Orange County Water District

Groundwater Replenishment System
Final Expansion Project
Contract No. GWRS-2019-01

TECHNICAL SPECIFICATIONS

Volume 2

ISSUED FOR BID
April 2019

Prepared by
BLACK & VEATCH

Irvine, California
B&V Project No. 196566
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Fault Rupture Hazard Study Groundwater Replenishment System – Final Expansion; prepared by Shannon & Wilson, Inc., July 10, 2018

Limited Environmental Site Assessment Groundwater Replenishment System Final Expansion; prepared by Shannon & Wilson, Inc., April 10, 2019


Geotechnical Investigation Initial Expansion of the Groundwater Replenishment System Orange County Water District, prepared by Diaz, Yourman & Associates, April 2010

Geotechnical Investigation Secondary Effluent Flow Equalization Orange County Water District, prepared by Diaz, Yourman & Associates, August 2010

Final Geotechnical Report Secondary Activated Sludge Facility 2 at Plant No. 1 (P1-102), prepared by CDM, September 2006

Final Geotechnical Report Secondary Activated Sludge Facility 2 at Plant No. 1 (P1-102), prepared by CDM, October 21, 2004


Geotechnical Report Low-Flow and Plant Water Pump Station Ocean Outfall System Rehabilitation Project OCSD Plant No. 2 (J-117), prepared by Kleinfelder

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| 11345   | OCSD – Chemical Feed Pumps and Sample Pumps Peristaltic Pumps |
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| 11392   | Automatic Sampler |
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| 11403   | Cartridge Filters |
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General, Demolition, Civil, Corrosion Protection, Yard Piping, Foundation, Architectural, Structural, Mechanical, HVAC, Plumbing, Fire Protection

## VOLUME 6

**DRAWINGS (Continued)**
Electrical

## VOLUME 7

**DRAWINGS (Continued)**
Instrumentation and Control

## VOLUME 8

**DRAWINGS (Continued)**
Segment, Loop, and Ground Improvements
DIVISION 1 – General Requirements
1. GENERAL DESCRIPTION OF WORK. The Work to be performed under these Contract Documents involves furnishing all labor, materials, tax, equipment and services in strict compliance with the Contract Documents, for a completed and operating plant expansion. The Work consists of the expansion of the existing 100 million gallons per day (mgd) Advanced Water Treatment Facility (AWTF) by 30 mgd to a total production capacity of 130 mgd.

The existing AWTF is divided into reference areas requiring expansion or modification as follows:

- Area 100 General/Site Work
- Area 140 Screening Facility
- Area 144 Sitework/Site Structures (OCSD Plant 2)
- Area 144 Secondary Effluent Pump Station (OCSD Plant 2)
- Area 144 Secondary Effluent Equalization Tanks (OCSD Plant 2)
- Area 210 Microfiltration Facility
- Area 212 MF Filtrate Pumps
- Area 214 MF Air Compressor/Vacuum Pumps
- Area 216 MF Process Air
- Area 218 MF Backwash Pumps
- Area 235 MF Maintenance Wash Sodium Hypochlorite
- Area 255 RO Transfer Pump Station
- Area 400 Bulk Chemical Storage
- Area 420 Sulfuric Acid Bulk Storage
- Area 450 Cartridge Filters
- Area 470 RO Pretreatment Injection Vault
- Area 510 Reverse Osmosis Building
- Area 610 UV Facility
- Area 710 Decarbonation Facility
- Area 720 RO Flush Feed Pump Station
- Area 725 DPW Pump Station
- Area 730 Polymer Area
- Area 815 Product and Barrier Water Pump Station
- Area 830 Product and Barrier Water Surge Facilities
- Area 910 Switchgear Building
The UV system is being procured by the District under separate contract. A procurement contract has been negotiated between the District and the UV system supplier (Trojan). The procurement contracts for the UV system is assigned to the Contractor on the Project concurrently with the execution of the Agreement.

The MF membranes are also being procured by the District under separate contract. Alternative MF membrane suppliers (Scinor and Evoqua) are currently being evaluated by the District and the final MF membrane supplier selection is anticipated to occur no later than December 31, 2020. A procurement contract will be negotiated between the District and the selected MF membrane supplier. Finally, a change order will be negotiated with the Contractor on the Project for assignment of the procurement contract for the selected MF membranes.

2. OTHER CONSTRUCTION CONTRACTS. Work by others will be in progress on the project construction sites (OCSD Plant 1, OCSD Plant 2 and SCE property) under separate contracts including, but are not limited to, the following:

OCSD Plant 1:
- OCSD P1-101: Dewatering and Odor Control at Plant 1
- OCSD P1-105: Headworks Rehabilitation Project
- OCSD P1-133: Primary Clarifiers 6-31 Reliability Improvements at Plant 1

OCSD Plant Site 2:
- OCWD Contract 2: Secondary Effluent Pipeline Rehabilitation (Plant 2)
- OCSD Project J-117B: Outfall Low Flow Pump Station (Plant 2)
- OCSD Project P2-98A: A-Side Primary Clarifiers Replacement (Plant 2)
- OCSD Project P2-107: SCADA System & Network Upgrades (Plant 2)
- OCSD Project P2-122: Headworks Modifications at Plant 2

SCE Property:
- Maintenance and modifications to existing electrical systems

It shall be the duty of the Contractor of this project to contact the contractors of any other adjacent projects under construction and to coordinate the work to avoid any delays or inconvenience to any project. The Contractor's attention is directed to the fact that other contractors will be working in the areas where work under this Contract is being performed. All planned coordination events shall be coordinated through the Owner and shall include Owner attendance or designated representative of the Owner.

3. COORDINATION. Contractor shall plan, schedule, and coordinate its operations in a manner which will facilitate the simultaneous progress of the Work under other OCWD and OCSD contracts outside the scope of these Contract Documents.
4. **WORK BY OWNER.** There are no activities identified for Owner to perform in connection with this Work.

5. **PROCUREMENT CONTRACTS.** The Owner has entered into a Procurement Contract for engineering procurement, delivery of certain equipment, services and components of specialty systems that are to be installed by the selected Contractor in connection with the completed Work including a Pre-Selection Contract with Trojan Technologies Inc. for the Ultraviolet Disinfection and Oxidation System. A Procurement Contract for the MF membranes will be negotiated at a later date and will be assigned to the Contractor for this Project by change order.

The Owner will assign to the selected Contractor the Owner’s rights, and will delegate performance to the selected Contractor of the Owner’s obligations, under the Contract for Procurement, and delivery of the systems as described in the respective Procurement Contracts. The selected Contractor shall accept transfer of such rights and obligations, assume responsibility for payment of the vendor for the systems, and assume responsibility for procurement and delivery of the MF membranes and UV system.

6. **SALVAGE OF MATERIALS AND EQUIPMENT.** Existing materials and equipment removed and not reused as a part of the Work shall become Contractor's property, unless otherwise stated in the Contract Documents.

Contractor shall carefully remove, in a manner to prevent damage, all materials and equipment specified or indicated to be salvaged and reused or to remain the property of Owner. Contractor shall store and protect salvaged items specified or indicated to be reused in the Work.

Salvaged items not to be reused in the Work, but to remain Owner's property shall be delivered by Contractor in good condition to Owner at OCWD.

Any items specified or indicated to be salvaged which are damaged in removal, storage, or handling through carelessness or improper procedures shall be replaced by Contractor in kind or with new items.

Except where specified as no exception, Contractor may furnish and install new items instead of those specified or indicated to be salvaged and reused, in which case such removed items will become Contractor's property. Contractor may only provide new items instead of those specified where it is allowed in the Technical Specifications.

Existing materials and equipment removed by Contractor shall not be reused in the Work, except where so specified or indicated.
7. **LAND FOR CONSTRUCTION PURPOSES.** Contractor may be permitted to use available land belonging to OCWD and OCSD, on or near the Site, in fee or by agreement, for construction purposes and for storage of materials and equipment.

The locations and extent of the areas available for the Contractor’s use shall be as indicated on the Drawings.

If the designated space is not sufficient for Contractor’s activities, the Contractor shall arrange, at Contractor’s cost, for additional space as required for construction purposes.

Contractor shall immediately move stored materials or equipment if any occasion arises, as determined by OCWD or OCSD, requiring access to the storage area. Materials or equipment shall not be placed on the property of OCWD or OCSD until OCWD or OCSD has agreed to the location to be used for storage.

8. **OPERATION OF EXISTING FACILITIES.** The existing treatment plant facilities (owned and operated by OCWD and OCSD) must be kept in continuous operation throughout the construction period unless shutdown is required for the work. No interruption will be permitted which adversely affects the degree of service provided. Provided permission is obtained from Owner in advance, portions of the existing facilities may be taken out of service for short periods corresponding with periods of minimum service demands.

Contractor shall provide temporary facilities and make temporary modifications as necessary to keep the existing facilities in operation during the construction period.

9. **USE OF OWNER’S EXISTING EQUIPMENT.** The existing overhead cranes inside the pump stations and facilities shall not be used for installation of new piping and equipment.

10. **NOTICES TO OWNERS AND AUTHORITIES.** Contractor shall, as provided in the General Conditions, notify owners of adjacent property and utilities when prosecution of the Work may affect them.

When it is necessary to temporarily deny access to property, or when any utility service connection must be interrupted, Contractor shall give notices sufficiently in advance to enable the affected persons to provide for their needs. Notices shall conform to any applicable local ordinance and, whether delivered orally or in writing, shall include appropriate information concerning the interruption and instructions on how to limit inconvenience caused thereby.
Utilities and other concerned agencies shall be notified at least 24 hours prior to cutting or closing streets or other traffic areas or excavating near underground utilities or pole lines.

11. **LINES AND GRADERS.** All Work shall be done to the lines, grades, and elevations indicated on the Drawings.

Basic horizontal and vertical control points will be established or designated by Engineer to be used as datums for the Work. All additional survey, layout, and measurement work shall be performed by Contractor as a part of the Work.

Contractor shall provide an experienced instrument person, competent assistants, and such instruments, tools, stakes, and other materials required to complete the survey, layout, and measurement work. In addition, Contractor shall furnish, without charge, competent persons and such tools, stakes, and other materials as Engineer may require in establishing or designating control points, in establishing construction easement boundaries, or in checking survey, layout, and measurement work performed by Contractor.

Contractor shall keep Engineer informed, a reasonable time in advance, of the times and places at which it wishes to do Work, so that horizontal and vertical control points may be established and any checking deemed necessary by Engineer may be done with minimum inconvenience to Engineer and minimum delay to Contractor.

Contractor shall remove and reconstruct work which is improperly located.

12. **CONNECTIONS TO EXISTING FACILITIES.** Unless otherwise specified or indicated, Contractor shall make all necessary connections to existing facilities, including structures, drain lines, and utilities such as water, sewer, gas, telephone, and electric. In each case, Contractor shall receive permission from OCWD, OCSD, or the owning utility prior to undertaking connections. Contractor shall protect facilities against deleterious substances and damage.

Connections to existing facilities which are in service shall be thoroughly planned in advance, and all required equipment, materials, and labor shall be on hand at the time of undertaking the connections. Work shall proceed continuously (around the clock) if necessary to complete connections in the minimum time. Operation of valves or other appurtenances on existing utilities, when required, shall be by or under the direct supervision of the owning utility.

13. **UNFAVORABLE CONSTRUCTION CONDITIONS.** During unfavorable weather, wet ground, or other unsuitable construction conditions, Contractor shall confine its operations to work which will not be affected adversely by such conditions. No portion of the Work shall be constructed under conditions which would affect adversely the quality or efficiency thereof, unless special means or
precautions are taken by Contractor to perform the Work in a proper and satisfactory manner.

14. **CUTTING AND PATCHING.** As provided in General Conditions, Contractor shall perform all cutting and patching required for the Work and as may be necessary in connection with uncovering Work for inspection or for the correction of defective Work.

Contractor shall perform all cutting and patching required for and in connection with the Work, including but not limited to the following:

- Removal of improperly timed Work.
- Removal of samples of installed materials for testing.
- Alteration of existing facilities.
- Installation of new Work in existing facilities.

Contractor shall provide all shoring, bracing, supports, and protective devices necessary to safeguard all Work and existing facilities during cutting and patching operations. Contractor shall not undertake any cutting or demolition which may affect the structural stability of the Work or existing facilities without Engineer's concurrence. Contractor shall abide by all Owner policies (OCWD for AWTF and associated facilities, and OCSD for work on Plant 1 and Plant 2 sites) regarding Confined Space and OSHA requirements.

Materials shall be cut and removed to the extent indicated on the Drawings or as required to complete the Work. Materials shall be removed in a careful manner, with no damage to adjacent facilities or materials. Materials which are not salvable shall be removed from the site by Contractor.

All Work and existing facilities affected by cutting operations shall be restored with new materials, or with salvaged materials acceptable to Engineer, to obtain a finished installation with the strength, appearance, and functional capacity required. If necessary, entire surfaces shall be patched and refinishing.

The Contractor shall maintain the existing MF building structure (including structural floor and roof decking), envelope (exterior skin and framing, excluding window assemblies and nonstructural roofing material), and interior non-structural elements not indicated to be removed; and shall not cut such existing construction beyond indicated limits.

15. **CLEANING UP.** Requirements for cleaning up are covered in the General and Special Provisions. Adequate clean-up will be a condition for recommendation of progress payment application.
16. **APPLICABLE CODES.** References in the Contract Documents to local codes mean the following:

- International Building Code with California amendments
  - 2016 California Building Code
- 2016 California Plumbing Code (Title 24 – Part 5)
- 2016 California Electrical Code (Title 24 – Part 3)
- 2016 California Mechanical Code (Title 24 – Part 4)
- 2016 California Fire Code (Title 24 – Part 9)
- 2016 Title 24 Energy Provisions
- National Electric Code
- State of California Codes
- County of Orange Codes and Standards
- American Water Works Association (AWWA)
- Hydraulic Institute Standards (HIS)
- National Fire Protection Association (NFPA) Recommended Practices and Manuals
- Owners (OCWD and/or OCSD) Confined Space Protocols

For the above Codes, the current Code at the time of Bid is applicable. Other standard codes which apply to the Work are designated in the Specifications.

17. **REFERENCE STANDARDS.** Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to the laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code, or laws or regulations in effect at the time of opening of Bids (or on the effective date of the Contract or Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents. However, no provision of any referenced standard, specification, manual, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents, nor shall any such provision or instruction be effective to assign to Owner, Engineer, or any of Engineer's Consultants, agents, or employees, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

18. **SPECIFICATION DATA SHEETS AND SCHEDULES.** Specifications may have data sheets and schedules as part of specific specification sections. Locations for data entries on the data sheets and schedules may be left blank intentionally. When no data is entered in a respective cell, this indicates that no data is required for that cell of the data sheet or schedule. The Contractor shall be responsible for furnishing and installing all equipment, piping, wires, and
devices in the Contract Documents whether or not they are shown in the data sheets and schedules.

19. PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES. In accordance with the General Provisions and the Special Provisions, the Contractor shall assume full responsibility for the protection of all buildings, structures and utilities, public or private, including poles, signs, services to buildings, utilities in the street, gas pipes, water pipes, hydrants, on-site wells, sewers, drains and electric and telephone cable, whether or not they are shown on the Drawings. The Contractor shall carefully support and protect all such structures and utilities from damage of any kind. Any damage resulting from the Contractor’s operations shall be immediately repaired by Contractor, at Contractor’s own expense.

20. SITE ADMINISTRATION. Contractor shall be responsible for all areas of the Site used by it, by other contractors, and by all Subcontractors in the performance of the Work. Contractor shall exert full control over the actions of all employees and other persons with respect to the use and preservation of property and existing facilities, except such controls as may be specifically reserved to Owner or others. Contractor shall have the right to exclude from the Site all persons who have no purpose related to the Work or its inspection, and may require all persons on the Site (except Owner’s employees) to observe the same regulations as Contractor requires of its employees.

21. POTHOLING. In addition to the utilities identified for potholing in the Yard drawings and as otherwise required in the Contract Documents, the Contractor shall include in the Bid potholing at ten (10) locations along the pipeline corridor between OCSD Plant 1 and Plant 2 near the west Santa Ana River levee. At each location 6 utilities shall be potholed. The approximate maximum pothole depth is 10 feet. Potholing shall use vacuum non-destructive digging.

22. OCSD PLANT 2 PARKING. The Contractor’s parking area identified in the Contract Documents (Drawing No. 100-G-043) is shared by all Plant 2 and other OCSD Contractors. The Contractor shall attempt to utilize the Contractor’s staging area for it’s own parking of vehicles. OCSD will provide a 30 calendar day notification to the Contractor to vacate the shared Contractor’s parking area at any time during the period of performance of the Contract. OCSD may utilize this parking area for other purposes. 0101501

End of Section
1. **SCOPE.** This section covers methods of measurement and payment for items of Work under this Contract.

2. **GENERAL.** The Contract Price for each section of the Contract shall cover all Work required by the Contract Documents. All costs in connection with the proper and successful completion of the Work, including furnishing all materials, equipment, supplies, and appurtenances; providing all construction plant, equipment, and tools; and performing all necessary labor and supervision to fully complete the Work, shall be included in the unit and lump sum prices bid. All Work not specifically set forth as a pay item in the Bid Form shall be considered a subsidiary obligation of Contractor and all costs in connection therewith shall be included in the prices bid.

3. **ESTIMATED QUANTITIES.** All estimated quantities stipulated in the Bid Form or other Contract Documents are approximate and are to be used only (a) as a basis for estimating the probable cost of the Work and (b) for the purpose of comparing the Bids submitted for the Work. The actual amounts of work done and materials furnished under unit price items may differ from the estimated quantities. The basis of payment for work and materials will be the actual amount of work done and materials furnished. Contractor agrees that it will make no claim for damages, anticipated profits, or otherwise on account of any difference between the amounts of work actually performed and materials actually furnished and the estimated amounts therefor.

