, secure, heavy-gauge steel enclosure, suitable for mounting the unit outdoors. The enclosures shall be Onan, Kohler or approved equal.
- B. The enclosure doors and walls shall be insulated with sound-absorbing material to reduce the overall general noise to less than 85 dBA as measured in eight locations at 45 degree increments around a circle of 23 foot radius centered on the middle of the enclosure. Microphone height shall be between 3 and 5 feet from the ground.

2.13 CONTROL PANEL

- A. Provide an engine-generator control panel shock-mounted to the generator set that is factory built, wired, and tested by the generator manufacturer. The control panel shall be capable of operating the generator set in compliance with these Specifications. Provide an emergency STOP pushbutton.
- B. With the mode selector switch in AUTO, the system shall perform as specified under FUNCTIONAL REQUIREMENTS.
- C. With the mode selector switch in HAND, the generator set shall be started and stopped by the manual start-stop pushbutton control in the control panel.
- D. When the mode selector switch is moved to OFF, it shall not be possible to start the generator set, and, if the generator set is running, it shall stop.
- E. The control panel shall operate on dc battery voltage; shall be NEMA 12 or 3, vibration isolated, dead front, type enclosure; and shall be constructed so that all components can be adjusted and replaced from the front. Control wiring shall be stranded copper and shall be brought to master terminal blocks for termination of external wiring. Identify control wiring with wire labels and terminal points with appropriate markers. Arrange wiring neatly cut to proper length, bundle wires, and tie them down securely. Wiring shall not be spliced or tapped except at device terminals or on terminal blocks. The control panel shall include the following equipment:
 - 1. Manual start-stop control.
 - 2. Three-position mode selector switch, with positions labeled AUTO, OFF, and MANUAL.
 - 3. GENERATOR RUNNING indicating light and NO contact which will be wired to the PLC/RTU and close on run.
 - 4. READY indicating light and NO contact.
 - 5. Separate alarm indicating lights and NO contacts for high coolant temperature, low coolant level, low oil pressure, high oil temperature, overspeed, generator fail, fail to start, generator not in AAUTO@, battery voltage low, and battery voltage high.

6. Separate gauges for indicating oil pressure, oil temperature, and water temperature.
7. Fail to start - NO contact which will be wired to the PLC/RTU to close on alarm.
8. RESET pushbutton.
9. Manual control for adjusting voltage.
10. Solid-state voltage regulator.
11. Manual control for adjusting speed.
12. Solid-state speed regulator.
13. Voltage indication, 2-percent-minimum accuracy.
14. Amperage indication, 2-percent-minimum accuracy.
15. Current transformers and potential transformers as required.
16. Running time indication.
17. Frequency indication.
18. Coolant Temperature.
19. Oil Pressure indication.
20. DC Voltage.

2.14 VIBRATION ISOLATORS

- A. The generator set shall be furnished with spring-type vibration isolators between the generator-set base and the engine-generator set: integral isolators are acceptable. The quantity and load range shall be selected for a minimum efficiency of 90-percent damping or better. Isolators shall be adjustable for leveling and equalizing loads. 3/4-inch thick minimum, waffle patterned, neoprene pads shall be provided beneath isolators and floor.

2.15 LIFTING LUGS

- A. Equipment over 100 pounds in weight shall be provided with lifting lugs.

2.16 ANCHOR BOLTS AND TIEDOWN LUGS

- A. Furnish and install anchor bolts and tiedown lugs. As a minimum requirement, furnish and install anchor bolts and tiedown lugs as recommended by the manufacturer and approved by the Engineer.

2.17 SPARE PARTS, CONSUMABLE ITEMS, AND TOOLS

- A. Provide the following spare parts as a minimum:

5 each	Lamps for each type of indicating light
2 sets	Lube oil filter element
2 sets	Fuel filter element
1 set	Air cleaner element
1 set	V-belts (complete set)
1 set	Each size fuse
1 set	Special nuts, bolts, screws, etc.

PART 3 EXECUTION

3.1 INSTALLATION

- A. The generator set, including all auxiliaries and accessories, shall be installed in accordance with the manufacturer's instructions and recommendations. Antifreeze and oil of the type and amount recommended by the manufacturer shall be furnished and added to the engine.
- B. Keep a copy of the manufacturer's installation instructions available on the job site for review at all times.
- C. Provide a housekeeping pad for the engine-generator set.
- D. Mount all devices which an operator may need to read or operator between 42 and 72 inches above the finished floor.
- E. Installation shall be checked and approved by the engine-generator set supplier.

3.2 START-UP SERVICES

- A. A manufacturer/supplier's representative shall be present at the job site for a minimum of two man-day each, travel time excluded, for assistance during construction, equipment startup, and testing.

3.3 TESTING

- A. After installation has been completed, Contractor shall conduct tests required by Section 16010, General Requirements, Electrical.
- B. In addition, 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, fuel, and other material to complete the operational readiness, and functional acceptance tests.
- C. Functional Acceptance Test (FAT)
 - 1. Once the facility has been started up and is operating, a witnessed FAT shall be performed on the complete standby generator system to demonstrate that it is operating as specified and meets the requirements of the Specifications.
 - 2. 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.

3. The FAT shall demonstrate under actual operating conditions that operation is satisfactory without overheating of any part and that the equipment is free from excessive vibration throughout the entire range of speed and load.
4. The generator set shall be operated at rated standby service load for a period of not less than 2 hours, and all necessary adjustments shall be made by the generator-set supplier. This test shall demonstrate the ability of the set to satisfactorily carry its rated load and to meet requirements for motor starting.
5. With the station load at normal operating level, a power failure shall be initiated by opening the main circuit or breaker supplying the normal power to the pump station.
6. If any equipment or system fails the FAT, the CONTRACTOR shall correct the problem and shall repeat the test until it is successful.
7. The FAT shall be performed in the presence of the Engineer.