4. **UNITS OF MEASUREMENT.** A pound is an avoirdupois pound. A ton is 2,000 pounds avoirdupois. The unit of liquid measure is the U.S. gallon.

5. **CERTIFIED WEIGHTS.** When payment is to be made based on weight, the weighing shall be done on platform scales certified and inspected by applicable California State Weights and Measures Department, or when approved by the Engineer, on a completely automated weighing and recording system. The Contractor shall take all measurements, compute all payment quantities, and furnish the Engineer with duplicate licensed weighmaster's certificates showing the actual net weights. The Engineer shall verify and approve measurements.

6. **METHODS OF MEASUREMENT.** Materials and items of work which are to be paid for based on measurement shall be measured in accordance with the method stipulated in the sections involved or the description of Bid Items found in 2.2 of this Section. In determining quantities, all measurements shall be made in a horizontal plane unless otherwise specified.
Material not used from a transporting vehicle shall be determined by the Engineer and deducted from the certified tag.

When material is to be measured and paid for on a volume basis and it would be impractical to determine the volume, or when requested by the Contractor in writing and approved by the Engineer in writing, the material will be weighed and converted to volume measurement for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the Engineer and shall be agreed to by the Contractor before such method of measurement of pay quantities will be adopted.

Full compensation for all expense involved in conforming to the above requirements for measuring and weighing materials shall be considered as included in the unit prices paid for the materials being measured or weighed and no additional allowances will be made therefore.

Quantities of material wasted or disposed of in a manner not called for under the Contract; or rejected loads of material, including material rejected after it has been placed by reason of failure of the Contractor to conform to the provisions of the Contract; or material placed outside the lines indicated on the plans or given by the Engineer; or material remaining on hand after completion of the Contract, will not be paid for and such quantities will be deducted from the final total quantities. No compensation will be allowed for hauling rejected material.

2. DESCRIPTION OF BID ITEMS.

2-1. Summary.

The Bid Amounts for each Bid Item will be used for comparative bid analysis. The Bid amounts will also form the basis of monthly progress payments. Each Lump Sum bid amount will undergo further breakdown as described later in this section. Unit prices for any unit price bid items will be the basis for monthly progress payment determinations and for any changes related to that Work item. Bid Item No. 2, Worker Protection and Safety/Sheeting, Shoring and Bracing will also demonstrate the Contractor's compliance with the California Labor Code relating to the price for sheeting, shoring, and bracing of excavations. Bid items are not intended to be exclusive descriptions of work categories and the Contractor shall determine and include in its pricing all materials, labor, and equipment necessary to complete each Bid Item as shown and specified.

Each lump sum price shall be full compensation for the preparation, demolition, installation, and/or submittal of the materials, and for all labor, equipment, tools and incidentals to complete that Bid Item.
2-2. Description of Bid Items.

BID ITEM NO. 1, MOBILIZATION, DEMOBILIZATION, AND CLEANUP. Bid Item No. 1 is a lump sum bid item for mobilization and demobilization. Sixty (60) percent of the total for Bid Item No. 1 shall be applied to mobilization. Forty (40) percent of the total for Bid Item No. 1 shall be applied to demobilization.

Mobilization shall include the obtaining of insurance, bonds, and other documents; moving of all equipment onto site and setting up field offices; submittal and approval of the complete shop drawing project construction schedule; obtaining and paying for all permits by other agencies as applicable and as required by the Regulatory Requirements and Permits Section to complete all the Work described herein; contacting and coordinating with Underground Services Alert (USA) and other utility owners; furnishing and erecting temporary construction facilities; making connections to temporary utilities (including, but not limited to, power, toilets, water, and fences); installing construction signs; temporary buildings and field office trailer(s); and other pre-construction efforts as required for the proper performance and completion of the work.

Contractor may apply for mobilization/demobilization as follows:

a. When the contract time line reaches Day 30 (Notice-to-Proceed plus 30 calendar days), 40 percent of the portion of this lump sum bid item associated with mobilization shall be included in the progress payment provided the activities identified for mobilization are completed.

b. For each of the following six progress payments, 10 percent of the portion of this lump sum bid item associated with mobilization shall be included in the progress payment (for a total of 100 percent the portion of this lump sum bid item associated with mobilization) provided the activities identified for mobilization are completed.

Demobilization shall include site cleaning and restoration of surfaces within the job site; moving of all equipment away from site and deconstructing field offices' post-construction meeting, removal of all temporary facilities and equipment from the work area, disconnection of the temporary construction facilities and turnover of project to the Owner, and off-site disposal, handling, and transporting of demolition material not covered in another bid item. Payment for demobilization will be with the Final Progress Payment.

Demobilization also includes the submission by the Contractor of a final payment letter stating that acceptance of the final payment shall operate as and shall be a release of all claims arising by virtue of the Agreement. The Work will not be complete, and final payment cannot be approved or paid, until this letter is received and is acceptable to the Owner.
Contractor may not apply for payment of demobilization until all demobilization items are completed as specified.

**BID ITEM NO. 2, WORKER PROTECTION AND SAFETY/SHEETING, SHORING, AND BRACING.** Bid Item No. 2 is a lump sum bid item for work associated with worker protection and sheeting, shoring and bracing. This bid item includes:

(A) Sheeting, shoring, and bracing associated with the Project
(B) All other worker protection and safety

Measurement of each of these Bid Items is described below. Contractor may apply for payment for these Bid Items on a percent complete basis of the items covered in Worker Protection and Safety/Sheeting, Shoring, and Bracing Bid Item.

(A) All Other Sheeting, Shoring, and Bracing.
This portion of Bid Item No. 2 shall include all costs for providing all sheeting, shoring and bracing or equivalent method for stabilizing excavations and its appurtenances for the completion of other Work as part of the AWTF Final Expansion. Full compensation for all planning; design; engineering fees, submittal preparation, furnishing and constructing, and removal and disposal of sheeting, shoring, and bracing or other means of excavation stabilization as required by, but not limited to, Labor Code Sections 6700-6708 shall be included. This work shall be completed as required under the provisions of any permits, and in accordance with the requirements of OSHA and Construction Safety Orders of the State of California.

(B) All Other Worker Protection and Safety.
This portion of Bid Item No. 2 shall include all costs for providing a detailed plan of worker safety and maintaining safety during construction. This plan shall conform to Labor Code Sections 6700-6708 and implement all applicable safety orders and permits.

**BID ITEM NO. 3, BUILDERS ALL RISK INSURANCE.** Bid Item No. 3 is a lump sum bid item for the purchase of Builders All Risk insurance for the Project in compliance with Public Contract Code Section 7105.

**BID ITEM NO. 4, P2 PRESTRESSED CONCRETE EQUALIZATION STORAGE TANKS.** Bid Item No. 4 is a lump sum bid item that includes the work associated with the furnishing and installing two prestressed concrete equalization storage tanks and associated facilities on the OCSD Plant 2 site. This bid item includes the two prestressed concrete equalization storage tanks, all tank nozzles and hatches, overflow piping up to the exterior discharge bell,
piping within and below the tank footprints, and ground improvements for the tank area.

**BID ITEM NO. 5, P2 PUMP STATION & ASSOCIATED FACILITIES.** Bid Item No. 5 is a lump sum bid item that includes the work associated with furnishing and installing of a pumping station to convey secondary effluent from the OCSD P2 site via a rehabilitated pipeline (by others under separate construction contract) to the existing GWRS screenings facility located on the OCSD P1 site. Bid item 5 also includes associated facilities including the Weir Box, Diversion Structure, 84-inch secondary effluent pipeline to the pump station, surge mitigation facilities, connection to the rehabilitated conveyance pipeline, chlorination station improvements, ground improvements, paving and grading, electrical, instrumentation, and all work on the P2 site for a complete and operating conveyance system as shown on the drawings.

**BID ITEM NO. 6, MICROFILTRATION MEMBRANES (Scinor or Evoqua, as selected by Owner).** Bid Item No. 6 is a lump sum bid item (estimated placeholder amount) for the procurement of microfiltration membranes and associated facilities as described in the specifications.

At the time of this bid, a final selection of the microfiltration membrane supplier (Scinor or Evoqua) had not been made. The Owner expects to finalize the selection process by no later than December 31, 2020. Once the selected membrane supplier is identified, a procurement agreement will be negotiated between Owner and the selected supplier which will be assigned to the Contractor for this Project.

The estimated cost for the procurement of the microfiltration membranes is stated in the Bid form. The final negotiated procurement cost may be higher or lower than the estimated cost. Assignment of the microfiltration membranes to the Contractor will be completed via change order.

The Contractor's installation costs for either Scinor or Evoqua microfiltration membranes are not to be included in this bid item. The installation costs are to be included in Bid item 7.
BID ITEM NO. 7, MICROFILTRATION MEMBRANES INSTALLATION (Scinor or Evoqua, as selected by Owner). Bid Item No. 7 is a lump sum bid item for the installation of microfiltration membranes (procured by Owner and assigned to the Contractor) manufactured by either Scinor or Evoqua. The requirements for coordination and installation of the microfiltration membranes shall be as described in the specifications. Any additional administrative costs required for the handling of the procurement agreement should be included in this bid item.

Contractor may apply for payment for this Bid Item in accordance with the milestones presented in the agreement from the pre-negotiated contract.

BID ITEM NO. 8, TROJAN ULTRAVIOLET LIGHT SYSTEM EQUIPMENT. Bid Item No. 8 is a lump sum bid item for the Trojan Ultraviolet Light System Procurement Contract. The pre-negotiated price agreed between Trojan and the Owner is stated on the Bid Form. Costs to install the Trojan Ultraviolet Light System are not included in this Bid Item No. 8 and shall be included in Bid Item No. 12.

Contractor may apply for payment for this Bid Item in accordance with the milestones presented in the agreement from the pre-negotiated contract.

BID ITEM NO. 9, REVERSE OSMOSIS ELEMENTS. Bid Item No. 9 is a unit price bid item for the design, manufacturing, and delivery FOB to the project site of the RO elements. Payment for this bid item shall be based on actual number of elements delivered to the project site. The unit price shall include all labor, tools, equipment, storage costs; Contractor profit, overhead, sales tax, bonds, and insurance associated with the RO elements. The price for installing and testing the RO elements shall not be included in this Bid Item.

BID ITEM NO. 10, PROCESS CONTROL SYSTEM INTEGRATION. Bid Item No. 9 is a lump sum bid item that includes all Work performed by the Process Control System Integrator (PCSI) associated with upgrading and expanding the existing Process Control System (PCS) as specified in the Process Control System section. This bid item includes Upgrade of the PCS.

The PCS upgrade includes upgrading the DeltaV software and firmware; replacement of PCS servers and operator stations; programming and configuration of the PCS for the modifications and expansion of the existing facilities; integration of the microfiltration membrane filtration system (either Scinor or Evoqua, depending on the final selection by the Owner) into the PCS; testing of all PCS communications including fieldbus communications; and furnishing instrumentation and control panels. The PCS upgrade also includes integration of the secondary effluent conveyance facilities (weir structure, GWRS diversion box, P2 pump station, P2 EQ tanks, and associated facilities into the control system.
Contractor may apply for payment for Bid Item No. 10 on a percent complete basis of the items covered in PCS Integration.

**BID ITEM NO. 11 ALLOWANCE – WITNESSING FACTORY TESTING.** Bid item No. 11 is a bid allowance for travel related expenses from the project site and to the factory inspection site, including travel arrangements, transportation to and from airport, air fare, rental vehicles, toll or parking fees, and lodging and meals for the Owner’s representative(s) conducting the factory inspection or witness testing.

Although this bid item is a stipulated bid allowance, the allowance will be only utilized on actual travel completed following the prior approval by Owner.

**BID ITEM NO. 12, FURNISH ALL EQUIPMENT, LABOR AND MATERIALS TO CONSTRUCT THE PROJECT, INCLUDING ALL WORK NOT INCLUDED IN OTHER BID ITEMS, COMPLETE AND IN PLACE.** Bid Item No. 13 is a lump sum bid item that includes all Work required to construct the Final Expansion of the Groundwater Replenishment System that is not included in other bid items. Contractor shall furnish all equipment, labor, and materials necessary to for the Work and to achieve a fully operational final expansion. See Section 01015 Paragraph 21 POTHOLING for potholing work.

Contractor may apply for payment on Bid Item No. 12 on a percent complete basis of all items not included in other bid items.

End of Section
1. LIST OF ABBREVIATIONS. Abbreviations for standards and organizations used in the Contract Documents are defined as follows:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Name</th>
</tr>
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<tbody>
<tr>
<td>AA</td>
<td>Aluminum Association</td>
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<tr>
<td>AABC</td>
<td>Associated Air Balance Council</td>
</tr>
<tr>
<td>AAMA</td>
<td>Architectural Aluminum Manufacturers Association</td>
</tr>
<tr>
<td>AASHTO</td>
<td>American Association of State Highway and Transportation Officials</td>
</tr>
<tr>
<td>ABMA</td>
<td>American Bearing Manufacturers Association</td>
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<tr>
<td>ACI</td>
<td>American Concrete Institute</td>
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<tr>
<td>ACPA</td>
<td>American Concrete Pipe Association</td>
</tr>
<tr>
<td>AEIC</td>
<td>Association of Edison Illuminating Companies</td>
</tr>
<tr>
<td>AFBMIA</td>
<td>Antifriction Bearing Manufacturers Association now Recognized as the ABMA</td>
</tr>
<tr>
<td>AFPA</td>
<td>American Forest &amp; Paper Association</td>
</tr>
<tr>
<td>AGA</td>
<td>American Gas Association</td>
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<tr>
<td>AGMA</td>
<td>American Gear Manufacturers Association</td>
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<tr>
<td>AHA</td>
<td>American Hardboard Association</td>
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<tr>
<td>AHRI</td>
<td>Air-Conditioning, Heating and Refrigeration Institute</td>
</tr>
<tr>
<td>AISC</td>
<td>American Institute of Steel Construction</td>
</tr>
<tr>
<td>AISI</td>
<td>American Iron and Steel Institute</td>
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<tr>
<td>AITC</td>
<td>American Institute of Timber Construction</td>
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<td>AMCA</td>
<td>Air Movement and Control Association International</td>
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<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
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<td>APA</td>
<td>Engineered Wood Association (formerly American Plywood Association)</td>
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<td>API</td>
<td>American Petroleum Institute</td>
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<td>APWA</td>
<td>American Public Works Association</td>
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<tr>
<td>AREMA</td>
<td>American Railway Engineers and Maintenance-of-Way Association</td>
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<tr>
<td>ASAHC</td>
<td>American Society of Architectural Hardware Consultants</td>
</tr>
<tr>
<td>ASCE</td>
<td>American Society of Civil Engineers</td>
</tr>
<tr>
<td>ASHRAE</td>
<td>American Society of Heating, Refrigerating, and Air-Conditioning Engineers</td>
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<td>ASME</td>
<td>American Society of Mechanical Engineers</td>
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<td>ASSE</td>
<td>American Society of Sanitary Engineers</td>
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<td>ASTM</td>
<td>ASTM International</td>
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<td>AWI</td>
<td>Architectural Woodwork Institute</td>
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<td>AWPA</td>
<td>American Wood-Preservers’ Association</td>
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<tr>
<td>Abbreviation</td>
<td>Full Form</td>
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<tr>
<td>AWS</td>
<td>American Welding Society</td>
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<td>American Water Works Association</td>
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<td>BHMA</td>
<td>Builders Hardware Manufacturers Association</td>
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<td>BIA</td>
<td>Brick Institute of America (formerly SCPI)</td>
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<td>CDA</td>
<td>Copper Development Association</td>
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<td>CISPI</td>
<td>Cast Iron Soil Pipe Institute</td>
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<td>CMAA</td>
<td>Crane Manufacturers Association of America</td>
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<td>CRA</td>
<td>California Redwood Association</td>
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<td>CRSI</td>
<td>Concrete Reinforcing Steel Institute</td>
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<td>CS</td>
<td>Commercial Standard (U.S. Department of Commerce)</td>
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<td>DHI</td>
<td>Door and Hardware Institute</td>
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<td>DIPRA</td>
<td>Ductile Iron Pipe Research Association</td>
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<td>EEI</td>
<td>Edison Electric Institute</td>
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<td>EJCDC</td>
<td>Engineers' Joint Contract Documents Committee</td>
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<td>Environmental Protection Agency</td>
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<td>Federal Specification</td>
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<td>FM</td>
<td>Factory Mutual</td>
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<td>FSA</td>
<td>Fluid Sealing Association</td>
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<td>Heat Exchange Institute</td>
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<td>Hoist Manufacturers Institute</td>
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<td>HPMA</td>
<td>Hardwood Plywood Manufacturers Association</td>
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<td>HTI</td>
<td>Hand Tools Institute</td>
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<td>I-B-R</td>
<td>Institute of Boiler and Radiator Manufacturers</td>
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<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
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<td>IBC</td>
<td>International Building Code</td>
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<td>IES</td>
<td>Illuminating Engineering Society</td>
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<td>Industrial Fasteners Institute</td>
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<td>IPCEA</td>
<td>Insulated Power Cable Engineers Association</td>
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<td>Industrial Risk Insurers</td>
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<td>ISA</td>
<td>International Society of Automation</td>
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<td>Leadership in Energy and Environmental Design</td>
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<td>MHI</td>
<td>Materials Handling Institute</td>
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<td>Military Specification</td>
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<td>Manufacturers Standardization Society of Valve and Fitting Industry</td>
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<td>National Institute of Standards and Technology (formerly NBS)</td>
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</tr>
<tr>
<td>NRMCA</td>
<td>National Ready Mixed Concrete Association</td>
</tr>
<tr>
<td>NSC</td>
<td>National Safety Council</td>
</tr>
<tr>
<td>NSF</td>
<td>NSF International (formerly National Sanitation Foundation)</td>
</tr>
<tr>
<td>NTMA</td>
<td>National Terrazzo and Mosaic Association</td>
</tr>
<tr>
<td>NWMA</td>
<td>National Woodwork Manufacturers Association</td>
</tr>
<tr>
<td>OCWD</td>
<td>Orange County Water District</td>
</tr>
<tr>
<td>OCSD</td>
<td>Orange County Sanitation District</td>
</tr>
<tr>
<td>OSHA</td>
<td>Occupational Safety and Health Administration</td>
</tr>
<tr>
<td>P1</td>
<td>Plant 1</td>
</tr>
<tr>
<td>P2</td>
<td>Plant 2</td>
</tr>
<tr>
<td>PCA</td>
<td>Portland Cement Association</td>
</tr>
<tr>
<td>PCI</td>
<td>Precast/Prestressed Concrete Institute</td>
</tr>
<tr>
<td>PPI</td>
<td>Plastic Pipe Institute</td>
</tr>
<tr>
<td>PS</td>
<td>Product Standard</td>
</tr>
<tr>
<td>RIS</td>
<td>Redwood Inspection Service</td>
</tr>
<tr>
<td>SAE</td>
<td>SAE International</td>
</tr>
<tr>
<td>SEFE</td>
<td>Secondary Effluent Flow Equalization</td>
</tr>
<tr>
<td>SDI</td>
<td>Steel Door Institute</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------------------------------------------------</td>
</tr>
<tr>
<td>SFPA</td>
<td>Southern Forest Products Association</td>
</tr>
<tr>
<td>SI</td>
<td>Système International des Unités (International System of Units)</td>
</tr>
<tr>
<td>SIGMA</td>
<td>Sealed Insulating Glass Manufacturers Association</td>
</tr>
<tr>
<td>SJI</td>
<td>Steel Joist Institute</td>
</tr>
<tr>
<td>SMA</td>
<td>Screen Manufacturers Association</td>
</tr>
<tr>
<td>SMACNA</td>
<td>Sheet Metal and Air Conditioning Contractors National Association</td>
</tr>
<tr>
<td>SPFA</td>
<td>Steel Plate Fabricators Association</td>
</tr>
<tr>
<td>SPI</td>
<td>Society of the Plastics Industry</td>
</tr>
<tr>
<td>SPTA</td>
<td>Southern Pressure Treaters Association</td>
</tr>
<tr>
<td>SSFI</td>
<td>Scaffolding, Shoring &amp; Forming Institute, Inc</td>
</tr>
<tr>
<td>SSPC</td>
<td>SSPC: The Society for Protective Coatings</td>
</tr>
<tr>
<td>SSPWC</td>
<td>Standard Specification for Public Works Construction</td>
</tr>
<tr>
<td>SWPPP</td>
<td>Storm Water Pollution Prevention Plan</td>
</tr>
<tr>
<td>TABB</td>
<td>Testing, Adjusting, and Balancing Bureau</td>
</tr>
<tr>
<td>UL</td>
<td>Underwriters' Laboratories</td>
</tr>
<tr>
<td>USBR</td>
<td>U.S. Bureau of Reclamation</td>
</tr>
<tr>
<td>USGBC</td>
<td>U.S. Green Building Council</td>
</tr>
<tr>
<td>WEF</td>
<td>Water Environment Federation</td>
</tr>
</tbody>
</table>