3.4 TRAINING

- A. Upon completion of the FAT, final adjustments shall be made to the equipment as necessary. Oil filters shall be replaced, oil shall be changed and the proper operation of all equipment shall be demonstrated to the Engineer. Owner personnel shall be instructed in the maintenance and operation of the equipment. These final adjustments and instructions shall be carried out by the generator-set supplier.

****END OF SECTION****

SECTION 16450

GROUNDING SYSTEM

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. Applicable provisions of Section 16010 are incorporated herein as though fully set forth at length.
 - 1. Ground Power system, electrical equipment and raceway grounding and bonding, and specialized systems including testing.
- B. Work Included: Furnish all labor, material, equipment, tools and services necessary for the installation, connection and testing of all grounding as specified herein and as shown on the Drawings.

1.2 STANDARDS

- A. American Society for Testing and Materials (ASTM) Publication:
 - 1. B228 Copper Clad Steel Conductors Specification
 - 2. D178 Specifications for Rubber Insulating Matting
- B. National Electric Code (NEC)
- C. International Electrical Testing Association (NETA) Publication:
 - 1. ATS - Acceptance Testing Specifications for Electrical Equipment Power Systems

1.3 SUBMITTALS

- A. Submit material or equipment data in accordance with the Product Information category of the General Conditions and the submittal requirements of Section 16010.
- B. Manufacturer's product data for the following:
 - 1. Connection methods and details.
 - 2. Ground Rods.
 - 3. Ground rod wells.

1.4 QUALITY ASSURANCE

A. Comply with the following codes and standards, and section 16010:

1. IEEE 81- Recommended guide for measuring ground resistance and potential gradients in the earth.
2. NEMA.
3. UL Listings.
4. MIL Handbook 419.

PART 2 MATERIALS

2.1 GENERAL SYSTEM DESCRIPTION

- A. The grounding systems shall consist of the ground rods, grounding conductors, ground bus, ground fittings and clamps, and bonding conductors to water piping and structural steel as shown on the Drawings. One system shown provides service and separately derived system grounds. A second system is an electronic ground system to provide for the discharge of static electricity. All are bonded together.
- B. Ground all electrical equipment, conduits, supports, cabinets, and switchgear in accordance with National Electrical Code and as shown on the drawings, the intent being a complete system ground and equipment ground.

2.2 ACCEPTABLE MANUFACTURERS

A. Ground Rods:

1. Anderson Electric Corporation
2. Copperweld Corporation
3. Harger

2.3 SYSTEM COMPONENTS

- A. Ground Rods: Ground rods shall be cone pointed copper clad Grade 40 HS steel rods conforming to ASTM B228. The welded copper encased steel rod shall have a conductivity of not less than 27% of pure copper. Rods shall be not less than 3/4-inch in diameter and 10 feet long, unless otherwise indicated. The manufacturer's trademark shall be stamped near the top.
- B. Ground Conductors: Buried conductors shall be medium-hard drawn bare copper; other conductors shall be soft drawn copper. Sizes over No.6 AWG shall be stranded. Coat all ground connections except the exothermic welds with electrical joint compound, non-petroleum type, UL listed for copper and aluminum applications.

- C. Ground Connections: Connection to ground rods and buried connections shall be by exothermic weld. Lugs for attachment of cables to steel enclosures shall be of the binding post type with a 1/2-13NC stud. Each post shall accommodate cables from #4 AWG to #3/0 AWG.
- D. Ground Rod Boxes: Boxes shall be a 9-inch-diameter precast concrete unit with hot-dip galvanized traffic covers. Units shall be 12-inches deep. Covers shall be embossed with the wording "Ground Rod."
- E. Ground rod wells shall be 8" inch diameter constructed of reinforced concrete with a reinforced concrete removable cover stamped "GROUND" as manufactured by Christy or equal.
- F. Ground Bus: Ground bus shall be a high conductivity copper alloy strap measuring 3/16-inch by 3/4-inch and of lengths as shown on the Drawings. Bus shall be predrilled and tapped to accept 8-32" brass machine screws on 12-inch centers or with greater density if required.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Ground all equipment for which a ground connection is required per NEC whether or not the ground connection is specifically shown on the Drawings.
- B. Where mechanical lugs are not welded or fastened with threaded bolt, surfaces shall be thoroughly cleaned and paint scraped to bare metal before connections are made to insure good metal-to-metal contact.
- C. Grounding conductors shall be so installed as to permit shortest and most direct path from equipment to ground. Ground connections shall be accessible for inspection and made with approved solderless connections braced (or bolted) to the equipment or structure to be grounded.
- D. An equipment grounding conductor must be installed in each conduit with power conductors or, in the case of multi-conductor cable, run inside the sheath.
- E. Where generators and transformers are indicated on the drawings to be grounded solidly to a separate grounding electrode located at the equipment in addition to the ground connection, this grounding electrode shall be bonded to the system ground through the equipment grounding conductor(s) and/or a separate grounding conductor as indicated on the drawings.
- F. A main system ground, bare copper conductors, size as indicated, shall be run in PVC conduit from the MCC/switchboard to a ground point outside the pad and an

electrode ground under the pad as indicated on the drawings. This ground shall be extended to metallic water piping.