End of Section
Section 01080
IDENTIFICATION AND TAGGING

PART 1 – GENERAL

1-1. DESCRIPTION. The Contractor shall provide for each piece of equipment supplied, a 316-stainless steel or non-corrosive asset nameplate firmly attached and permanently engraved with the “asset tag” directed by the Owner. In addition, a separate equipment nameplate with the Owner’s standard equipment number shall be permanently affixed to each piece of equipment. The Owner shall assign a block of equipment numbers to be assigned by the Contractor for each piece of equipment.

The unique equipment number used by the manufacturer shall be consistent with the number used to identify the equipment in parts listings and O&M documentation. Equipment numbers shall be provided and affixed to the equipment by the equipment manufacture prior to delivery to the Contractor.

For all devices where nameplates are supplied, the Contractor shall develop an “Equipment Cross Reference Schedule” that matches the asset tag and equipment number to the appropriate equipment manual and parts list. The equipment schedule shall include the pertinent information associated with the equipment including asset tag and equipment number, description, functional name, location, component equipment model, part number, size, materials, accessories, range, equipment cost, replacement cost, purchase order number, warranty information, expected life, etc. The Equipment Cross-Reference Schedule shall be provided in the form of a Microsoft Excel spreadsheet.

The Contractor shall coordinate the identification of all equipment provided with the Owner’s asset tagging and management system.

OCSD nameplates and tags requirements are in Section 17075 OCSD Equipment Panel Instrumentation Nameplates and Tags and shall be used for the following facilities.

1. Diversion Structure
2. Weir Box
3. Chlorination Facility at Plant 2
4. Butterfly Valves on 66-inch Pipeline
5. Plant 2 Service Center
6. TFSC Pump Station C at Plant 2
7. Plant 2 Stormwater Pump Station
1-2. **SUBMITTALS.** The Contractor shall provide asset tags as part of the Shop Drawing Submittal.

Submit a complete listing of all equipment furnished along with both equipment identification number and asset tag number for approval.

Submit the “Cross Reference Schedule” approved equipment number and asset tag for each piece of equipment furnished in the same electronic format as that provided by the Owner.

**PART 2 – PRODUCTS**

2-1. **EQUIPMENT DESIGN AND FABRICATION.** There are two types of tags that are needed for the identification of assets in the field. One is the asset tag and the other is the equipment tag. Asset numbers are already formatted as shown on the P&IDs. Equipment numbers are not going to be available until the assets and the equipment have been entered into Maximo (the CMMS software) and Maximo assigns the equipment its unique identifier. Hence, the submission of tags by the Contractor will be a two-phased activity. First, the Asset Tags will be submitted as set forth below by the Contractor at the same time the assets are delivered and installed by the contractor. Later, at a predetermined time set by the OCWD, and when the equipment numbers are available from the CMMS program, and submitted by OCWD to the Contractor, the Contractor will deliver the equipment tags as set forth below.

Two forms of identification will be used for assets:

**Asset Tag** – will refer to the identification of the asset in the context of the facility, process, site, etc. The Asset Tag will include Area/location, Train/Block Number, Component ID, and Sequence Number (unique identification) of the asset related to the function. The Asset Tag will remain with the location or function.

**Equipment Tag** – will refer to the unique identifier of the specific piece of equipment or asset. The Equipment Number will remain with that asset/equipment and “travel” with it as it is put in service, taken out of service, repaired, overhauled, etc. The Equipment Number will be linked to an Asset Tag when the equipment is in service.

2-1.01. **Asset Tags.** Assets are identified by facility, location / area, process, relative position within a process, and related system using an asset tag. The purpose of having asset tags is for operations and maintenance personnel to be able to identify the asset in the field.

Asset tags are assigned to the placement of the asset and remain if the actual equipment is replaced. The asset tags are mounted adjacent to the equipment
on slabs, mounting stands, conduit and similar locations closely associated with
the asset.

All process equipment, valves, instruments and controls will be given an asset
tag. All process plant assets, non-fixed equipment, and furnishing assets shall be
given an asset tag.

Pipe and appurtenances are associated with a process and flow steam/system.
Pipes and appurtenances shall receive asset numbers but shall not be tagged in
the field.

Asset tags shall match the format and tagging shown on the P&IDs unless noted
otherwise.

The asset register contains the complete relationship an asset has within the
facility. The asset tag is derived from the information contained in the register.
The asset tagging conventions define what elements of the asset register are
used for each asset tag type.

An example of an asset register is shown below:

<table>
<thead>
<tr>
<th>Facility Code</th>
<th>Area/Location Code</th>
<th>Equipment/Component Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facility</td>
<td>Process Unit</td>
<td>Location /Area</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Train/Block Number</td>
</tr>
<tr>
<td></td>
<td></td>
<td>System/Service</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Component ID</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sequence Number</td>
</tr>
<tr>
<td>AWTF</td>
<td>UV</td>
<td>610</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DPW</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3310</td>
</tr>
</tbody>
</table>

The asset tag will comprise of the Location/area, Train/Block Number,
Component ID, and Sequence Number as shown below:

<table>
<thead>
<tr>
<th>Area/Location Code</th>
<th>Equipment/Component Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location /Area</td>
<td>Train /Block Number</td>
</tr>
<tr>
<td></td>
<td>Component ID</td>
</tr>
<tr>
<td></td>
<td>Sequence Number</td>
</tr>
<tr>
<td>610</td>
<td>A01</td>
</tr>
<tr>
<td></td>
<td>FV</td>
</tr>
<tr>
<td></td>
<td>3310</td>
</tr>
</tbody>
</table>

All component, Sequence Number, and Sub-Process Sequence Number for
equipment contained as part of a duplicated process shall be the same
component, sequence and sub-process designation. For example, all the UV
Discharge Valves shall carry the final designation as FV 3310. The designator for
the Unit in contained in the Train or Block Number.

Tagging schedules shall be obtained form the PCSS and the ISS.
2-1.02. **Equipment Number.** Unique equipment identification numbers are assigned to a specific equipment item for the life of the item. When the equipment item is moved from the process, the equipment identification number goes with the equipment item.

Each device shall bear a nameplate to identify its equipment identification number both in text and bar code formats. Equipment numbers shall be displayed on the outside of equipment enclosures and panels. Bar codes shall reflect the equipment number using Code 39 and printed in a minimum of 18-point font size. Bar codes shall be printed on adhesive backed labels designed for exterior applications for both adhesion and fading for a minimum of seven years exposure, affixed to the permanent nameplates.

The equipment number will be assigned by Maximo, the CMMS software and will be a random sequential number. This number shall be unique. Contractor shall use this equipment number as part of the equipment cross-reference schedule for each equipment item. Equipment numbers shall be represented with a bar code as part of the equipment identification engraved on the equipment number nameplate. Codes shall be printed with the minimum 18pt font in Code 39 or as specified herein.

Nameplates shall be attached using Type 316 stainless steel self-tapping machine screws where possible or as specified otherwise. If the use of a stainless-steel screw is not possible, provide a 316-stainless steel chain or stainless-steel wire (18-gauge min) and affix to a non-removable part of the device. Where specified, attach the nameplate using permanent Silicon II adhesive as approved by the Engineer.

Equipment number and asset tags shall be provided for all equipment furnished including but not limited to:

1. PCS Computer and Networking Equipment (e.g. Controller Servers, Workstations, and network equipment).
3. Mechanical process equipment, pump, blowers, valves, etc.
4. Field instrumentation.
5. Control panel.
6. Electrical distribution equipment
7. Facility equipment: Hoists, HVAC equipment, security, fire alarm, communication systems, etc.
8. FRP and Steel storage tanks.
9. Prestressed Concrete Tanks.

10. Miscellaneous items as required.

2-1.03. Equipment Nameplates. Information to be permanently engraved onto the nameplate shall include the identifying equipment number, asset tag, manufacturer, model number, and manufacturer part number.

The asset tag included on the nameplate shall only include the Location/Area, Train/Block Number, Component ID, and Sequence Number fields.

Nameplate asset tag example:

<table>
<thead>
<tr>
<th>Location/Area</th>
<th>Train/Block Number</th>
<th>Component ID</th>
<th>Sequence Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>610</td>
<td>A01</td>
<td>FV</td>
<td>3310</td>
</tr>
</tbody>
</table>

2-1.04. Control Components Tagging. All process controller racks mounted on or within control panels and enclosures shall have the equipment identification nameplate installed so that the engravings are easily visible to service personnel.

Equipment nameplates shall be provided for components located in control panel enclosures. Equipment information shall be located on the front of the panels and the complete tag, including bar code identification shall be located on the back of the component.

Tagging shall also be used to denote the function of all panel enclosure electrical devices including switches, lamp indicators, potentiometers and panel-mounted instruments.

Control Panel Nameplates shall be constructed as follows:

1. 3/32-inch thick laminated phenolic for engraving composed of core, laminated on both sides with a matte (non-glare) finish cover sheet.
2. Core to be black; cover sheet to be white.
3. Nameplates shall be engraved with 3/16-inch letters, minimum.
4. Mounting holes to be centered on width and 1/4 inch from each end.
5. Information to be permanently engraved onto the nameplate shall include the identifying asset tag or equipment number with manufacturer, model number, and part number.
6. The nameplates shall be fastened to the control panel device with self-tapping stainless-steel screws. Where fastening with screws is not permitted or impractical the nameplates shall be attached to the device using permanent Silicon II adhesive.
7. Specific Nameplate Material and Installation Requirements:
   a. Manufacturer for S1, S2 and S3: Dreiling Manufacturing (Pacoima, CA) or Nu-Way (14744 Richvale Dr., La Mirada, CA Tel: 562-906-0097) or equal.
   b. Holes shall be at least one diameter from all edges and centered.
   c. All edges shall be deburred and smooth to the touch.
   d. Metal Nameplates, Type S1:
      
      Designation: Type S1
      Material: Stainless steel, Alloy 316
      Thickness: 0.040" minimum
      Size: 2-3/8" x 3/4" ± 0.1"
      Holes: 2, DIA=0.12", See Fig. 1 for location.
      Letter size: 3/16" high, 1/8" wide (no more than 12 characters in one line)
      Remarks: Characters shall be engraved in the center of the tag with a minimum depth of 0.009 inch or more and filled with black enamel paint.

      ![FIG. 1 (not to scale)](image1)

   e. Metal Nameplates, Type SB1, SB2, or SB3
      Designation: Type SB1, SB2, or SB3
      Material: Stainless steel, alloy 316
      Thickness: 0.040" minimum
      Size: (B1) 8-1/2" x 5-1/2" ± 0.1"
      (B2) 8 1/2" x 11" ± 0.1"
      (B3) Cut to fit
      Holes: 2, DIA=0.12", See Fig. 2 for location.
      Letter size: 3/16" high, 1/8" wide (no more than 12 characters in one line)
      Remarks: Characters shall be engraved in the center of the tag with a minimum depth of 0.009 inch or more and filled with black enamel paint.

      ![FIG. 2 (not to scale)](image2)

   f. Plastic Nameplates, Type L1, L2, and L3
      Designation: Type L1
Material: Laminated Plastic with UV inhibitor
Thickness: 1/16"
Color: Black plastic behind and light blue on front.
Size: 2 3/8" x 3/4" ± 0.1"
Letter size: 3/16" high, 1/8" wide and engraved minimum 0.010" deep
(one line with 12 characters maximum)

Designation: Type L2
Material: Laminated Plastic with UV inhibitor
Thickness: 1/16"
Color: Black plastic behind and light blue on front.
Size: 2" x 3/8" ± 0.1"
Letter size: 5/32" high, 1/8" wide and engraved minimum 0.010" deep
(one line with 12 characters maximum)

Designation: Type L3 (backplate with no lettering)
Material: Laminated Plastic with UV inhibitor
Thickness: 1/16"
Color: Black plastic behind and light blue on front.
Size: 3" x 3/4" ± 0.1"
Letter size: 1, DIA=3/16", See Fig. 3 for location.

![FIG. 3 (not to scale)](image1)

Plastic Nameplates, Type LB1, LB2, and LB3
Designation: Type LB1, LB2, and LB3
Material: Laminated Plastic with UV inhibitor
Thickness: 1/16"
Color: Black plastic behind and light blue on front.
Size: (LB 1) 8 1/2" x 5 1/2" ± 0.1"
8 1/2" x 11" ± 0.1"
Cut to fit
Holes: 2, DIA=3/16". See Fig. 4 for location

![FIG. 4 (not to scale)](image2)
h. Adhesive:
   1) Silicone II from GE (General Electric)

i. Attachment Wire:
   1) 316 Stainless Steel
   2) Nylon coated stranded stainless-steel wire alloy 316 from BRADY Signmark Division Catalog number: 23310. Use Brass wire clamp double ferrule design Catalog number 23311. Use .030-inch, 2N5 Titanium wire for mounting in chemical storage or feed areas or in areas designated corrosive or NEMA 4X on the Drawings. Provide ESPI Electronic Space Products International, Item KCN3114, or equal. Titanium wire shall be loop, twisted, and tucked down for physical protection when used for mounting nameplates.

j. Material Selection:
   1) Laminated Plastic nameplates (UV inhibitor) Type L1, L2, or L3 for Asset Tag Numbers for indoor panels, for the inside of panels and for approved chemical areas. Some installations require the Type LB1, LB2 or LB3 nameplates for proper installation when the nameplate cannot be placed next to the devices.
   2) SST nameplates (316 stainless steel) Type S1, S2 or S3 for Asset Tag Numbers for panels, valves, and field devices located outdoors or in corrosive environments. Some installations require the Type SB1, SB2, or SB3 nameplates for proper installation when the nameplate cannot be placed next the device.
   3) Laminated Plastic nameplates for indoor devices, non-corrosive areas, and inside panels.
      i. SST nameplates (316 stainless steel) Type S1, S2 or S3 with Type SB1, SB2 or SB3 for Asset Tags for panels, valves, and field devices located outdoors or in corrosive environments, and for all indoor mechanical equipment.

k. Nameplate Mounting:
   1) Use Silicone II adhesive for Laminated Plastic Nameplates on panel face.
   2) Use plastic ties where metal corrosion is likely. Ties shall have UV inhibitor.
   3) SST wire for field device asset tag attachment will be used except where tie.
   4) Length exceeds 12 inches where a nylon coated stainless steel wire with brass clamps shall be provided.
1. Specific Installation Methods: Following is a list of general attachment methods to be followed for nameplates:

1) Device completely hidden from view — example a valve or device under a trench cover or device submerged in a closed or open tank. Two nameplates would be used for non-submerged devices. One nameplate attached directly to or in close proximity to device. Second nameplate at a visible location. Criteria for remote nameplate location in order of preference:
   i. Above ground attachment to handrail
   ii. Ground level attachment to facility framework.
   iii. Ground or above grade attachment to concrete.

m. Back Plate — A placard or back plate with individual nameplates attached to it. A back plate is used where space is inadequate for attachment of individual nameplates for each device. Examples include a panel, an annunciator, or loop valve controller.