- G. Connections to ground rods shall be as noted on Drawings or be exothermically welded. Ground rod connections shall be in a ground rod well for inspection purposes.
- H. All bonds between the grounding electrode conductors and the grounding electrodes must be accessible for inspection and routine maintenance. No buried ground connections (except rebar bonds) shall be accepted.
- I. All enclosure doors with 120 VAC mounted devices shall be bonded to the enclosure ground bus.
- J. Where ground rods must be driven to depths over 8 feet, increase rod diameter used, sufficiently to prevent the rod from bending or being damaged.
- K. All direct buried conductors shall be minimum of 30" below grade.
- L. Bond metallic water piping at its entrance into each building. Ground separately derived electrical system neutrals to the metallic water piping in addition to the system driven ground, per NEC requirements.
- M. Provide a ground wire in every conduit carrying a circuit of over 50 volts to ground.
- N. Make embedded or buried ground connections, taps and splices with exothermic welds. Coat ground connections.
- O. Effectively bond structural steel for buildings to the grounding system using exothermic welds.

3.2 TESTING

- A. Conduct ground resistance tests using a ground megohmmeter with a scale reading of 25 ohms maximum. Resistance between ground and absolute earth shall not exceed 25 ohms and shall be measured using the fall of potential method with a three or four terminal ground resistance tester. A minimum of ten (10) ground resistance tests shall be measured at 30-foot intervals from the service-grounding electrode. The test results shall be plotted on a curve and submitted in the report. The ground resistance test shall be conducted in the presence of the Engineer before the equipment is placed in operation. Use of salts, water or compounds to attain the specified ground resistance is not acceptable.

- B. Test methods shall conform to NETA Standard ATS using the three electrode method. Conduct tests only after a period of not less than 48 hours of dry weather.
- C. Furnish to the Owner a test report with recorded data of each ground rod location included on a drawing with date of test, weather conditions and the measured resistance.

****END OF SECTION****

DIVISION 17 – INSTRUMENTATION AND CONTROLS

SECTION 17010

INSTRUMENTATION

PART 1 GENERAL

1.1 DESCRIPTION

- A. Provide and install all instruments, devices, wiring, terminal blocks, accessories, and enclosures as specified herein and as shown on Contract Drawings for the instrumentation system. The Contract Documents are intended as an outline for the work and are descriptive of the type of hardware and software configuration to be provided. Any error or omission of detail shall not relieve the Contractor from the obligations there under to provide and install in correct detail any and all materials necessary for a complete operational instrumentation system, at no additional cost to the Owner.
- B. Work includes that specified in Division 16, Electrical.
- C. The major components for in the instrumentation scope of work, which includes both the furnishing and installation of:
 - 1. Level Switches
 - 2. Flow Meter
 - 3. Level/Pressure Transmitter.
 - 4. Pressure Gauges
 - 5. Turbidity Analyzer – See Specification Section 11500
 - 6. Chlorine Residual Analyzer – See Specification Section 11500
 - 7. Telemetry System
 - 8. Accessories
- D. The contract documents are not intended to cover every detail of materials, configuration, or construction. The Contractor shall furnish all tools, temporary utilities, materials, setup, parts, labor, and other incidentals necessary to fully complete the entire work, whether or not said details are particularly shown or specified, all at no additional cost to the Owner.
- E. Coordinate the installation of instruments and accessories in the control panel as shown on the Drawings.

1.2 RELATED WORK

- A. Installation of primary elements which require placement into or taps off of a process flow line is included under Division 15000 Mechanical. Electrical equipment interface,

control panels, conduit and cable for instrumentation is covered in Division 16000 Electrical.

1.3 QUALITY ASSURANCE

- A. All equipment shall comply with applicable standards of the Underwriter's Laboratories, Inc.
- B. Provide enclosures suitable for the type of location in which they are located per Specification Section 16010, General Requirements Electrical.

1.4 SUBMITTALS

- A. Provide submittals and drawings as specified in Section 16010, General Requirements, Electrical.

1.5 OPERATION AND MAINTENANCE MANUALS

- A. Provide operating instructions as specified in Section 16010, General Requirements, Electrical.

PART 2 PRODUCTS

2.1 GENERAL

- A. It is the intent of the Contract Specifications and Drawings to secure the highest quality in all materials and equipment in order to facilitate operation and maintenance of the plant. All equipment and materials shall be new and the products of reputable suppliers having adequate experience in the manufacture of these particular items. For uniformity, only one manufacturer will be accepted for each type of product.
- B. All equipment shall be designed for the service intended and shall be of rugged construction, of ample strength for all stresses which may occur during fabrication, transportation, erection, and continuous or intermittent operation. All equipment shall be adequately stayed, braced and anchored; and shall be installed in a neat and workmanlike manner. Appearance and safety, as well as utility, shall be given consideration in the design of details. All components and devices installed shall be standard items of industrial grade, unless otherwise noted, and shall be of sturdy and durable construction suitable for long, trouble-free service. Light-duty, fragile and competitive grade devices of doubtful durability shall not be used.
- C. Products that are specified by manufacturer, trade name or catalog number establish a standard of quality and do not prohibit the use of equal products of other manufacturers provided they are approved by the Engineer prior to installation.

- D. The equipment specifications have been prepared on the basis of the equipment first named in the Specifications. The Contractor shall note that the second named equipment, if given, is considered acceptable and equal equipment, but in some cases additional design, options, or modifications may be required, at no additional cost to the Owner, to meet Specifications.
- E. All equipment shall be designed and constructed so that in the event of a power interruption, the equipment specified hereunder shall resume normal operation without manual resetting or operator interaction when power is restored.
- F. Signal transmission from remote or field electric and electronic devices shall be 4-20 mA, powered by a 24 VDC loop supply from the panel that is to receive the signal. Nonstandard transmission methods such as impulse duration, pulse rate, and voltage regulated will not be permitted except where specifically noted.
- G. Outputs of equipment that are not of the standard signals as outlined, shall have the output immediately raised and/or converted to compatible standard signals for remote transmission.