   The Back Plate is then attached to a panel or box with wire or glue depending on the situation. Hole punched in middle top for attachment with SST wire.

   The Back Plate shall be SST 316 for outside locations and plastic for inside locations.

   The individual nameplates are attached to the Back Plate in accordance with the geometric layout of the panel. Writing is assumed to be up. No other indication of layout direction will be put on Back Plate.

n. Nameplates attached to panel face:

   1) Leave existing descriptive nameplates in place.
   2) Attach in location that clearly associates nameplates with device.
   3) If there is little space for nameplate, use smaller size nameplate as approved by the Owner.
   4) Where space permits the nameplate should touch the descriptive tag.
   5) Nameplates for inside of panels, cabinets.
   6) Use non-metallic nameplate if there is a terminal strip in the panel (possibility of short circuiting).
   7) Use plastic ties to attach tag.
   8) Overhead valve with chain control.
   9) One nameplate attached directly to device. Second nameplate at a visible location near eye level.
o. Following is a list of general attachment methods to be followed for Asset tagging:
   1) Devices and equipment located outdoors or in corrosive environments
      Use SST nameplate Use silicon II adhesive to attach nameplate (general
      location of future rivets where applicable).
   2) Inside panel and building devices use plastic nameplate. Attach
      nameplate to device with self-adhesive.

p. Following is a list of general attachment methods to be followed for asset
tag nameplates:
   1) The asset tag nameplate is applied directly to the device. Select a
      location that is visible when the device is installed.

PART 3 – EXECUTION

3-1. ASSET TAGS. Asset Tags shall be mounted in close proximity to the asset
   but not likely to be removed if the asset is removed. Use 316 SS, 0.032-inch wire with
   3 full twist (minimum), folded inward to prevent puncture wounds to mount tags to
   conduit, pipe support stands, or silicone adhesive (preferred) to mount nameplates to
   flat or large-radius inflexible surfaces such as concrete pad, panels and support stands.

3-2. EQUIPMENT NUMBERS. Equipment Numbers shall be mounted directly on
   the asset so that the equipment number travels with the asset, providing a unique
   identifier to allow historical asset management of that asset. Use 316 SS #4 screws
   (preferred) or 0.032-inch wire with 3 full twist minimum folded round to prevent
   puncture wounds or silicon adhesive.

End of Section
Section 01090

REGULATORY REQUIREMENTS AND PERMITS

1. APPLICABLE CODES. See Technical Specifications for Applicable Codes.

2. FEES AND PERMITS.

2-1. Summary. Contractor shall comply with all the terms, conditions and requirements attached to all permits, bonds and licenses required by any local, state, or federal agencies to perform work, construct, erect, test and start up of any equipment or facility for this Contract. The Contractor shall give all notices necessary and incidental to the due and lawful prosecution of the Work.

Any permits, bonds, licenses and fees therefore required for the performance of work under this Contract and not specifically mentioned herein as being obtained and paid for by the Owner shall be included in the Contractor's Bid price. The Contractor shall apply for and obtain all safety permits for excavations, tunneling, trenches, construction (building structure, scaffolding, or falsework) and demolition required by CAL/OSHA.

The Contractor shall post at the site of Work all required permits as stipulated by the respective regulatory agency.

2-2. Local Agency Fees and Permits. The Contractor shall be responsible for satisfying all code requirements, calling for inspections, and obtaining final approvals on behalf of the Owner. The Contractor shall notify the Engineer of the need and the readiness of all required inspections. All inspections are to be coordinated with the Engineer. The Contractor shall comply with all construction conditions stipulated in the permits. The Contractor shall be responsible for and the Owner shall not provide reimbursement for any costs required for the reinspection of defective work or additional costs due to the Contractor's failure to properly schedule the inspections. The Contractor shall comply with the provisions of any and all permits obtained by the Owner and/or contained in these Specifications.

The Owner is not responsible for any local agency or utility permits required for temporary facilities during construction such as field office trailers and temporary electrical service for construction operations. Obtaining all such permits and the costs associated with such permits are the responsibility of the Contractor and shall be included in the Contractor's Total Base Bid.

2-3. Environmental Restrictions. The Owner has prepared an Environmental Impact Report (EIR) and issued subsequent addenda in response to CEQA.
comments for the Project in accordance with the California Environmental Quality Act (CEQA) and the CEQA Guidelines. A copy of the EIR is available for review at the Owner’s offices. In addition to the requirements in the summary of permits, environmental protection, protection of sensitive habitats, and other actions are required by mitigation measures adopted by the Owner. Mitigation Monitoring and Reporting Plan is included as an appendix to the EIR.

The Contractor shall be responsible for compliance with the environmental controls listed in the Environmental Controls section. The Contractor shall coordinate its work relating to these requirements with the Engineer.

2-4. Summary of Permits. The Contractor shall be responsible for coordination with the Engineer and complying with all the terms, conditions and requirements on the following requirements.

- **South Coast Air Quality Management District (SCAQMD).** The Contractor shall comply with all applicable District Rules and Regulations, particularly Regulation VIII.

- **Coastal Development Permit, Plant No. 2 GWRS Facilities.** The contractor shall comply with all requirements and conditions of approval stated in OCWD’s Coastal Development Permit No. 18-023 in the implementation of the Project work on the OCSD Plant 2 site. A copy of the Permit is available for review at the Owner’s office.

- **Orange County Sanitation District (OCSD) Dewatering Permit (Sewer Discharge Requirements).** Direct or indirect discharge of water from dewatering operations into the OCSD’s sanitary sewer system first requires a Contractor application for a no-fee permit issued by the OCSD prior to any discharge. For permit application, the Contractor shall obtain and complete required documents from the Engineer to secure an Authorization to Discharge Letter from the OCSD’s Source Control staff. The Contractor shall allocate a minimum of 10 working days for this process. Additionally, the Contractor must implement the following requirements:
  1. As a part of the permit application process, the Contractor shall analyze a representative sample of the dewatering wastewater, as required, for Total Toxic Organics (TTO’s), Selenium, and other Pollutants of Concern and provide the analytical results and the completed permit application to the Engineer. Pollutants shall mean any constituent, compound, or characteristic of wastewaters on which a discharge limit may be imposed either by the OCSD or the regulatory bodies empowered to regulate the OCSD and as defined in the OCSD’s Wastewater Discharge Regulations (Ordinance).
2. The permit issued by the OCSD’s Source Control staff may require the Contractor to monitor its discharge for Total Toxic Organics (TTO’s), Selenium, and other Pollutants of Concern and provide the analytical results to the OCSD’s Source Control staff. Typical monitoring frequency is after the commencement of discharge and before the end of discharge. Monitoring frequency shall be specified by the OCSD’s Source Control staff.

3. Monitoring of Dewatering Effluent Discharge Into OCSD’s Collection System: Any discharge of on-site dewatering to OCSD’s collection system shall be monitored by the Contractor, as required, for Heavy Metals, Selenium, Total Toxic Organics (TTO’s), Indicator Bacteria and other Pollutants of Concern to ensure compliance with the OCSD’s NPDES permit. In case where chlorine addition is used for disinfection or biological control, the Contractor shall monitor for Chlorine.

4. Any discharge of on-site dewatering directly to OCSD’s ocean outfall (bypassing treatment processes) shall be monitored by the Contractor, as required, for TSS, VSS, BOD, Ammonia, Heavy Metals, Selenium, Toxicity, Total Toxic Organics (TTO’s), and Indicator Bacteria and other Pollutants of Concern to ensure compliance with the OCSD’s NPDES permit. In cases where chlorine addition is used for disinfection or biological control, the Contractor shall monitor for Chlorine.

5. All dewatering operations require the use of a desilting tank with a stainless-steel sampling port and a drip container so that the Engineer may collect periodic dewatering samples. Additionally, the desilting tanks shall be covered with sturdy and air-tight covers so no odors can escape, and no illegal dumping is possible. The air-tight covers shall be maintained throughout the dewatering period, and only removed when necessary for silt removal or other maintenance activities. The desilting tank shall be located in a safe and easily accessible location. The system used for desilting the water shall be a baffled structure and shall provide not less than 5 minutes detention time and have a "flow-through" velocity not exceeding 0.2 feet per second at the anticipated peak flow. The desilting box shall be cleaned as required to maintain the detention time and flow-through limitations specified above. The intent is to avoid any addition of soil materials from dewatering operations into the receiving sewer or storm drain systems. The method of desilting and point of disposal of water shall be subject to the Engineer’s approval.

6. For all dewatering operations, each disposal point must have a calibrated, non-resettable totalizing effluent flow meter with a flow accuracy of ± 5% to track the discharges into the Owner’s facility. The
Contractor shall submit weekly reports showing total amount of discharge at each point with meter readings and other data necessary to support the quantity reported. Also, an accessible sample collection point shall be provided immediately upstream of the tie-in point to the sewer or OCSD’s sewerage facilities. The Contractor shall provide OCSD’s SOURCE CONTROL staff and Engineer unrestricted access to the facility and site to inspect, monitor, or verify compliance with OCSD’s Permit and Ordinance requirements. Contractor shall make provisions to allow entry to the site for the purposes outlined herein at all times.

7. The Contractor is responsible for development and implementation of a detailed contingency plan in the event that it becomes necessary to reduce or cease dewatering flows into the OCSD’s sanitary sewer system.

8. All dewatering operations with detectable levels of pollutants shall be pretreated to reduce the amount of pollutants, eliminate the pollutants, or alter the nature of the pollutant properties in the dewatering water to a level authorized by OCSD prior to, or in lieu of, discharge of the dewatering water into OCSD’s system. The reduction or alteration can be obtained by physical, chemical or biological processes, or process changes, or by other means. The method of pretreatment and point of disposal of water shall be subject to the OCSD’s Source Control staff and Engineer’s acceptance.

9. All dewatering operations with detectable levels of TTO’s, or evidence of TTO’s in the extraction zone, or significant amounts of volatile organics, may require the use of granular activated carbon (GAC) filters in lead-lag arrangement or other suitable technology to mitigate a Lower Explosion Limit (LEL) event. Note that additional particle filtration is typically provided upstream of the GAC filters to prevent fouling and to extend the life of the carbon. The GAC filters shall be equipped with a stainless-steel sampling port and a drip container on the final stage discharge outlet so that the Engineer may collect periodic dewatering samples. Additionally, the GAC filters shall be air-tight so no odors can escape, and no illegal dumping is possible. The air-tight covers shall be maintained throughout the dewatering period, and only removed when necessary for carbon changeout or other maintenance activities. The GAC filters shall be located in a safe and easily accessible location. Each GAC filter shall provide enough detention time to meet OCSD’s discharge standards. The carbon shall be changed in the lead GAC filter as required. The GAC filters and additional particle filtration equipment upstream of the GAC filters shall be cleaned as required to maintain the detention time and flow-through limitations specified above. The intent is to avoid any addition of soil materials from dewatering operations into the receiving sewer system.
or fouling of the GAC filter carbon media. The method of pretreatment and point of disposal of water shall be subject to the Engineer’s acceptance.

10. Pretreatment of Chlorinated Dewatering Effluent: All dewatering operations that discharge significant levels of chlorine directly to the OCSD’s ocean outfall (bypassing treatment processes), or in areas where fugitive odor emissions may impact local residences, or where chlorine levels may cause a safety concern as a result of disinfection or biological control, require the use of dechlorination dosing and on-stream monitoring to ensure compliance with the OCSD’s NPDES permit effluent requirements. The method of pretreatment and point of disposal of water shall be subject to the Engineer’s approval.

11. Discontinuation of Dewatering Discharge into OCSD’s Sewer System: The Contractor is responsible for development and implementation of a contingency plan in the event that it becomes necessary to reduce or cease dewatering flows into OCSD’s sanitary sewer system for reasons other than a storm event.

12. Discharge During Storm Event: Water may not be discharged into the OCSD’s sanitary sewer during a significant wet-weather storm event without the acceptance of the Engineer. Wet season period is defined in the Work Restrictions section. The disposal system must be equipped with an instant shut off mechanism to protect the OCSD’s facilities in a high flow situation. All costs associated with temporary shut-off of the dewatering system, including protection of the Contractor’s Work, shall be the responsibility of the Contractor. The Contractor will be notified by the Engineer when such a situation is at hand. Failure to provide notification in advance of a high flow situation will not relieve the Contractor of its responsibility to stop discharging all dewatering flows once the high-flow situation is present, and its responsibility to absorb all costs associated with the temporary shut-off of dewatering. When continued discharge into the OCSD’s sanitary sewer system has been disapproved during a wet weather/high flow event, but continued dewatering is desired, the Contractor may elect to discharge into the storm drain system, but must have a pre-approved NPDES permit issued by the RWQCB to discharge and must comply with all provisions of these specifications. Switching of discharge points shall be at no cost to OCSD or the Owner.

13. Dewatering flow shall be discharged as indicated in these Contract Documents and subject to the OCSD’s Source Control staff and Engineer’s acceptance. The Contractor shall notify the Owner when discharge occurs so that sampling of the groundwater can be performed to verify that it complies with the treatment requirements identified herein.
• **Southern California Edison (SCE).** SCE owns and operates underground electrical transmission and distribution facilities that are near the site. The Contractor shall assume, in preparing its Bid, that conditions will include:
  a. The Contractor shall contact Underground Services Alert (USA) at least two (2) working days prior to construction within the vicinity of the underground electric conduits.
  b. SCE requires that all construction activities within the vicinity of facilities are in accordance with appropriate OSHA and California Public Utilities Commission regulations.
  c. SCE policy requires that all relocation and repair be performed by their own forces. The Contractor shall immediately contact SCE should any damage occur to utilities and appurtenances.
  d. All construction activities must be limited to the right-of-way or limits of construction, as designated on the design drawings, unless specifically authorized by the Owner.

• **Southern California Gas Company (SCGC).** SCGC owns and operates underground gas transmission and distribution facilities that are near the site. The Contractor shall assume, in preparing its Bid, that conditions will include:
  a. The Contractor shall contact Underground Services Alert (USA) at least two (2) working days prior to construction within the vicinity of the underground gas conduits.
  b. SCGC requires that all construction activities within the vicinity of facilities are in accordance with appropriate OSHA and California Public Utilities Commission regulations.
  c. SCGC policy requires that all relocation and repair be performed by their own forces. The Contractor shall immediately contact SCGC should any damage occur to gas pipelines and appurtenances.
  d. All construction activities must be limited to the right-of-way or limits of construction, as designated on the design drawings, unless specifically authorized by the Owner.

• **State of California Department of Industrial Relations Occupational Safety and Health Administration (Cal/OSHA) – Construction Activities Permit.** The Contractor shall obtain a Construction Activity Permit from Cal/OSHA for excavations and pipeline trenches greater than five (5) feet deep into which construction personnel will enter. This permit will include any confined space entry requirements. To obtain the permit, the Contractor shall schedule and attend a safety permit conference with the nearest Cal/OSHA District office. At the conference, the Contractor shall provide...
enough project details that Cal/OSHA can make a determination that the work will be performed safely.

The Contractor shall provide the following to Cal/OSHA:

a. Permit Application Form
b. Activity Notification Form
c. Copy of Contractor’s IIP Program
d. Copy of Contractor’s Code of Safe Practices

- State of California Department of Industrial Relations Occupational Safety and Health Administration (Cal/OSHA) – Lead Abatement. Cal/OSHA Consultation Service/California Department of Industrial Relations is the regulatory agency for Lead. Specifically, Section 1532.1 in Title 8 of California Code of Regulations makes construction employers responsible for basic steps in recognizing lead in construction; and Section 36100 Title 17 of CA Code of Regulations covers lead abatement as part of demolition. The fact sheet, found at the website http://www.dir.ca.gov/dosh/dosh_publications/lead-fct-sheet-rev.pdf, summarizes the answers to most questions.

The Owner has conducted a Lead Survey. This survey is available for review at the District or for purchase from OCB Reprographics for a nominal fee per the location and contact details listed in the Notice Inviting Bids.

- Verizon Wireless. Verizon Wireless (Verizon) owns and operates overhead and underground telecommunications facilities near the site. The Contractor shall assume in preparing its Bid, the following conditions:

  a. The Contractor shall contact Underground Services Alert (USA) at least two (2) working days prior to construction within the vicinity of any underground telecommunications lines. The Contractor shall also notify Verizon at least five (5) working days prior to construction in the vicinity of underground or overhead utilities that require support, as defined by Verizon or the Owner.

  b. Verizon requires that all construction activities within the vicinity of overhead electrical facilities be conducted in accordance with appropriate Cal/OSHA and California Public Utilities Commission regulations.

  c. Verizon policy requires that all relocation and repair be performed by their own forces. The Contractor shall immediately contact Verizon should any damage occur to cables, appurtenances, or overhead lines.