2.2 PRESSURE/LEVEL TRANSMITTER (PIT/PT/LIT/LT)

- A. Pressure transmitters shall be two wire devices with continuously adjustable span, zero and damping adjustments, integral indicator scaled in engineering units, solid state circuitry with a 4-20 mA output. Accuracy shall be plus or minus 0.10 percent of calibrated span. Process wetted and body materials shall be 316L SS. Process connections shall be ½-inch NPT.
- B. The transmitters shall be capable of withstanding an over pressure of 50% of rating without requiring recalibration. Range shall be 0-100 PSIG for pressure monitors and 0-35 FT for level sensors unless otherwise noted.
- C. Wetted components shall be stainless steel. Transmitters shall be housed in NEMA 4 enclosure for indoor mounting and shall be equipped with a stainless steel wall mounting bracket and hardware. Each pressure transmitter shall include a stainless steel valve manifold and fittings for calibrating the unit.
- D. Level/Pressure transmitters shall be manufactured by Rosemont Model 2088G2S22 or equal.

2.3 LEVEL SWITCHES

- A. The float level switches shall use the movement of a float, the weight of whose moving parts is less than that of the displaced process liquid, to actuate switches as the level rises and

falls. The switches shall be integrally mounted within the float. The switch covering shall be made of indestructible polypropylene material. The cable shall be PVC coated. The switches shall be reversible such that the switching action operates on rising or falling level. The switch contacts shall be rated for 250 volts ac or dc and 5 amperes minimum, and shall be terminated with 14 AWG wires in a NEMA 4X terminal box with appropriate compression fittings. Provide a stainless steel bracket and stainless steel mounting hardware for adjusting the operating points of the float switches. Float level switches and bracket shall be as manufactured by Flygt Corporation model ENM-10 with cable lengths and hardware, as required to complete the installation, or equal.

2.4 PRESSURE GAUGES

- A. The pressure gauges shall be 4-1/2 inch diameter bourdon tube type. The scale and range shall be as shown on the Process and Instrumentation diagrams. Gauge scales shall have a minimum of 5 major and 50 minor divisions. Major divisions shall be equally spaced and shall be in whole integers. Scale units (psi) shall be engraved on the scale face. Gauges shall have clear acrylic or shatterproof glass windows and shock resistant cases. Gauge accuracy shall be ± 1 percent of span. All wetted parts shall be Type 316 stainless steel. Pressure Indicator (gauge) 4.5" dial, Ashcroft 45-1279-SS-04L-XLL

2.5 MAGNETIC FLOWMETER

- A. The Modular pulsed DC magnetic flowmeters measure the process flow. The device consists of a flowmeter tube (element), through which the fluid to be measured flows and a transmitter, which converts the element signal into the 4–20mA dc current flow signal with a flow totalization pulse output. Where elements are mounted below grade provide potting gel in the unit to prevent moisture intrusion or NEMA 6P construction.
- B. Accuracy shall be $\pm 0.5\%$ or better and unaffected by temperature changes. Provide positive zero return, low flow cut-off, bi-directional flow, noise suppression and empty pipe detection features.
- C. The electrodes shall be AISI 316 stainless steel. Flange connections shall be ANSI class 150 carbon steel flanges. The liner shall be hard rubber. Provide built-in ground electrodes to eliminate grounding rings.
- D. The Magnetic Flowmeter, where not shown to be provided under other sections of these specifications, shall be as manufactured by Sparling, Series TigerMag FM655/656 with integral mounted transmitter.

2.6 TURBIDITY ANALYZER

See Monitoring and Control specifications

2.7 CHLORINE RESIDUAL ANALYZER

See Monitoring and Control specifications

2.8 TANK TELEMETRY SYSTEM

- A. Provide a telemetry system that communicates the power failure status and tank level from the tank site pedestal to the water treatment plant PLC over dial-up voice grade telephone lines: components shall be AGM Electronics, Inc. or equal. Provide an RTU (data controller with analog and digital inputs), Dial-up MODEM and power supply at the tank site RTU pedestal. Provide a matching RTU (data controller with analog and digital outputs), Dial-in MODEM and power supply in the control panel (or adjacent enclosure) at the Water Treatment Plant.
- B. Provide two AGM Electronics, Inc. Data Controllers, model 5018 DC with power supply and cables. The unit shall be capable of analog and digital, inputs and outputs as well as communicating over telephone lines using a modem. The unit shall be programmable. The unit shall be capable of operating in environments of -30 degrees C to 80 degrees C and humidity levels of 5 to 95% and be provided with a seven year warranty.
- C. Provide two AGM Electronics, Inc. Dialup Leased Line Modems, model DLM with power supply and cables.
- D. Provide surge/lightning protection for the telemetry system.

2.9 ACCESSORIES

- A. Isolators. The current/current (I/I) and voltage/current (V/I) isolators shall have all solid state circuitry mounted in plug-in modules. Each isolator shall provide complete isolation and amplification of the 4-20 mA output signal from the 4-20 mA or 1-5 VDC input signal and the isolator power supply. The output signal shall be capable of driving a 600 ohm load. Accuracy shall be +/- 0.25% of span. The isolators shall be powered from a 120 VAC source. Isolators shall be intrinsically safe where shown on drawings. Each isolator shall have a seven year warranty. The isolators shall be as manufactured by AGM Electronics, Action Instruments, or equal.
- B. Tubing shall be stainless steel tubing shall be Type 304 seamless, cold drawn and annealed per ASTM A269. Unless shown otherwise provide 1/4 inch diameter with 1/4 inch O.D. x 0.045 inch wall or 3/8 or 1/2 inch diameter where shown on plans which shall be 3/8-inch O.D. x 0.035-inch wall or 1/2 inch O.D. x 0.035-inch wall. Compression fittings shall be Type 316 stainless steel equal to Imperial, Swagelok or equal.
- C. Instrument valves shall be 1/4-inch, 3/8-inch or 1/2-inch from Whitey, Hoke or equal to

match tubing material and size.

PART 3 EXECUTION

3.1 WORKMANSHIP

- A. All instrumentation work in this contract shall conform to the codes and standards outlined herein.
- B. The Contractor shall employ personnel who are skilled and experienced in the installation and connection of all elements, equipment, devices, instruments, accessories, and assemblies. All installation labor shall be performed by qualified personnel who have had experience on similar projects. Provide first class workmanship for all installations.
- C. Ensure that all equipment and materials fit properly in their installations.
- D. Perform any required work to correct improper installations at no additional expense to the Owner.
- E. The Owner reserves the right to halt any work that is found to be substandard or being installed by unqualified personnel.
- F. Rejected equipment or equipment without approved submittals shall be immediately removed from the delivery or job site by the Contractor.

3.2 INSTALLATION

- A. Install and supply all products necessary, at no additional cost to the Owner, to provide an operational system. This shall include the following:
- B. Contract Drawings are intended to show the basic functional requirements of the instrumentation system and do not relieve the Contractor from the responsibility to provide a complete and functioning system.
- C. Provide relays, signal converters, isolators, boosters, power conditioners, circuit cards, and other miscellaneous devices as required for the proper interface.
- D. Provide analog loop isolators where required to eliminate "ground loops."
- E. All wires shall be identified with machine printed labels. Plastic wire gutters shall be used for routing of wire bundles. Wiring shall be neat and laced with plastic tie wraps.
- F. The instrumentation and accessory equipment shall be installed in accordance with the manufacturer's instructions and located as shown on the Drawings. When manufacturer's

installation literature specifies a particular location or orientation in a process line due to measurement accuracy considerations, the installation shall be in conformance with the manufacturer's instructions.

- G. Engineering scales and charts for all instruments shall be provided that match the range of instruments that monitor the process.
- H. Instrument installation methods.
 - 1. Install instruments at the location shown on the Plans or approved by the Owner. Instruments shall be NEMA rated for the installed location.
 - 2. Install level and plumb.
 - 3. All instruments shall be provided with floor stands or wall brackets as shown or required.
 - 4. Mounting hardware, stands, channels, and spacers shall be either galvanized steel, stainless steel, or non metallic to match the NEMA rated location.
 - 5. All screws and bolts shall be stainless steel.
- I. Wiring and raceway installation methods.
 - 1. Instrumentation wiring shall be carried in conduits provided in compliance with the Division 16, electrical. All analog circuits shall be run as twisted pairs or triads. In no case shall a circuit be made up using conductors from different pairs or triads. Triads shall be used wherever three wire circuits are required. Triads are not to be formed by using two pairs. Terminal blocks shall be provided at all instrument cable junctions and all wires shall be identified at such junctions. Instrumentation wiring shall be run without splices between instruments, terminal boxes, or panels.
 - 2. The number of signal wires listed on the Drawings is approximate only, and the Contractor shall determine the required number of signal pairs or triads to properly connect the system furnished, especially when substituting equipment.
- J. Wiring, grounding, and shielding methods.
 - 1. It is important to observe good grounding and shielding practices in the generally noisy environment in this application. The following practices shall be observed unless modified by manufacturer's standards:
 - 2. Each electronic equipment chassis shall be grounded to power ground.
 - 3. All analog signals shall be transferred over shielded twisted pair cables.
 - 4. All communication signals shall be transferred over shielded cables.
 - 5. All shields of analog inputs and outputs of the PLC shall be connected at the PLC unit only. They shall not contact ground at any other point including the transmitters or receiving devices.
 - 6. Status and alarm signals routed through noisy environment shall be transferred

over shielded twisted pair cables.

7. Each shield which is not connected to ground shall be covered with a heat shrink insulating boot. Shields shall be connected together at each transition from one cable to another for a continuous effective shield circuit. All shields shall be connected on terminal blocks.

K. Mechanical Installation

1. Install new instruments and transmitters at locations as shown on Drawings.
2. Install and calibrate indicators/transmitter and connect to elements per manufacturer's recommendations.
3. Ground transmitters/elements per manufacturer's recommendations.

3.3 TESTING

- A. The Contractor shall use the services of qualified testing personnel for the purpose of performing inspections and tests as herein specified and indicated on the Drawings. The procedures stated herein are guidelines for the intended tests, the Contractor shall be responsible to modify these tests to fit the particular application and insure personnel safety. It is the intent of these tests to assure that the instrumentation system is operational and is installed in accordance with design Documents.
- B. Test plans and test reports shall be treated as formal submittal. 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.
- C. The Contractor shall be responsible for each supplier of equipment to provide the following minimum services for each type of instrument supplied. The supplier shall use a qualified instrumentation field technician (sales representatives are not acceptable) to perform services listed herein.
 1. Advise and instruct Contractor on installation requirements.
 2. Check, calibrate, and place equipment in operation.
 3. All programmable devices shall be programmed and tested prior to startup. Programming shall be adjusted or changed as directed by the Owner or Engineer, at no additional cost.
 4. Coordinate with the Owner and setup all alarm, process, and operation setpoints.
 5. Perform the acceptance tests.
 6. Visit the job as often as required and spend as much time as necessary to ensure an operational instrumentation system.
 7. Be readily available by telephone to answer all questions on supplied equipment.
 8. Provide training as specified in subsection labeled Training.
 9. The Contractor shall insure each supplier of instrumentation assumes the

responsibility for providing primary elements in a timely manner, for insertion into the process line, coordinating size and material type when applicable, overseeing the actual installation, calibration, and acceptance testing.