- California Division of Drinking Water (DDW). DDW has the primary responsibility for establishing criteria to protect the public health with
regard to recycled water use. DDW requirement for water recycling are contained in the California Code of Regulations, Title 22, Division 4, Chapter 3, Wastewater Reclamation Criteria. The Owner will be preparing an updated Title 22 Engineers Report and Operations Plan for the Project.

- Orange County Flood Control District (OCFCD). The Contractor shall coordinate with OCWD and OCFCD prior to the start of construction to obtain an Encroachment Permit. OCFCD shall be notified of all work within its property.
- City of Huntington Beach. The Contractor shall coordinate with OCWD and the City of Huntington Beach, including the Huntington Beach Fire Department, to obtain a Permit to Occupy at the completion of construction.
- City of Fountain Valley. The Contractor shall coordinate with OCWD and the City of Fountain Valley, including the Fountain Valley Fire Department, to obtain a Permit to Occupy at the completion of construction.

3. STORM WATER QUALITY CONTROLS.

Requirements presented in this section cover stormwater quality controls for the entire project including work on both OCWD and OCSD property. No stormwater within the OCSD property construction area shall leave the site nor shall stormwater be tracked off site. The Contractor shall make all necessary provisions for the capture of stormwater within the OCSD property construction area. For bidding purposes, the Contractor shall assume a Risk Level 2 for determining BMP requirements. The Contractor shall be responsible for retaining a person certified in performing the Risk calculation as required in the permit.

Contractor shall file a Notice of Intent (NOI) to apply for coverage under the General Construction Activities Storm Water Permit (State Water Resources Control Board WQ Order No. 99-08) prior to commencement of construction activity.

3-1. General. The 1972 amendments to the Federal Water Pollution Control Act established the National Pollutant Discharge Elimination System (NPDES) permit program to control discharges of pollutants from point sources. The 1987 amendments to the Clean Water Act (CWA) created a new section of the CWA devoted to storm water permitting (Section 402(p)). The EPA has delegated permitting authority to the State Water Resources Control Board (SWRCB). The SWRCB issues both general and individual permits. Construction activities including all construction discharges are regulated under the NPDES General Permit for Storm Water Discharges Associated with Construction Activity (General Permit). The appropriate Regional Water Quality Control Board (RWQCB) enforces the General Permit. Coverage under a General Permit requires the submission of a Notice of Intent (NOI) with the appropriate fee,
annual compliance reports, a Notice of Termination (NOT) and preparation of a storm water pollution prevention plan (SWPPP).

Construction activity includes, but is not limited to: clearing, grading, demolition, excavation, construction of new structures, pipelines and reconstruction of existing facilities involving removal and replacement that results in soil disturbance. This includes construction access roads, staging areas, storage areas, stockpiles, and any off-site areas, which receive run-off from the construction project such as discharge points into a receiving water.

The Owner has permits from the RWQCB: Recycled Water Order No. R8-2004-0002 and Amending Order Nos. R8-2008-0058 R8-2014-054, R8-2016-0051, and R8-2019-0007, and SAR discharge permit Order No. R8-2014-0069 and NPDES Number CA8000408. While the Owner will continue to be responsible to the RWQCB for causing the preparation of and compliance with the various management plans called for in the permits, the Owner will require the Contractor to provide the detail planning and compliance activities required insofar as they would potentially affect the Contractor's methods and means of performing the Work.

If a violation of the permits is due to the Contractor's actions or inactions and a fine is assessed, the Contractor shall be responsible for the fine.


3-2. Contractor’s Responsibilities. The Contractor shall comply with the SWRCB, RWQCB, County, City, and other local agency requirements regarding stormwater management, inspection, and monitoring.

The Contractor shall be responsible for meeting the requirements of the General Permit except as specifically noted below. The Contractor shall prepare the following documents in accordance with Section C, STANDARD PROVISIONS FOR CONSTRUCTION ACTIVITY, of the General Permit and submit them to the Owner as follows:

- Prepare NOI and provide to Owner for signature, then file NOI.
- Prepare and submit the SWPPP for Owner review at least 30 days prior to any soil disturbing construction in accordance with Section A: STORM WATER POLLUTION PREVENTION PLAN of the General Permit. The Plan shall follow the format presented in the California Storm Water Best Management Practices (BMP) Handbook - Construction Activity volume,
available for order from www.cabmphandbook.com. The plan must address all areas outside of the Project site that are disturbed by Contractor for the prosecution of the Work.

- Install, construct, implement, monitor, maintain and remove upon completion all of the BMPs and other pollution prevention measures in accordance with Section A: STORM WATER POLLUTION PREVENTION PLAN of the General Permit.
- Prepare the annual compliance report and submit to the Owner prior to review as required by Section B, Item 4. – Compliance Certification of the General Permit.
- Prepare all inspection and monitoring reports in accordance with Section B, items 3 through 6 of the General Permit and submitting them to the Owner for review.
- Prepare NOT for Engineer and Owner review. The Owner will file the NOT, however, the Contractor shall certify the NOT.
- Provide evidence to the Engineer that the individual responsible for the SWPPP preparation, implementation, and permit compliance has been appropriately trained and has attended training and/or workshops offered by the SWRCB, RWQCB, or other locally recognized agencies or professional organizations in accordance with Section A, Item 12. – Training of the General Permit. All workers on-site shall, at a minimum, have received training from the responsible individual.
- Contractor shall provide the Engineer the names and 24-hour phone numbers for parties responsible for implementing, monitoring, inspecting and maintaining the SWPPP.

With the exception of the NOI, all documents prepared by the Contractor shall be routed through the Owner, via the Engineer, for submission to the RWQCB.”

Contractor shall be bound to the conditions on the Notice of Intent (NOI) that will be filed by Contractor and will be responsible for all costs associated with the implementation of the Plan including all fines, damages and job delays incurred due to failure to implement the requirements of the Permit.

Contractor shall maintain a copy of the NOI, Plan and Permit at the Project Site at all times, and shall make the Plan available to Owner, Engineer, Engineer, and the State Water Quality Control Board during construction activities. Contractor shall allow authorized agents of the Water Quality Control Board, State Water Resources Control Board, U.S. Environmental Protection Agency, and local storm water management personnel upon the presentation of credentials and other documents as may be required by Laws and Regulations to accomplish the following.
a. Enter, at reasonable times, upon the construction site and Contractor’s facilities pertinent to the Work.

b. Have access to and copy, at reasonable times, any records that must be kept as specified in the permit.

c. Inspect, at reasonable times, the construction site and related erosion and sediment control measures.

d. Sample or monitor, at reasonable times, for the purpose of ensuring compliance with the Permit.

e. Contractor shall notify the Engineer immediately following a request from any regulatory agency to enter, inspect, sample, monitor or otherwise access the Project Site or its records.

The Contractor shall be responsible for taking the proper actions to prevent stormwater coming into contact with contaminants and sediments from migrating offsite or entering storm sewer drainage systems. The Contractor shall take immediate action if directed by the Engineer or if the Contractor observes contaminants and/or sediments entering the storm drainage system, to prevent further stormwater from entering the system.

The Contractor shall update the SWPPP whenever there is a change in construction or operations which may affect the discharge of pollutants to storm water.

The Contractor's attention is directed to the following requirements:

- The Contractor shall clean and maintain the construction sites free from excess construction materials, spoils, and dust daily during construction operations. The Contractor shall also prevent spillage of soil on haul routes and immediately remove any spilled materials. Near creeks or drainage ways, the Contractor will be required to keep all equipment and materials out of the drainage path during construction.

- Excavated material not acceptable for use as backfill shall be removed and disposed of by the Contractor.

- Water used for hydrostatic testing may be discharged provided that the water has been tested and determined to be free of contamination, in accordance with the SWPPP, the General Permit, and in accordance with NPDES.

- The Contractor shall use sediment barriers near rivers, creeks, and drainage swales to prevent sediment, construction materials, or fluid spills from construction equipment from entering the rivers, creeks, drainage swales, or drainage canals. If the pollutants or sediments from the
construction site enter the rivers, creeks, drainage swales, or drainage canals, the pollutants and sediments shall be removed immediately.

- Mechanical and electrical equipment, pipe, valves, and embankment materials may be loaded, unloaded, and stored at the site with enclosures or flow barriers, which shall be erected by the Contractor. The barriers shall surround the temporary storage areas to prevent storm water flows from entering the areas and to control sediments and other pollutants discharge in storm water flows from leaving the temporary storage areas.

- If storm water flows enter the temporary storage areas and contact the construction material, the Owner shall determine if the storm water has become contaminated or may be allowed to be discharged to the storm drains or steam channels. For the purposes of this paragraph, contamination is defined as any degradation of the storm water quality due to contact with construction materials including but not limited to excavated materials and petroleum products. If the storm water flows have become contaminated due to contact with the construction materials, the Contractor shall provide for disposal of the storm water flows at no additional costs to the Owner in a manner acceptable to the Owner and the Regional Water Quality Control Board.

- If spills occur in the temporary storage areas or at the site, the Contractor shall immediately notify the Owner and, at the Contractor’s expense, contain and clean up the spill to prevent spilled material from entering storm drains, creeks, stream channels, drainage canals, or groundwater, or from being absorbed by the underlying pavement or soil.

- The Contractor shall immediately clean up spills of fuel, hydraulic fluid, or oil from construction equipment or vehicles, including spills on the construction site, and at the Contractor’s yard. The Contractor shall include containment areas for these materials, and provide for disposal of these materials, their containers, and pavement or soil that may be contaminated with fuel, hydraulic fluid, or oil in accordance with all applicable laws and regulations.

- Backfill material stored at the construction site shall be protected from storm water flows with solid barriers. If a potential for erosion due to storm water exists, covers shall be provided. The purpose of these barriers and covers shall be to prevent the backfill material from flowing into water courses.

- Water from equipment washing shall not be discharged to creeks, drainage swales, or drainage canals or allowed to percolate into the ground. The Contractor shall not sweep, grade, or flush surplus materials, rubbish or debris into creeks, drainage swales, or drainage canals.
• Fueling, maintenance, and parking of vehicles and vehicle maintenance equipment are prohibited within 0.20 mile of any river, creek, drainage canal, drainage swale, or stream.

3-3. **Owner Responsibilities.** The Owner shall be responsible for the following:

- Review and sign Notice of Intent (NOI) for Contractor to file.
- Furnish the Contractor with base maps of a suitable scale in order to satisfy the requirements of Section A, items 5 through 10 of the General Permit.
- The Owner will submit to the RWQCB an annual summary report and pay the associated fee. This annual summary report will require the submission of the annual certification and update as required in Contractor’s responsibilities above.
- Signatory responsibility as defined in Section C, Item 9. a. – Signatory Requirements of the General Permit.

4. **DEWATERING.**

Construction dewatering is regulated by the California Regional Water Quality Control Board- Santa Ana Region and is governed by the National Pollutant Discharge Elimination System (NPDES) Permit No. CAG998001 adopted by the Regional Water Quality Control Board (RWQCB) to regulate construction dewatering. Should the Contractor need to control groundwater by dewatering and/or depressurization of water bearing soil and rock formations, or other low threat discharges, the Contractor must comply with this NPDES Permit, or any updated NPDES Permit, and all other laws and regulations having jurisdiction over construction dewatering. The Contractor is responsible for obtaining all permits from agencies with control over all dewatering matters including well installation/abandonment, water discharge, use of existing storm drains and natural water sources. Contractor can refer to copy included herein as an appendix. The Contractor will be held responsible for any fines or penalties from regulatory agencies resulting from its dewatering system.

Before dewatering is commenced, the Contractor shall obtain acceptance of OCSD and Engineer for the method, installation, monitoring, testing, removal, discharge point(s) and other system details of the Contractor’s proposed dewatering system. To that end, the Contractor is to submit to the Engineer all the requirements specified in the Dewatering Specification.
Water may not be discharged into OCSD’s sanitary sewer during a wet-weather storm event.

End of Section
Section 01140

WORK RESTRICTIONS

1. GENERAL SEQUENCING AND CONSTRAINTS. The Advanced Water Treatment Facility (AWTF), operated by the Orange County Water District (Owner/District), is a component of the Groundwater Replenishment System (GWRS) and it is a critical source for supplementing existing water supplies by providing reliable, high-quality source of water to recharge the Orange County Groundwater Basin and protects the Basin from further degradation due to seawater intrusion. The Secondary Effluent Flow Equalization Facilities support GWRS by providing more total flow and allowing operation at a more constant flow rate into the AWTF.

The facility operates under the terms of the District’s Producer/User Water Recycling Requirements from the California Regional Water Quality Control Board – Santa Ana Region. The Owner maintains a rigorous testing and monitoring schedule to assure compliance. A copy of the permit is on file available for review at the Owner’s offices. Except where outages or bypasses have been approved by the Owner, the Contractor is to conduct the Work such that the Owner’s ability to produce water shall not be impaired or reduced. The Contractor’s work must never prevent the OCWD facilities from complying with the water requirements established by State and Federal regulations.

The Orange County Sanitation District (OCSD) owns and operates Plant No. 1 and 2. Plant No. 1 and 2 are critical means of treating wastewater for reclamation purposes, including feed to the AWTF, and for conveying treated wastewater to the ocean for safe disposal. Impairing the operational capabilities of this treatment plant will result in serious environmental damage and monetary fines. Bypassing of untreated or partially treated wastewater to surface waters or drainage courses is prohibited. When accidental bypassing occurs, the Owner is entitled to take appropriate action and costs incurred will be deducted from progress payments, if deemed appropriate by the Owner.

The Contractor shall conduct work in a manner that will not impair the operational capabilities of the AWTF and Orange County Sanitation District's Plant Nos. 1 and 2 or reduce the capacity of the AWTF or treatment plants, except as provided in Section 01140 Work Restrictions.

The Contractor is to employ personnel knowledgeable and experienced in treatment plant construction including knowledge of treatment processes, facility operations and chemical systems. Examples of required knowledge include, but are not limited to, treatment terminology, functions of treatment plant facilities, and actions that would adversely impact water treatment and water quality.
Work Sequence and Constraints described hereinafter are critical events in work sequence, which are presented to underscore the importance of proper sequencing, scheduling and coordination so that it is integrated with the required OCWD and OCSD (Plant 1 and Plant 2) facility production. The work sequence and constraints presented do not describe all items affecting the completion of the Work, but are intended to describe important events necessary to minimize disruption of the existing facilities and to ensure compliance with water quality permit requirements.

The existing facility where Contractor’s work is to be done will be occupied by the Owner throughout the construction period. The existing facility where Contractor’s work is to be done within OCSD’s Plant No. 1 and 2 sites will be occupied by OCSD staff throughout the construction period. Coordination with OCSD and OCWD will be required to maintain Plant No. 1 and GWRS in operation. The Contractor shall provide all necessary access to the Owner’s and OCSD’s personnel as required to safely and efficiently operate/maintain the facilities. At all times during the Contract duration, the Contractor is to provide the Owner’s and OCSD’s personnel and representatives safe and immediate access to all process control equipment. Additionally, the Contractor is to provide for unimpeded access for all delivery vehicles transporting materials, chemicals and equipment to the facility for the Owner’s and OCSD’s operations.

CONTRACTOR shall inform OCSD’s Public Information Officer (PIO) of construction activities impacting residents, businesses, schools, and general public a minimum of two (2) weeks prior to performing any Work. OCWD to inform OCSD’s PIO. These requirements are in addition to already included in the Contract Documents.

The tie-ins and outages discussed in this section do not represent all required tie-ins or outages for the Work. It shall be the contractor’s responsibility to identify additional tie-ins and outages and provide required planning documents and coordination.

2. INTERRUPTION OF FACILITY OPERATIONS.

2-1. General Requirements. The Work shall be bid, scheduled and constructed in such a manner as to result in the least possible disruption to the operations and staff of the existing facility. Modifications that affect or may affect the operation of the facility shall not be made without first obtaining written permission from the Engineer. Disruptions or interference to one portion of the facility will likely affect other facility processes since they are interrelated and dependent on one another. The Contractor must fully understand any and all possible reductions on facility production and/or water quality as they plan the Work.
The Contractor shall note that not all valves and gates that may be used to isolate lines and facilities will completely seal. The Contractor shall allow for leakage in planning its work and may, with the Owner’s concurrence, test certain valves and gates before work involving isolation has begun. The Contractor shall provide adequate temporary pumping and piping facilities to properly clear the work areas as necessary of water, chemicals, sludge and/or sewage. The Contractor shall clean the work areas as required to perform the work. Shutdown and isolation of existing facilities by closing existing valves/gates and operating electrical control panels, or as specifically provided for in the Contract Documents, will be performed by Owner personnel in conjunction with Contractor’s staff upon preapproval by Engineer or according to approved schedule.

Prior to any shutdown or flow diversion all materials, fittings, supports, equipment and tools shall be on the site and all necessary skilled labor scheduled prior to starting any connection work. The Contractor shall provide staff following shutdowns to monitor and ensure the proper operation of systems.

The Contractor is advised that any shutdown of facilities will place a considerable burden on the Owner's staff before, during and after the shutdown. If through inadequate planning, lack of preparedness, faulty or inefficient workmanship or other causes controllable by the Contractor, delays, excessive time, or additional shutdowns are required that cause the Owner to incur extra cost, said extra cost will be assessed against the Contractor. To minimize impact on plant staff, all outages shall be limited to the periods specified herein unless a different shutdown time is otherwise required in the Contract Documents.