D. Operational Readiness Test (ORT)

1. Prior to startup, the complete instrumentation system shall be inspected, tested, and documented to show that it is ready for operation.
2. The Contractor shall prepare a test plan for the ORT and shall submit it for review at least 30 days before the ORT is performed.
3. The ORT shall demonstrate that the instrumentation system meets the requirements of the Specification which are nonloop-specific. Following are examples of non-loop specific functions.
 - a. Capacity. Demonstrate that all components and subsystems have the specified capacity, including spare capacity.
 - b. Timing. Include tests to demonstrate all specified timing requirements.
 - c. Diagnostics. Include tests to demonstrate specified diagnostic capabilities and procedures.
4. If any component or subsystem fails the ORT, the Contractor shall correct the problem and repeat the test until it is successful.
5. 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 reviewed by the Engineer before the FAT (functional acceptance test) is performed.

E. Functional Acceptance Test (FAT)

1. Once the facility has been started up and is operating, a witnessed FAT shall be performed on the complete instrumentation system to demonstrate that it is operating as specified and meets the requirements of the Specifications.
2. 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.
3. 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.
4. If any equipment or system fails the FAT, the Contractor shall correct the problem and shall repeat the test until it is successful.
5. The FAT shall be performed in the presence of the Engineer.
6. After completion of the FAT, the Contractor shall prepare a test report and shall submit it for review. The instrumentation system will not be accepted before the FAT is successfully completed and the test report submitted to and reviewed by

the Engineer.

3.6 TRAINING

- A. The Contractor shall provide a eight man-hour (total for both sites) for training of the operation of the instrumentation system to Owner personnel.
- B. Instructions shall consist of the functional description of each piece of equipment, including calibration and setting of set points. Demonstration of the operation of each system shall be included.
- C. The Contractor shall provide all manuals and study materials required for the training of Owner personnel.

3.7 WARRANTY

- A. The instrumentation supplier shall have a staff of experienced personnel available to provide service on 2 working days notice during the warranty period. Such personnel shall be capable of fully testing and diagnosing the hardware and software delivered; and of implementing corrective measures.
- B. If the instrumentation supplier fails to respond in 2 working days, the Owner at its option will proceed to have the warranty work completed by other resources; the total cost for these other resources shall be reimbursed in full by the Contractor. The use of other resources, as stated above, shall not change or relieve the Contractor or supplier from fulfilling the remainder of the warranty requirements.
- C. Prior to "final acceptance", the Contractor shall furnish to the Engineer a listing of warranty information for all manufacturers of materials and equipment used on the project. The listing shall include the following:
 - 1. Manufacturer's name, service contact person, phone number, and address.
 - 2. Material and equipment description, equipment number, part number, serial number, and model number.
 - 3. Manufacturers warranty expiration date.
 - 4. Completed test forms.

****END OF SECTION****

SECTION 17330

SCADA AND CONTROLS

PART 1 GENERAL

1.1 SCOPE OF WORK

- A. The CONTRACTOR/SYSTEM INTEGRATOR shall furnish all labor, materials, equipment and incidentals, including a SCADA Server, Programmable Logic Controller (PLC), Operator Interface Terminal (OIT), components, associated equipment, hardware and software necessary to provide a complete and operational control system with telemetry. It follows that a single System INTEGRATOR supplies complete responsibility of the control system required for this project. This responsibility includes, but is not limited to, all work necessary to select, furnish, construct, and supervise installation, calibrate, test, and place into operation all server, transmitters, probes, instruments, Programmable Logic Controller, motor controls, alarm equipment, data lines, communication cables, telephone systems, monitoring equipment, and accessories as specified herein.
1. The SCADA server.
 2. The telemetry pedestal shall communicate the tank level to the WTP PLC.
 3. All communications are via two existing voice grade telephone lines at the WTP.
- B. The CONTRACTOR/SYSTEM INTEGRATOR is responsible for coordinating software requirements for the SCADA server, PLC and associated communication equipment with the OWNER. The CONTRACTOR/SYSTEM INTEGRATOR shall provide software and programming for the SCADA Server and PLC.
- C. The CONTRACTOR/SYSTEM INTEGRATOR is responsible for the testing, startup and training.
- D. The OWNER's existing control system shall remain in operation throughout the duration of this project.
- E. Meet with the OWNER to discuss the work plan, shutdowns, field conditions, testing, schedule and any other relevant issues.
- F. Meet with the OWNER to coordinate the installation of the remote telemetry enclosure at the main office. Mount the enclosure on the wall, plug it in, connect the telephone modem and satisfactorily test the unit.
- G. Review programming requirements required by the narrative in Specification Section

11200, Monitoring and Control Equipment.

1.2 SUBMITTALS

- A. Submittals shall include those set forth in Specification Section 16010, General Requirements, Electrical.
- B. Provide operating and maintenance instructions as specified in Section 16010, Electrical, General. This shall include complete technical manual, programming, wiring diagrams. Provide drawings and diagrams showing final as-built conditions.