Planned utility service shutdowns to any service area or process unit of the project shall be accomplished during periods of minimum use. In some cases, this will require night or weekend work, which shall be at no additional cost to the Owner. The Contractor shall program work so that service will be restored in the minimum possible time and shall cooperate with the Owner in reducing shutdowns of the utility to a minimum. No utility shall be disconnected without prior written approval from the utility owner and Engineer. When it is necessary to disconnect a utility, the Contractor shall give at least two (2) weeks' notice to the utility owner and to the Engineer for approval of the proposed schedule. When outages require electrical switching procedures, Contractor shall schedule a final work plan review meeting a minimum of 48 hours prior to the outage. Downtime for piping, power interruptions, and other utility services requiring taps or connections will require prior written acceptance seven (7) days in advance, starting on a Thursday, of the requested downtime.

The Contractor shall note that only certain structures, tie-ins and constraints are addressed in this section. All work, whether or not addressed here, shall be governed by applicable parts of this section, and schedules and procedures further submitted for approval.
When construction includes temporary or permanent modifications to systems conveying or potentially conveying hazardous materials such as chemical systems, valves shall not be considered a sufficient means of isolation during construction. A positive isolation and sealing method such as caps, plugs, blind flanges, pancake flanges and/or spectacle flanges shall be used in addition to isolation valves.

2-2. Outage or Bypass Submittal Requirements.

An outage is defined as a complete shutdown of facilities that eliminates the ability to produce Final Product Water (FPW) water from the existing AWTF, or the ability to convey flow through the existing 66 inch interplant pipeline or TFSC 120 inch effluent pipeline, or shutdown of the TFSC treatment train. FPW is the flow stream that has received full treatment through the AWTF and is ready for delivery to the barrier or recharge basins. A bypass is defined as a partial shutdown of some equipment to facilitate construction that enables the AWTF to remain operational but reduces the operable production of the existing AWTF below 100 MGD or reduces operable production of the existing TFSC below 30 mgd. A minimum production capacity of 70 MGD is associated with the AWTF remaining operational.

The Contractor shall submit to the Engineer, for review and acceptance, a detailed outage or bypass plan and time schedule for operations not less than sixty (60) days in advance of each scheduled outage or bypass. The detailed plan shall meet the restrictions and conditions found in the Contract Documents. A System Outage Request (SOR) form shall accompany each outage or bypass plan. The outage plans shall be coordinated with the construction schedule and shall meet the Contractor's planned method; describe the proposed points of isolation; the length of time required to complete said operation; any necessary temporary power, controls, instrumentation or alarms required to maintain control, monitoring and alarms; and the manpower and equipment which the Contractor shall provide in order to ensure proper operation of affected facilities. In addition, the outage plan shall describe the Contractor's contingency plan that shall be initiated in the event that its temporary facilities fail or it becomes apparent that the time constraints described in the approved SOR cannot be met. The contingency plan shall conform to all specified outage requirements. All costs for preparing and implementing both the outage and contingency plans shall be borne by the Contractor.

The Contractor shall attend a meeting with the Engineer, OCSD, and the Owner two (2) weeks before the scheduled outage to review the SOR. Any changes to the SOR must be approved by the Engineer and the Owner prior to the outage.

Contractor shall demonstrate readiness to begin outage at a Go/No-Go meeting no less than forty-eight (48) hours prior to outage. Contractor shall demonstrate
that all required equipment, materials, and personnel will be on-site and operational for the outage.

2-3. **Work Constraints, Sequencing and Planned System Outages Specific to This Project.**

The Contractor shall note that during the construction of the Project, the existing OCWD and OCSD facilities will remain in service except where outages or bypasses have been approved by the Owner. The Contractor is responsible for sequencing the Work so that the Work is completed on or prior to the Substantial Completion dates. The Work shall be sequenced in stages and scheduled to accommodate the Owner’s operational requirements during the construction period. The Contractor is responsible for coordinating the construction schedule and operations with the Owner to allow the plant operations to function properly during the Work.

2-3.01. **Sequence of Work.**

A suggested sequence of work is specified below for project construction. The list below does not relieve the Contractor of responsibility of providing a complete outage sequence including all components of the work. The work sequence shall include but not be limited to:

Note that Steps 4 through 14 are only required for facilities in which new structures will be constructed.

1. Clearing and grubbing, trailer set-up, staging area construction, traffic control features.
2. Upgrade existing DeltaV system to 14.3.1. Work to be completed within 120 consecutive calendar days from Notice to Proceed. See Outage J for additional schedule requirements.
3. Make utility arrangements. While clearing and grubbing, excavating, and grading, the General Contractor will make any temporary utility arrangements required for construction, such as routing temporary power lines and including temporary structure support systems. The Contractor will also provide support systems to protect existing utilities.
4. Pothole required utilities
5. Identify and shut off existing utilities serving the facilities.
6. Design and install excavation support system (shoring system).
7. Perform structural excavation within excavation support system.
8. Set up pile template.
9. Perform predrilling. All pile locations will be predrilled.
10. Place reinforcement cage and concrete for cast piles at an assumed average of ten piles per day. Perform ground improvements.

11. Install subgrade materials underneath slabs/foundations/pile caps.

12. After foundation is complete, commence construction of wall sections.

13. After wall placement is underway, construct the network of suspended slabs and walkways.

14. The walls will be stripped and cured for 21 days. Following curing, hydrostatic leakage testing of the new water-containing structures will commence for a minimum of 48 hours.

15. Place backfill once the structures have successfully passed the hydrostatic leakage testing.

16. Install P2 pipeline from Screenings Facility up to north bidirectional connection, and from SE Pump Station up to south bidirectional connection.

17. Install process equipment once the structures have been backfilled and tested (where required).

18. Perform miscellaneous site work and remaining site utilities work will commence after backfilling operations.


20. Demolish wall at Screenings Facility.

21. Integrate I&C systems (Delta V) for each facility.

22. Commissioning and startup will occur by process area as determined by the schedule.

23. Restore site and remove temporary access road, if required.

Any deviations from the specified work sequence must be reviewed and approved by the Engineer prior to commencement of the Work.

2-3.02. Time Constraints.

The following time constraints will affect the Contractor’s work sequence, site access and construction schedule. The listing of time constraints in this section and elsewhere in the Contract Documents shall not mean that all time constraints or special conditions have been identified. The list does not substitute for the Contractor’s coordination and planning for completion of Work within the specified Contract time.

The following requirements shall be incorporated into Contractor’s CPM Construction Schedule.
• Preconstruction surveys shall be performed to address any required mitigation measures as required in the Field Engineering section.

• The Contractor shall maintain the access road(s) as a condition of their use. The Contractor shall minimize any interruptions to all access gates including the OCWD access via Ward Avenue and the OCSD accesses via Garfield Avenue at Plant 1 and Brookhurst Avenue at Plant 2.

• Project construction involves earthwork activities that include making excavations and placing and compacting engineered fills. Because of the nature of the onsite soils, such earthwork activities will expose slopes and other surfaces that are susceptible to the effects of erosion. Slopes and other surfaces that are exposed shall be protected from the effects of erosion, and shall receive permanent protection as soon after the earthwork activities are completed. Refer to additional requirements specified herein and in the technical specifications.

• The existing facilities are used to provide water service to Owner’s customers and cannot be out of service for more than the limits indicated without jeopardizing the Owner’s ability to provide continuous service to its customers.

• The existing facilities within Plant No.1 are used to provide treated effluent to Owner and cannot be out of service for more than the limits indicated without jeopardizing the OCSD’s ability to provide continuous service to Owner.

• The existing facilities within Plant No. 2 cannot be out of service for more than the limits indicated without jeopardizing the OCSD’s ability to provide continuous service to Owner.

• Maximum time for AWTF shutdown or reduction in AWTF treatment capacity is 48 hours. Any shutdowns greater than 48 hours will only be allowed with prior permission from the Owner, OCSD, and the Engineer. Any shutdowns greater than 48 hours (with the exception of the Screenings Facility, RO Facility H-I, and Decarbonation Facility) that have not been previously approved by the Owner and Engineer shall be assessed liquidated damages at the same rate as that defined for Substantial Completion in the Bid Form.

• If multiple plant shutdowns are determined to be needed to complete the outages, the shutdowns shall be separated by at least 14 calendar days, unless otherwise approved by the Owner and/or OCSD.

• Contractor shall plan, coordinate, schedule and complete work for as many outages as possible within the period. Contractor will not be permitted to exceed the time limits specified unless authorized by the Owner to do so.

• One AWTF shutdown of up to seven (7) 24-hour days will be scheduled for work associated with Area 710. Contractor should plan accordingly and
have all preparation work completed and materials in hand prior to initiating work. Any outage duration in excess shall be assessed liquidated damages at the same rate as that defined for Substantial Completion in the Bid Form.

- One AWTF shutdown of up to three (3) 24-hour days will be scheduled for work associated with the Screenings Facility. Contractor should plan accordingly and have all preparation work completed and materials in hand prior to initiating work. Any outage duration in excess shall be assessed liquidated damages at the same rate as that defined for Substantial Completion in the Bid Form.

- One AWTF shutdown of up to three (3) 24-hour days will be scheduled for work associated with RO H & I and Static Mixer. Contractor should plan accordingly and have all preparation work completed and materials in hand prior to initiating work. Any outage duration in excess shall be assessed liquidated damages at the same rate as that defined for Substantial Completion in the Bid Form.

- The Contractor shall be allowed a total outage duration for all tie-ins (including, but not limited to Decarbonation area [Outage F], Screenings Facility [Outage M], and RO H&I [Outage C1]) of up to eighteen (18) 24-hour days. Any outage duration in excess of this allowance shall be assessed liquidated damages at the rate of Substantial Completion defined in the Bid Form.

- The PCS hardware and software upgrade to Delta V version 14.3.1 shall be completed within 120 consecutive calendar days after the Notice to Proceed is issued. See Outage J for additional requirements.

- OCSD depends on the GWRS for peak flow relief during the wet season which is from October 15 through April 15. During this period, shutdowns shall not be allowed unless authorized by the Owner to do so.

- Shutdowns requiring the use of OCSDs outfall shall be coordinated with OCSD at all times.

2-3.03. Owner Facilities Out of Service.

The Work under this Contract requires the Contractor to connect to or to permanently or temporarily modify, the existing Owner’s facilities as well as OCSD’s facilities listed below. Such facilities may be taken out of service only when the proposed outage plan has been reviewed and accepted (after being submitted for review not less than sixty (60) days prior to the outage), requested by the Contractor with fifteen (15) days advance notice, and approved in writing by the Owner.

The time limits presented above begin when the Owner’s crew begins to close in-line valves, and ends when the Owner’s crews have completed all procedures for putting a facility back in service. Work by the Contractor within the time limits...
include; but are not limited to; draining, installing, testing, refilling, and acceptance by Engineer of the installation completed within the outage period.

The Owner has the option of requiring Contractor to terminate its work and restore the facility back to full service at the end of the specified time period, or may allow Contractor to continue to work beyond the time limits specified, subject to the liquidated damages provisions stated in the Bid From.

The outage description below represents major outages that the Owner has identified in advance for the Contractor. The Contractor shall coordinate outages with all trades to achieve the maximum work. The table does not include all outages that are necessary for completion of the Work. Additional outages may be required as determined by Contractor for performing the work associated with demolition and utility relocation as specified in the Contract Documents.

The Contractor shall employ sufficient labor, superintendence, and equipment continuously during the outage to complete the designated work within the specified periods. The Contractor shall have available and provide as required temporary pumps, piping, valves, tanks, lighting, controls, instrumentation, and safety devices. Once initiated, the work during the outage may proceed on an extra shift or around-the-clock basis as necessary and approval from the Owner. Contractor shall note that to complete the required tie-ins during the specified outage periods, all required and related submittals shall have been submitted and accepted early in the construction phase.

The following outages include a suggested sequence of construction and work that should be completed and shall be taken into consideration when preparing the proposed schedule of construction. The suggested sequences and work contained herein are not inclusive and may require additional steps to provide a complete facility or system.

Major Outages (not listed in chronological order):
In order to minimize the required number of outages, the following Work is suggested to be grouped together. For all outages the Contractor shall plan to group as many outage as practical to minimize disruption to the OCWD and OCSD.

Group 1
Outage F – Decarbonation Piping Modifications
Outage X – Surge Tank Modifications
Outage G – Product/Barrier Pump Station

Group 2
Outage L – Cartridge Filters and Static Mixer
Outage D – Ultraviolet Light Facility
Outage C1 - Reverse Osmosis Facility Trains F, G, H, & I including RO Flush Feed Pump Station and DPW Pump Station

The following outages shall be scheduled

**Outage A**

Name of Facility: Microfiltration  
Nature or Type of Work:

Connections to:
- 60-inch MFF (Train E)
- 60-inch MFF (Train F)
- 54-inch MFF (Train E at 2 locations)
- 54-inch MF BWW (Train F)
- 60-inch MFE (Train F)
- Small pipe connections at compressors, blowers, and vacuum pumps
- 6-inch CIP Feed (MCR)
- New BWW pump tie-in
- 42-inch and 16-inch MF Backwash supply line
- Demolition of section of backwash waste wetwell wall

The existing MF system is critical for AWTF operation and must be kept operational during construction of the new facilities. Removal or stoppage of any part of the existing MF system from service will result in an outage. Efforts shall be made to keep existing piping intact and in operation during construction. Barriers such as plastic sheets or other means shall be temporarily installed around construction areas to minimize dust and debris from entering the existing MF system.

Points of Isolation and Considerations:

- Installation of the 60-inch MFF (Train E) requires isolation of the 60-inch MFF to allow removal of the 30-inch line and butterfly valve. The 60-inch MFF can be isolated by closing the adjacent 60-inch butterfly valve (E02-BFV-0315) on the branch off the 96-inch MFF. Water in the piping can be drained through the existing MF cells or pumped out through use of a Contractor supplied temporary pump.
- Installation of the 60-inch MFF (Train F) requires isolation of the upstream 96-inch MFF pipeline. The 96-inch MFF can be isolated by closing the influent valves to and gates within the Screenings Facility.
Water in the piping can be drained through the existing MF cells or pumped out through use of a Contractor supplied temporary pump.

- Installation of the 54-inch MFF (Train E) requires isolation of the 54-inch MFF upstream of the tie-in location to allow removal of the two blind flanges. The line can be isolated by closing the existing 60-inch valve (E02-BFV-0315) upstream of the tie-in location. Water in the piping can be drained through the existing MF cells and pumped out through use of a Contractor supplied temporary pump.

- Installation of the 54-inch MF BWW (Train F) requires isolation of the 66-inch BWW header downstream of the tie-in location to allow removal of the blind flange. Level in the MF Backwash Waste Pump Station (east side) shall be lowered to an elevation below the connection point to facilitate connection and maintain the pipe drained.

- Installation of the 60-inch MFE (Train E and F) requires isolation of the 60-inch MFE downstream of the tie-in location to allow removal of the blind flange. The line has to be isolated by closing the individual valves at each cell. Water in the piping can be drained by pumping out through use of a Contractor supplied temporary pump.

- Installation of small pipe connections at compressors, blowers, and vacuum pumps requires stoppage of the individual system to allow tie-ins to take place. Equipment shall remain out of service until connections are completed.

- Installation of small plumbing and fire piping connections shall be completed as indicated on the drawings. Piping shall be drained through use of Contractor supplied temporary pump as necessary.

- Installation of the 6-inch CIP Feed (MCR) requires isolation of the header pipe through closure of the isolation valves upstream of the tie-in location. This tie-in does not require a shut down.

- Installation of the 42-inch and 16-inch MF BW Supply pipelines requires shutdown / lockout tagout of the BW Supply pumps and closure of the pump discharge valves.

- Installation of the MF Backwash Waste Pump requires isolation of the discharge manifold at each pump on the west side and downstream valves (230-BFV-0836 AND 230-BFV-0833). Water in the manifold can be drained back into the west wetwell through temporary piping through the future MF Backwash Waste Pump discharge location.

- Close isolation valves (by Owner) and drain existing piping as noted above. Water drained from pipelines can be disposed of through contractor supplied temporary piping inserted into the west backwash waste wetwell (in MF basement) through the future MF Backwash
Waste Pump discharge location. Contractor shall be responsible for removing existing seal plate and providing all required temporary appurtenances.

- Remove existing blind flanges at connection points, or, cut and remove piping for insertion of new fitting. Clean and prepare existing pipe surface.
- Install mechanical connection as indicated on Drawings.
- Perform pressure and leakage testing
- Perform disinfection of pipe. Contractor to include in plan methods for protection of membranes.
- Demolition of the section of backwash waste wetwell wall will require shutdown / lockout tagout of the backwash pumps and closure of backwash waste valves at each cell. The contractor shall be responsible for dewatering of the wetwell for the work.

**Outage B**

**Name of Facility:** Transfer Pump Station (for MF Backwash Supply Pumps)

**Nature or Type of Work:**

Removal of existing blind flanges and installation of a portion of the pump discharge piping and discharge isolation valves for the MF Backwash Supply Pumps to the existing discharge manifold piping.

**Points of Isolation and Considerations:**

- Installation of valves and piping will require that the discharge manifolds of each pumping system be isolated and dewatered
- For the installation of the MF Backwash Supply Pumps close isolation valves at each MF Backwash Supply Pump discharge pipe. Shutdown / lockout tagout pumps. Water in the manifold can be drained to the MF cells.
- Remove blind flange and install piping and valves
- Perform pressure and leakage testing
- Disinfection of pipe
Outage C1

Name of Facility: Reverse Osmosis Facility Trains F, G, H & I including RO Flush Feed Pump Station and DPW Pump Station

Nature or Type of Work:

Connections to:

- 30-inch connection to existing 78-inch RO Permeate header (2 locations)
- 30-inch connection to existing 84-inch RO Feed header (2 locations)
- 12-inch connection to existing 36-inch RO Waste header (2 locations)
- 24-inch connection to existing 24-inch RO Concentrate header
- 12-inch connection to existing 12-inch CIP manifold (2 locations)
- 8-inch connection to existing 36-inch DPW header (DPW Pump)
- 8-inch connection to existing 30-inch DPW header (RO Flush Feed Pump)
- 4-inch connection to existing 4-inch CIP manifold
- DPW connection
- Train F-G – pump isolation

The existing RO system is critical for AWTF operation and must be kept operational during construction of the new facilities. Removal or stoppage of any part of the existing RO system from service will result in an outage. Efforts shall be made to keep existing piping intact and in operation during construction. Barriers such as plastic sheets or other means shall be temporarily installed around construction areas to minimize dust and debris from impacting operations of the existing system. It is noted that connections to be made at existing headers in the existing RO building basement have very small tolerances. Contractor shall survey and measure all connections prior to ordering pipe and fittings for connections and prior to scheduling tie-in work. Connections to be made outside of the RO building will require potholing to verify/confirm location of connection points prior to ordering pipe, fittings, and appurtenances and scheduling tie-in work.

Points of Isolation and Considerations:

- Both the 84-inch RO feed and 78-inch RO permeate lines will be isolated between the cartridge filters and the UV facility. They shall be drained from the 2" drain connections, located along the two headers
in the basement, to the RO building sump. The drainage water will then be pumped to the sump waste junction manhole using the existing sump pumps. Existing blind flanges at the connection points are to be removed and reused in the new RO building. Connections to the headers will be made in the existing RO building basement. Contractor to confirm capacity of the RO sump onsite in development of the outage plan.

- The 12-inch connection to existing 36-inch RO Waste header. The existing RO Waste Pump Station can be used to partially dewater the 36-inch RO Waste header.

- The 24-inch connection to existing 24-inch RO Concentrate header. Prior to connecting the new section of 24-inch pipeline, the existing RO Concentrate pipeline should be flushed towards the Primary Effluent Distribution Box at OCSD. The pipeline may be dewatered through the existing 12” BFV connection.

- The 12-inch CIP manifolds will be drained at the connection points when the blind flanges are removed. They will be drained to the existing RO building sump by way of the basement drainage trenches. The drainage water will then be pumped to the sump waste junction manhole using the existing sump pumps. Existing blind flanges at the connection points are to be removed. Connections to the CIP manifolds will be made in the existing RO building basement.

- The 8-inch RO flush water feed header will be isolated at the existing common feed header butterfly valves. The header will be drained at the connection point to the existing RO building sump. The drainage water will then be pumped to the sump waste junction manhole using the existing sump pumps. Existing blind flange will be removed from the connection point and reused at the end of the header extension. Connection to the header will be made in the existing RO building basement.

- The 4-inch CIP manifold will be drained to the existing RO building sump at the connection point. The drainage water will then be pumped to the sump waste junction manhole using the existing sump pumps. Connection to the manifold will be made in the existing RO building. Cut and remove piping and clean and prepare existing pipe surface for insertion of new fittings.

- Install mechanical connection as indicated on Drawings.

- The ERDs on Train F and G will be isolated one unit at a time for a motor replacement.

- Install valves at or near connection points as indicated on Drawings.

- Perform pressure and leakage testing per specifications.
• Disinfection of pipe per specifications. Contractor to include in plan methods of protection for membranes.

**Outage C2**

Name of Facility: Reverse Osmosis Facility Trains A-E

Nature or Type of Work:

Installation of BFV valves, piping and flowmeters.

Points of Isolation and Considerations:

• On Trains A – E, modification will occur first on one single unit of a Train. Modification of the remaining units may be perform based on isolation of an entire Train.
• Perform pressure and leakage testing per specifications.
• Disinfection of pipe per specifications. Contractor to include in plan methods of protection for membranes.

Maximum Time Facility Shall Be Taken Out of Service

The anticipated shutdown period for the Train A – E pump installation is approximately 72 hours (3 days) per Train. The anticipated shutdown period for the single unit is 24 hours.

**Outage D**

Name of Facility: Ultraviolet Light Facility

Nature or Type of Work:

Connections to:

• Three (3) 20-inch connections at the supply header (Trains N, O, and P)
• Three (3) 20-inch connections at the discharge header (Trains N, O, and P)

Points of Isolation and Considerations:

• For the discharge header, special instructions are described in the UV Disinfection Installation System Section.
• Isolation valves are not available and both headers (supply and discharge) must be isolated and dewatered for the work.
• Disinfection of pipe per specifications. Contractor to include in plan methods of protection for membranes.

**Outage E**

**Name of Facility:** Polymer System

**Nature or Type of Work:**
Removal and replacement of four polymer feeder blenders, one polymer storage tank, and 6 polymer feed pipelines to the saturators.

**Points of Isolation and Considerations:**
- Isolate each polymer blender by closing the valves serving each polymer blending unit. These include the polymer feed pipe, dilution feed water pipe, and polymer solution discharge pipe.
- For the polymer solution pipelines to each saturator, isolation valve operation shall be coordinated with the polymer unit being replaced and the saturator being temporarily removed from service.

**Maximum Time Facility Shall Be Taken Out of Service**
Installation of the polymer feeders shall be sequenced to maintain 3 polymer blenders on-line at all times. Installation of the polymer tank shall include temporary installation of a tote to allow feeding of the 3 on-line polymer blending units during tank replacement. Removal and upsizing of the polymer solution pipelines to each saturator shall be sequenced to allow 2 saturators to be in service at all time. A maximum outage for the tank switchover from tank to tote and from tote to tank is 3 hrs per event.

**Outage F**

**Name of Facility:** Decarbonation Facility

**Nature or Type of Work:**
- Addition of seventh decarbonation tower and blower.
- New bypass pipeline to Tank A02
- Add 4 orifice plates with pipe modifications
- Disinfection of decarbonation tanks and wasting of flow to ocean outfall

**Connections to:**
- 60-inch A02 Decarb Header
- 30-inch A01 Bypass Line
Points of Isolation and Considerations:

- Extend pipeline from header to isolation valves and new decarbonation tower.
- Isolation valves are not available on the supply header, which must be isolated and dewatered for the work.
- Bypass System:
  - Isolate 36-inch bypass header (710-BFV-7110) and relocate valves (A01-BFV-7120 & A02-BFV-7100). All bypass during this time will go through the 60-inch to 30-inch bypass line.
  - Isolate 30-inch bypass line (710-BFV-7110) and install new 30-inch bypass line.
- Disinfection of pipe per specifications.

Outage G

Name of Facility: Product/Barrier Pump Station

Nature or Type of Work:

Removal of existing blind flanges and installation of portion of pump suction and discharge piping and isolation valves for the Product Water Pump to the existing suction and discharge manifold piping.

Points of Isolation and Considerations:

- Installation of valves and piping will require that the suction and discharge manifolds be isolated and dewatered
- On the suction side of the pump station, the discharge gates at the Decarbonation Facility can be closed and the existing underground flume/channel drained and/or dewatered through an existing blowoff and pumped out through existing access hatches. Water can be pumped with dewatering pumps back into the Decarbonation Facility. Remaining water can be drained into the existing valve chamber on the west side of the Product/Barrier Pump Station. On the discharge side, isolate with isolation valve upstream of Finished Product Water Bypass Structure. The discharge manifold centerline is lower in elevation than the pump discharge centerline, thus the discharge manifold cannot be completely drained. Water above the spring line can be drained into the existing valve chamber on the west side of the Product/Barrier Pump Station.
- Remove blind flange and install piping and valves
- Perform pressure and leakage testing
• Disinfection of pipe

**Outage H**

**Name of Facility:** Surge Tank Facilities

**Nature or Type of Work:**
Addition of one new surge tank and appurtenances. Modifications to five existing surge tanks.

**Connections to:**
- 18-FPW

**Points of Isolation and Considerations:**
- Isolation for modifications of the 5 existing tanks are the isolation valves located at the base of each tank. After isolation and prior to opening of any access hatch, the tank shall be monitored to determine if leakage is occurring through the isolation valve.
- Isolation for installation of the new tank shall be the shutdown lockdown tagout of the product water / barrier water pumps and closure of each pump discharge pipes isolation valve.
- For the new tank remove the 18-inch blind flange to install the 24-inch harnessed double flange adaptor and butterfly valve to the tank.

**Maximum Time Facility Shall Be Taken Out of Service**
Prior to modification of any of the existing surge tanks, the new surge tank shall be installed, tested, and placed on-line. Modification of the five existing surge tanks shall occur one at a time allowing 5 surge tanks to remain in-service at all times.

**Outage I**

**Name of Facility:** Electrical Shutdowns for GWRS work

**Nature or Type of Work:**
- Modifications to switchgear and motor control centers in existing East MF Electrical Room, existing West MF Electrical Room, existing RO Electrical Building (540), existing RO Electrical Room (510), existing UV Electrical Building, existing prefabricated electrical enclosure outside RO Building, and existing prefabricated electrical enclosure for Lime/Polymer Areas.
• New motor control center 480-MCC-0085/0090 and VFDs in new MF West Electrical Room.

• New motor control center 480-MCC-0040/0045 and VFDs in new prefabricated electrical enclosure outside RO Building (510) for new Booster Pumps at existing RO Trains A through E.

• Replacement of existing (2) 12kV-480/277V Transformers XFMR-0000 and XFMR-0005 outside existing RO Electrical Room (510).

• Replacement of RO Train F and G motors and VFDs (510).

Points of Isolation and Considerations:

• Operation of switchgear and motor control centers shall be coordinated with the Owner to allow for a partial shutdown of that lineup.

• The bus which will accept the new connection(s) shall be de-energized while the other half of the switchgear/motor control center bus remains energized to provide partial facility capacity.

• The bus on each end of the Bus A and Bus B of 480V Switchgear 480-SWG-0000/0005 in RO Electrical Room (540) will be extended and a new section added to each end.

• Replacement of RO Trains F and G ERD motors and VFDs shall be coordinated with the Owner to allow for a partial shutdown of the RO trains F and G ERDs/Booster Pumps.

• Replacement of existing (2) 12kV-480/277V Transformers 510-BUSA-12K-XFMR-0000 and 510-BUSB-12K-XFMR-XFMR-0005 shall be coordinated with the Owner to allow for a partial shutdown of motor control center 480-MCC-0030/0035

Outage J

Name of Facility: Process Control System (PCS) upgrade and integrations for GWRS work

Nature or Type of Work:

Three areas of work that will require outages:

• Upgrade of components of the existing PCS as shown in the contract drawings to version 14.3.1. This task will upgrade network switches and controllers with corresponding hardware, software, firmware, drivers, and licensing. This activity will include any updates to software or drivers to ensure compatibility of existing Foundation Fieldbus and DeviceNet networks. It is anticipated that the network switches and controllers will be upgraded in a phased manner.
Contractor to coordinate outages with the Owner and perform outages as plant conditions permit.

- Upgrade of workstations and servers of the existing PCS as shown in the contract drawings to version 14.3.1. This task with upgrade hardware, software, configuration, and licensing. It is anticipated and expected that the workstations and servers will be upgraded in one outage. Contractor to coordinate outage with the Owner and perform outage as plant conditions permit.

- Modifications to PCS to integrate equipment related to GWRS expansion as shown in the contract drawings with corresponding hardware, software, configuration, and licensing. It is anticipated that the PCS equipment for the expansion will be integrated in a phased manner. Contractor to coordinate outages with the Owner and perform outages as plant conditions permit.

Points of Isolation and Considerations:

The PCS hardware and software upgrade shall be completed within 120 consecutive calendar days after the Notice to Proceed is issued. The Contractor shall submit within 10 days from the Notice to Proceed a list of hardware, software, and licensing that will be provided. The Contractor shall submit a schedule and update plan, including outages, for this upgrade within 30 consecutive calendar days after the Notice to Proceed is issued. Within the 120 consecutive calendar days, an outage of 14 consecutive, 24-hour days is allowed for installation. It is anticipated that the workstation / software outage will occur during the month of April.

Except for certain process sub-units, the existing AWTF cannot operate with any PCS controllers out of service due to water quality or equipment operation. Controllers critical to the operation of the facility are as follows: CHM_HP_SBS, CHM_SA_TI, CHM_SHC, FPW, GAP_CTL01, GAP_MS, LIME, MF_COM, MF_MST, PWPS_BPS, RO_MST, RO_PRE_TRT, RO_PRM, SCR_CTL01, UV_MST. Sub-process controllers may be individually isolated for modification: MF_TRA1, MF_TRA5, MF_TRB1, MF_TRB5, MF_TRD1, MF_TRD5, MF_TRE1, RO_TRA, RO_TRB, RO_TRC, RO_TRD, RO_TRE, UV_TRA, UV_TRB, UV_TRE, UV_TRC, UV_TRD, UV_TRE, UV_TRF, UV_TRG, UV_TRH, UV_TRJ, UV_TRK, UV_TRL.

Testing and commissioning of existing PCS controllers that are being modified have to be performed by areas and coordinated with area outages identified in this Section.
Outage L
Name of Facility: Cartridge Filters and Static Mixer
Nature or Type of Work:
Installation of two new cartridge filters with isolation valves, pipes, and fittings. Replacement of an existing inline static mixer with a new mixer within static mixer vault located upstream of Cartridge Filters.

Points of Isolation and Considerations:
An outage is required for the work. Lockout tagout of the RO Transfer Station Pumps and closure of each pumps discharge isolation valve. Blind flanges are available for connection of new cartridge filters and isolation valves. Dewatering of the pipeline by the Contractor will be required.

Outage M
Name of Facility: Screenings Facility
Nature or Type of Work:
Construction of a concrete connection box with sluice gate and weir, and connection to new Plant 2 pipeline. Shut down of Screenings Facility required for core drilling and removal of existing wall sections.

Points of Isolation and Considerations:
At Screenings Facility close: trickling filter influent gate (140-GAT-0135), AS1 and AS2 influent gate (140-GAT-0130), and screening filters 1, 2, 3, 4, and 5 gates (A01-GAT-0160, A02-GAT-0160, A03-GAT-0160, A04-GAT-0160, A05-GAT-0160).

At OCWD trickling filter influent metering box close butterfly valve.

At SEJB6 close OCSD gates which feed the Screenings Facility (12LGAT739 and 12LGAT741) open gates that feed SEJB7 (12LGAT742 and 12LGAT743).

At SEJB4 close OCSD gates which feed the Screenings Facility.

Coordinate with OCSD for potential lowering of weir at SEJB1 and opening of gates at SEJB3.

Shut down OCSD plant water supply to screens (location of shutoff valve to be determined).
Maximum Time Facility Shall Be Taken Out of Service

The maximum time the Screenings Facility shall be taken out of service is three (3) consecutive 24-hour periods. Demolition of the Screenings Facility wall shall occur after completion of the Contract 2 work and all interconnecting pipeline between the Screening Facility and the Plant 2 SE Pump Station.

Proposed Sequencing

Core drilling / demolition of the existing Screenings Facility wall shall occur after completion of the concrete connection box and pipeline from Screenings Facility to Plant 2 Pump Station, including testing and acceptance of the pipeline.

Outage N

Name of Facility: Diversion Structure (Plant 2)

Nature or Type of Work:

Construction of a new Diversion Structure, sluice gate, and 84-inch SE pipe stub that will tie-in to the 108-inch TFSC SE pipeline near TFSC Secondary Clarifier F.

Points of Isolation and Considerations:

- Stop plate at OOBS (24GGAT104)
- Stop plate for 36-inch plant water pipeline connection at LOFLO PS / PWPS Junction Structure.
- Timing and strategy for temporary shutdown of TFSC flow to be coordinated with OCSD.

Maximum Time Facility Shall Be Taken Out of Service

Work shall be performed during dry season. The shutdown period shall be coordinated and concurrent with the required shutdown for the Weir Box work. The TFSC plant shutdown shall be limited to a single maximum continuous duration of nine (9) hours. If in the event the Contractor fails to complete the work within the 9 hours, a full week of normal TFSC operation is required to allow process recovery and stabilization prior to another 9-hour shutdown event.

Proposed Sequencing

1. Reroute existing 12” HDPE POTW, 18” HDPE SW, and 8” STL SCUM pipelines. Initial relocation of scum line is temporary as described in plans.
2. Install ground improvements
3. Implement dewatering.
4. Install shoring and bracing required for Diversion Structure work and excavate.
5. Install weep rings on existing 108-inch pipeline.
7. Install permanent 8” scum pipeline.

**Outage O**

**Name of Facility:** Weir Box (Plant 2)

**Nature or Type of Work:**
Construction of a new Weir Box and sluice gate that will tie-in to the existing 120-inch TFSC SE line south of Trickling Filter C. Installation of a 36-inch plant water pipeline from the Weir Box to the LOFLO PS / PWPS Junction Structure.

**Points of Isolation and Considerations:**
- Stop plate at OOBS (24GGAT104)
- Stop plate for 36-inch plant water pipeline connection at LOFLO PS / PWPS Junction Structure.
- Timing and strategy for temporary shutdown of TFSC flow to be coordinated with OCSD.

**Maximum Time Facility Shall Be Taken Out of Service**
Work shall be performed during dry season. The shutdown period shall be coordinated and concurrent with the required shutdown for the Diversion Structure work. The TFSC plant shutdown shall be limited to a single maximum continuous duration of nine (9) hours. If in the event the Contractor fails to complete the work within the 9 hours, a full week of normal TFSC operation is required to allow process recovery and stabilization prior to another 9-hour continuous shutdown event.
Proposed Sequencing
1. SCE to temporarily brace power pole and/or install queen pole.
2. Install ground improvements.
3. Implement dewatering.
4. Install shoring and bracing required for Weir Box work and excavate.
5. Install weep ring on existing 120-inch pipeline.
6. Construct Weir Box.
7. Install and connect plant water pipeline at LOFLO PS / PWPS Junction Structure.
8. Coordinate existing 120-inch pipeline shutdown and remove 120-inch pipeline. Finish exposed edges of cut 108-inch pipeline. Contractor shall dewater the existing 120-inch pipeline as required for construction of the Weir Box
9. Install removable Weir Box concrete covers.
10. SCE to, if required, complete power pole bracing work.