1.3 MANUFACTURER'S DIRECTIONS

- A. Manufacturer's directions shall be followed in all cases where manufacturers of articles used furnish directions covering points not shown on the drawings or herein specified.

1.4 WARRANTY

- A. Guarantee all work for one year from date of acceptance against all defect in material, equipment, and workmanship.

1.5 SITE CONDITIONS

- A. General Environment. The programmable logic controller (PLC) shall withstand anticipated environmental conditions of -20 degrees to 65 degrees C operating temperature and 5 percent to 95 percent humidity non-condensing. Electro-magnetic interference (EMI) and radio frequency interference (RFI), as may be anticipated in a typical industrial environment, shall not impede proper functioning of the PLC systems. EMI and RFI is expected from two-way radios, variable frequency drives, lightning strikes, motors, transformers, contactors, relays, etc.
- B. Normal fluctuations of the 120 VAC 60 Hz power supply shall not cause improper operation of the PLC system. Normal fluctuations are voltage excursions between 100 and 130V, or surges caused by switching of electrical loads. On loss of station AC power, the PLC shall initiate an orderly shutdown of its control functions while powered by a UPS. No erratic operation of any PLC output device is allowed during start-up, shutdown, operation, or on loss of or restoration of power. On restoration of power, the PLC's shall restart the system in an orderly and controlled sequence. Surge Protection. PLC power supply, CPU and all I/O devices shall have built-in surge withstand capacity to prevent damage from electrical surges on any connected line.

1.6 QUALITY ASSURANCE

- A. The custom control panel shall be built in accordance with the overall sizing and

component layouts as detailed on the Drawings, and no deviations will be allowed without prior approval of the Engineer.

- B. Control panels shall be UL labeled as industrial control panels.
- C. All devices and components of a similar type or function (i.e., circuit breakers, control relays, timers, etc.) shall be the product of one manufacturer unless otherwise noted.
- D. The custom control panel shall be manufactured by Aqua Sierra Controls, Tesco or approved equal.

PART 2 PRODUCTS

2.1 SCADA SERVER

- A. The SCADA Server shall provide interface to the PLC and process via animated graphics accessible from a remote computer with a modem and web browser. The server and software shall be Data Flow Systems or equal.
- B. The Hyper SCADA Server (DFS HSS001) shall be an industrial grade computer. The server shall include as a minimum: NEMA rated fiberglass enclosure, (DFS HSS001) backplane, hyper server module (DFS HSM002), network switch module (NSM001), power supply module, 2.6 AH backup battery, Linux Operating System, HT3 SCADA software, MySQL software and telephone surge protector.
- C. Provide a communication system comprised of a dial-up modem.

2.2 CONTROL PANEL AND PEDESTAL ENCLOSURES

- A. Furnish and install all control equipment, as shown on drawings, in a U.L. listed enclosures. The enclosure shall be manufactured by Hoffman, Tesco or equal. The enclosure shall be constructed of 12 gauge hot dipped galvanized steel.
- B. Provide fluorescent panel light, door switch, GFCI receptacle, PFR power fail relay, strip heater, thermostat and heat shield (if required). All openings shall be sealed to prevent entrance of insects and rodents. Finish shall be polyester dry powder, electrostatically applied and baked on at 380 deg. F. Color shall be white interior doors and light brown (camel) exterior. The painting process shall include five stages of metal preparation using dip tanks as follows: 1) Alkaline cleaner, 2) Clear water rinse, 3) Iron phosphate application, 4) Clear water rinse, and 5) Inhibitive rinse to seal phosphated surfaces. All bussing and wire shall be copper. All wire shall be stranded with locking spade pressure connectors and labeled with clip-on permanent plastic wire markers. All circuit breakers and dead front mounted devices (lights and switches) shall be equipped with engraved

phenolic nameplates.

- C. Thermostatically controlled heating and cooling systems shall be provided and as approved by the Engineer to maintain suitable climate conditions within the control panel as required to provide proper operation of the panel and to comply with the Drawings and Specifications.
- D. A ground bus shall be provided. It shall be connected to the service ground. Screw type lugs shall be provided for connection of equipment grounding conductors.
- E. Provide interior lighting for each enclosure. The luminaries shall be the size and type normally supplied with the specified spaces. As a minimum, the luminaries shall be a 15 to 30 watt rapid start fluorescent strip type fixture with warm white lamps. A lens or guard shall be furnished and installed over each lamp. The fixture ballasts shall be capable of providing reliable starts with ambient temperatures down to 30 degrees. Ballast noise shall not exceed 50 dBA.
- F. Provide terminal blocks for all wiring connections. Bundle and neatly install wiring in panel. Utilize wire duct with isolation barriers when DC signal conductors are included: IBOCO, Panduit or equal.
- G. General Wiring: 600V type THWN copper, minimum size #12 AWG for power and #14 for control. All wire shall be stranded. Reference specification section 16120 for color coding and labeling requirements.

2.3 PROGRAMMABLE LOGIC CONTROLLER

- A. Provide a complete PLC system. Each PLC shall include: processor, power supply, input/output section and power supplies as required, and all necessary auxiliary devices for a complete automatically operating process control system for the station.
- B. The Control Panel PLC processors shall be SCADAPak, Modicon or Allen-Bradley PLC with Modbus or Ethernet communication ports, chassis and expansion I/O modules required to accommodate actual I/O plus 25% spare.
- C. All spare points available on the furnished I/O modules shall be wired out to terminal strips

2.4 OPERATOR INTERFACE TERMINAL

- A. The Panel-Mounted Operator Interface Terminal shall be front panel mounted. The units shall include a 7 inch color active matrix TFT screen with minimum 800 x 480 display resolution. The unit shall have adequate graphics capability and memory for the programming required by specifications. Graphics and functionality shall be programmed

with the appropriate version of manufacturer's recommended software or similar. Communications with PLC shall be Modbus or Ethernet.

- B. Provide Red Lion G07 or equal.

2.5 TELEMETRY COMPONENTS

A. Modem

- 1. Dial-up (and leased line) modem (AGM part number AUX/DIN5019-1). The dial-up modem shall be utilized to transmit and receive more than a single piece of data from a remote site or send bi-directional communications over leased (dedicated metallic wire pair) or dial-up phone system. The dial-up modem shall be completely "potted" in silicon rubber making it impervious to the elements commonly found in harsh environments.

B. Data Controller

- 1. Data Controller module (AGM part number DIN/AUX5018-X). The data controller shall provide the ultimate in remote site data acquisition, data processing, control and interface versatility and flexibility. The data controller shall easily configured for use as a stand-alone controller, site to site or site to multi-site data telephone telemetry system, or data concentrator using multiple data controllers. The module shall provide up to 8 analog and 8 discrete inputs and outputs in a single package. Data controllers shall be mixed and matched to meet the total input and output requirements. The shall provide a number of communication interface options and network configuration possibilities using the available RS485, RS232C and Ethernet ports. The module shall be completely "potted" in silicon rubber making it impervious to the elements commonly found in harsh environments.

C. Auxiliary Components

- 1. Provide power supplies, surge protector, cables, batteries, breakers and other components as recommended by the telemetry equipment manufacturer in order to complete the system.

2.6 MISCELLANEOUS CONTROL PANEL COMPONENTS

- A. The uninterruptible power supplies (UPS) shall consist of desk type commercial units securely mounted on channel. The units shall provide 120-volt uninterruptible power to the instrumentation and control equipment. Each UPS unit shall be modular in design with true electrical isolation and power conditioning. When utility power is available, rectifier/charger shall supply the load through the inverter and maintain the battery in a

fully charged "float" condition. When utility power drops below preset limits or fails the load shall be supplied from the battery through the static inverter. There shall be no output disturbance transmitted to the load. Upon return of the utility power, the rectifier/charger shall supply power to the load through the inverter while it recharges the battery. There shall be no output disturbance transmitted to the load.

- B. Other components shall be provided as described in Specification Divisions 16 and 17.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the manufacturer's instructions and located as shown on the Drawings. The CONTRACTOR/SYSTEM INTEGRATOR shall be responsible for coordinating the equipment, performing the installation and start-up in a timely manner, and assuring a fully operable and function-tested system.

3.2 PROGRAMMING SERVICES AND DOCUMENTATION

- A. In addition to the required application programming and warranty service the CONTRACTOR/SYSTEM INTEGRATOR shall provide 2 hours of on site SCADA and PLC programming services during start-up. Allotted programming hours are in addition to the requirements of the specification to provide for a complete and operational system. Programming allotment hours are to be utilized to provide for interfacing with equipment not specified or implied in the contract documents, enhancement of operation and interfacing with new equipment added during the course contract implementation. Onsite programming service shall be defined and directed by the OWNER on a task basis during the course of construction. Programming hours shall be applied in the field and logged accordingly by the Project Manager Representative. Unused programming hours shall be provided as a service contract during the warranty period.
- C. The PLC and OIT programmer shall provide programming documentation that fully describes the application program function and application. The programming documentation shall clearly identify all programming functions, configurations, set-up and as-programmed ladder-logic rungs, function blocks, modules and structured text blocks. Documentation shall be prepared to present the information to both an experienced and inexperienced programming audience. Standard self commenting/documenting programs may be utilized to generate the specified lists and cross reference files provided they utilize the ISA tag references, equipment's and descriptions specified herein to be included with the documentation. The printouts will not be accepted as a substitute for the required system overview and control description narratives specified.
- D. Provide programming for the SCADA Server and operator interface terminal unit (OIT).

Provide five to ten different primary screens and multiple popup or secondary screens to monitor and control the facility, view and acknowledge status and alarms, view collected and derived data, and troubleshoot problems by interfacing with the PLC. All PLC information shall be available via the OIT. All setpoints and other control parameters shall be modifiable at the local OIT and remotely via the SCADA Server.

- E. A comprehensive control description shall be provided for operations personnel inexperienced in PLC programming. The control description shall be prepared in a narrative format that explains the operation of the program based on a process-by-process and loop-by-loop basis. The programming documentation shall be provided in three ring binders with a table of contents and tabbed accordingly. All Setpoints shall be listed by their tag number with a given range of acceptable input values for operation.
- F. See Specification Section 11200, Monitoring and Control Equipment for control strategy guidelines.

3.3 TRAINING

- A. Provide four (4) hours of training on site.

3.4 TESTS

- A. Testing shall be provided as described in Specification Section 16010, General Requirements, Electrical.
- B. In addition, conduct a factory test all systems upon completion of production to demonstrate that equipment furnished and installed as connected functions electrically in the manner required.
- C. General Requirements. The CONTRACTOR/SYSTEM INTEGRATOR shall program, install and test all Computer, communication networks, and PLC components and communications equipment contained within their associated control and equipment panels. This testing shall be included in factory testing and field testing. The CONTRACTOR/SYSTEM INTEGRATOR shall provide a test plan that will address testing of the PLC control strategies and verify all communications. In addition to control panel factory testing, the PLC shall be interconnected with the Security System interface and the link tested.
- D. Do not energize PLC equipment before the manufacturer has checked the installation.

****END OF SECTION****