Outage P
Name of Facility: 14-inch PVC Reclaimed Water (RW) east of Equalization Tanks (Plant 2)

Nature or Type of Work:
Connection to the existing 14-inch PVC RW pipeline. Work requires installation of tee, coupling, and isolation valve. Tapping saddles are unacceptable.

Maximum Time Facility Shall Be Taken Out of Service
- A maximum continuous shutdown period of 4-hours shall be allowed.

Points of Isolation and Considerations:
- Shutdown and lockout of the valves serving the 14-inch RW.
- Perform pressure and leakage testing per specifications.
Outage Q

Name of Facility: 12-inch HDPE Potable Water (POTW), 8-inch scum, and 18-inch HDPE storm drain near Diversion Structure (Plant 2)

Nature or Type of Work:
Re-route of the existing 12-inch HDPE POTW 8-inch steel scum, and 18-inch HDPE storm drain pipelines to allow ground improvement work and installation of Diversion Structure. Work includes demolition of existing piping and installation of new re-routed piping. Work on POTW also includes installation of tee with isolation valve.

Maximum Time Facility Shall Be Taken Out of Service
• A maximum continuous shutdown period of 4-hours shall be allowed.

Points of Isolation and Considerations:
• Shutdown and lockout of the valves serving the 12-inch POTW.
• Shutdown and lockout of the valves serving the 8-inch scum.
• Re-routing and/or shutdown of flows into storm drawing and blockage of surface storm drains.
• Perform pressure and leakage testing per specifications.

Outage R

Name of Facility: Electrical Shutdowns for P2 System

Nature or Type of Work:
• Connection to OCSD existing 1200A feeder breaker in existing 12 KV Service Center Switchgear “SC-BUSB.” Connection to existing feeder will require new floor cutout below existing switchgear.
• New duct bank from OCSD Service Center vault to SE Facility.
• New 1500 KVA 12 KV – 480/277V Transformer at SE Facility.
• New 2500A, 480V Motor Control Center 144-480-MCC-0001 at new SE Facility.

Connection to and modification of OCSD existing motor control centers MCC-STE (22NMCC001), MCC-STF (22NMCC101), and MCC-LF-B (27KMCC960), and switchboard “MSB” (in existing temporary prefabricated electrical enclosure).
Points of Isolation and Considerations:

- Operation of Service Center Switchgear shall be coordinated with OCSD to allow connection to existing feeder breaker.
- Operation of switchboard and motor control centers shall be coordinated with OCSD to allow for a partial shutdown of equipment as required.

Outage S
Name of Facility: Plant Control System (PCS) integrations for P2 Pump System

Nature or Type of Work:
Modifications to PCS to integrate P2 Pump System as shown in the contract drawings. It is anticipated that the PCS equipment for P2 Pump System will be integrated in one outage. Contractor to coordinate outage with the Owner and perform outage as plant conditions permit.

Maximum Time Facility Shall Be Taken Out of Service
- A maximum continuous shutdown of 4 hours shall be allowed for integrating P2 Pump System.

Points of Isolation and Considerations:
- Except for certain process sub-units, the existing plant cannot operate with any PCS controllers out of service due to water quality or equipment operation.
- The fiber optic cable from P2 Pump System and GWRS facility shall be ready, tested, and approved prior to this outage.

Outage T
Name of Facility: P2 Bleach Station

Nature or Type of Work:
Replacement of three existing chemical feed pumps with three new chemical feed pumps. Connection to existing discharge pipes and installation of the two new flowmeter assemblies.

Points of Isolation and Considerations:
- Shutdown and lockout of pumps.
- Closure of valves on each pump suction and discharge pipe.
• Closure of isolation valves on the pump discharge headers.

**Maximum Time Facility Shall Be Taken Out of Service**
The shutdown period shall be a single maximum continuous duration of forty eight (48) hours.

**Proposed Sequencing**
1. Install all piping up to points of connection
2. Flush existing pipelines where connections are required.
3. Shutdown and lockout pumps.
4. Make connections to existing piping.
5. Remove existing pumps and install new pumps.

**Outage U**

**Name of Facility:** South Bi-directional Connection

**Nature or Type of Work:**
Connection to the 66-inch interplant pipeline at Plant 2. Work includes removal of an existing section of pipe installed by the Contract 2 contractor and installation of pipe, valve, thrust block, and couplings to FRP/HDPE and RCP pipe. See Drawing Nos. 100-G-043 and 144-Y-010.

**Points of Isolation and Considerations:**
• Shutdown and lockout of valve at Effluent Junction Box near Plant 1.
• Installation of stop plate/bulkhead at Ocean Outfall Booster Pump Station at Plant 2.

**Maximum Time Facility Shall Be Taken Out of Service**
Work shall not be performed during the wet season (October 15 through April 15). Work shall be performed after project completion of the Contract 2 66-inch RCP pipe sliplining work performed by others. It is anticipated completion of the Contract 2 work will occur by July 1, 2021. If Contract 2 work is completed prior to July 1, 2021 work may commence if approved by the Owner.

The 66-inch pipeline is a critical facility and may be required to be placed in-service during the work. If directed by the Owner to return the 66-inch pipeline to service, the Contractor shall have 2 days to return the 66-inch
pipeline to service. The Contractor shall include in the Bid the cost of the materials required to return the pipeline to service and shall have these materials on-site ready for installation during the work.

**Proposed Sequencing**

1. Install dewatering system as required.
2. Identify and protect in place or relocate existing utilities interfering with the work.
3. Install shoring and excavate
4. Remove existing temporary closure piece install in Contract 2 by others.
5. Install pipe, valve, thrust block, and connections.
6. Complete pipeline work toward pump station to clear existing 120-inch pipeline.
7. Remove shoring.

**Outage V**

**Name of Facility:** North Bi-directional Connection

**Nature or Type of Work:**
Connection to the 66-inch interplant pipeline near and south of Effluent Junction Box at Plant 1. Work includes removal of an existing section of pipe and installation of pipe, valve, thrust block, and couplings to FRP/HDPE and RCP pipe. See Drawing No. 100-Y-290.

**Points of Isolation and Considerations:**

- Shutdown and lockout of valve at Effluent Junction Box near Plant 1.
- Installation of stop plate/bulkhead at Ocean Outfall Booster Pump Station at Plant 2 or if in place new BFV installed as part of the South Bi-directional Connection in Outage U.

**Maximum Time Facility Shall Be Taken Out of Service**

Work shall not be performed during the wet season (October 15 through April 15). Work shall be performed after project completion of the Contract 2 66-inch RCP pipe sliplining work performed by others. It is anticipated completion of the Contact 2 work will occur by July 1, 2021. If Contract 2 work is completed prior to July 1, 2021 work may commence if approved by the Owner.
The 66-inch pipeline is a critical facility and may be required to be placed in-service during the work. If directed by the Owner to return the 66-inch pipeline to service, the Contractor shall have 2 days to return the 66-inch pipeline to service. The Contractor shall include in the Bid the cost of the materials required to return the pipeline to service and shall have these materials on-site ready for installation during the work.

Proposed Sequencing
1. Install dewatering system as required.
2. Identify and protect in place or relocate existing utilities interfering with the work.
3. Install shoring and excavate
4. Remove existing temporary closure piece install in Contract 2 by others.
5. Install pipe, valve, thrust block, and connections.
6. Remove shoring.

Outage W

Name of Facility: GAP Pipeline

Nature or Type of Work:
Connection to the existing 24-inch GAP DI pipeline in Garfield Avenue. Work requires installation of a tee and isolation valve.

Maximum Time Facility Shall Be Taken Out of Service
- A maximum continuous shutdown period of 4-hours shall be allowed.

Points of Isolation and Considerations:
- Shutdown and lockout of the GAP Pump Station and valves serving 24-inch pipeline.
- Coordination with OCWD and contributing agencies for shutdown of pipeline.
- Perform pressure and leakage testing per specifications.

2-4. Work Under Other Contracts.

The Owner anticipates potential construction activities will be performed in the area of the project site by other forces or by other contractors for Orange County Water District and the Orange County Sanitation District. Multiple construction
contracts may be occurring during the construction of the Project including but not limited to the following:

1. OCWD Contract 2: Secondary Effluent Pipeline Rehabilitation
2. OCSD Project J-117B: Outfall Low Flow Pump Station (at Plant 2)
3. OCSD Project P2-98A: A-Side Primary Clarifiers Replacement at Plant 2
4. OCSD Project P2-107: SCADA System and Network Upgrades (at Plant 2)
5. OCSD Project P2-122: Headworks Modifications at Plant 2
6. OCSD Project P1-101: Dewatering & Odor Control at Plant 1
7. OCSD Project P1-105: Headworks Replacement Project
8. OCSD Project P1-133: Primary Clarifiers 6-31 Reliability Improvements at Plant 1

The projects will impact the use of Orange County Sanitation District property adjacent to and encompassing some of the property required to construct project facilities. Contractor shall coordinate the Project construction with the construction of these projects.

3. OTHER WORK RESTRICTIONS AND COORDINATION REQUIREMENTS.

3-1. Work Hours. See the General Provisions “Working Hours” section for restrictions.

3-2. Rights of Way. The Owner will acquire all grants for easements shown on the Drawings to allow the Contractor to perform the Work. Within the terms of the easement, the Contractor may use the easement only for accessing the Site, performing survey staking, storing equipment, materials and supplies for this Project only, and performing the required Work. Once work is completed the Contractor is to leave the easement area in a neat and clean condition. The Contractor is not allowed to use the easement for any other purposes without written approval of the Owner.

3-3. Existing Utilities. A minimum of forty-eight (48) hours in advance of excavation activities, the Contractor shall contact the following parties to ascertain and verify the existence and location of utility lines and facilities and shall coordinate all work in accordance with the information obtained from such inquiries in order to prevent damage to such lines and facilities.

Underground Service Alert (USA) (811)

Prior to conducting any excavation, the Contractor shall contact the appropriate regional notification center as required by Government Code Section 4216. In accordance with Government Code Section 4215, the Contractor shall be compensated for the costs of locating, repairing damage not due to the failure of
the Contractor to exercise reasonable care, and removing or relocating existing main or trunkline utility facilities not indicated in the Contract Plans and Specifications with reasonable accuracy, and for the equipment on the project necessarily idled during such work; provided that the Contractor shall first notify the Agency before commencing work on locating, repairing damage to, removing or relocating such utilities.

All sewer crossings shall conform to the State Health Department regulations for water/sewer separation and materials. Cost for special pipeline materials to meet Health Department regulations, and repair of services damaged shall be included in the cost of the bid items to which the work is appurtenant. No separate payment will be made.

The Engineer or his representative has endeavored to determine the existence of utilities at the work site from the records of the owners of known utilities in the vicinity of the work. The positions of these utilities, as derived from such records, are shown on the Plans. The service connections to these utilities may not be shown on the Plans.

The Contractor shall make his own investigations, including exploratory excavations, to determine the locations and type of existing service laterals or appurtenances when their presence can be inferred from the presence of other visible facilities, such as buildings, meters and junction boxes, on or adjacent to the work site.

3-3.01. **Hand Excavation.** Contractor’s attention is directed to the work in the new MF Facility, new pipeline alignment from the interplant corridor to the Screenings Facility at OCSD Plant 1, new work within OCSD’s Plant 2 at the Diversion Structure and Weir Box, and connection to the existing 66-inch pipeline at OCSD’s Plant 2. Existing utilities have been shown in these areas which have been identified from other records. As indicated above, Contractor shall identify all existing utilities prior to beginning work and obtain approval from Engineer that Contractor has conducted all its investigations. Contractor shall hand excavate to depth shown on the Drawings prior to installation of shoring support system.

3-4. **Trench Excavation.** No trench in shall be left open during periods when the Contractor is not at the site of work. Trenches in roadways shall be backfilled and temporarily paved, where applicable, or if trench shall be left open, covered with steel trench plates as specified in the technical specifications.

3-5. **Curtailment in Power Usage.** The Owner has entered into a three-year agreement with Enelx whereby Enelx may curtail power usage with 30-minutes notice. The plant is subject to a 14-megawatt curtailment in power usage during times when the SCE electric grid is in jeopardy (usually on hot summer days). The Owner must curtail power usage to reach a firm service level (FSL) of 5-megawatts. During these shutdowns, it might be possible to continue with
construction activities, but the various energy-intensive water treatment processes and pumps will be shut down in accordance with the AWTF’s Demand Response (DR) plan requirements. The following table lists the curtailment in power requirements as part of the DR. The Contractor shall incorporate this concept into the planning of the project and shall not receive any change orders or extra time for these events.

<table>
<thead>
<tr>
<th>Demand Response Program Parameters</th>
<th>D.R. Vendor, North American Power Partners (A-4 Program)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notification</td>
<td>30 minutes</td>
</tr>
<tr>
<td>Load Curtailment</td>
<td>14 Megawatts (5 Megawatts FSL)</td>
</tr>
<tr>
<td>Maximum interruption hours per day</td>
<td>6 -hrs / day</td>
</tr>
<tr>
<td>Contract Term</td>
<td>2019, 2020, and 2021</td>
</tr>
</tbody>
</table>

3-6. **Contractor’s Use of Premises.** Owner and OCSD’s operating personnel will be responsible for operating the existing facilities throughout the execution of this contract. Equipment presently installed in the facility must be available to Owner and OCSD personnel at all times for use, maintenance, and repair. If it is necessary in the course of operating the facility, for the Contractor to move his equipment, materials, or any material included in the work, he shall do so promptly and place that equipment or material in an area which does not interfere with the facility operation. The Contractor shall not adjust or operate serviceable or functioning equipment or systems.

All of the existing facilities at Plant No. 1 and 2 will remain in operation throughout this Contract except as specifically identified for temporary shutdowns and bypasses. The Contractor shall schedule and conduct his work to minimize necessary shutdowns and interference with operations and maintenance.

The Contractor shall notify the Engineer whenever it is necessary to take out of service any pump, pipeline, wet well, channel, electrical circuit, equipment, or structure. The Contractor shall be responsible for providing whatever temporary piping, pumping, power, and control facilities as are required to maintain continuous facility operation except as otherwise specified. The Contractor shall maintain the integrity of the existing facility utilities at all times.

3-7. **Plant 2 Tank and Valve Vault Construction Sequencing.** Construction of the prestressed concrete tanks require a clear distance of 10 feet from the outside face of the tank wall. The proposed valve vaults and overflow piping are to be located within the 10 foot clearance requirement. The tank manufacturer and Contractor shall coordinate construction sequencing of these facilities to allow the 10 foot clearance required by the tank manufacturer for tank wall construction. See drawing 144-S-410 for potential use of form savers to allow partial construction of valve vault to accommodate work sequencing.
3-8. **Plant 2 Stormwater Pump Station.** The existing stormwater pump station is to be upgraded per Drawing 144-C-013. The stormwater pump station is also the construction dewatering discharge location. Prior to entering the stormwater pump station the dewatering flow shall be desilted per Contract Document requirements. During the dewatering period of construction, the stormwater pump station will serve the dual purpose of conveying dewatering and stormwater flow to the Interplant Trunkline. It shall be the Contractor’s responsibility to maintain the stormwater pump station to serve both purposes.

End of Section
**SYSTEM OUTAGE REQUEST FORM**

System to be Shutdown: ____________________________________

Date of Shutdown: __________ Beginning at __________ a.m.  p.m.

Duration of Shutdown: __________ Critical Path Activity? ( ) yes ( ) no

Owner: Orange County Water District

Project: GROUNDWATER REPLENISHMENT SYSTEM
FINAL EXPANSION
CONTRACT NO. GWRS-2019-01

Contractor:

Regulatory Agency Notification Required? ( ) yes ( ) no

Is a Dry Run Required? ( ) yes ( ) no

Confined Space Entry? ( ) yes ( ) no

Combustible/Hazardous Gases Present? ( ) yes ( ) no

Certified by: ________________________________  Date: __________

(Contractor’s Signature) (Construction Manager’s Signature)

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**Outage Contact Information**

<table>
<thead>
<tr>
<th>Name of Person on Call/Duty</th>
<th>Home Phone</th>
<th>Cell Phone and/or Pager</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contractor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Construction Manager</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OCWD Operations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineer</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CM / OCWD / Engineer Review Action**

( ) SOR Acceptable with comments noted on attached.

( ) SOR Not Acceptable with reasons noted on attached. Re-Submittal is required.

Orange County Water District 01140A SYSTEM OUTAGE REQUEST FORM
Groundwater Replenishment System -1- Final Expansion February 2019
Issued for Bid
Section 01150

SITE SECURITY

1. GENERAL.

1-1. Security Program.

A. The Contractor shall:

1. Protect the area associated with completion of the Work including all field office trailers and their contents from theft, vandalism, and unauthorized entry. The Contractor is not responsible for monitoring actions or procedures of staff, deliveries, or other visitors associated with the existing facility or other work occurring at the site.

2. The Contractor shall maintain a secure project site 24 hours per day, every day beginning on the first day of construction and ending at Final Completion. The Contractor shall make adequate provisions for protection of the Work against fire, theft, vandalism and for the protection of public against exposure to injury. If in the opinion of the Owner, the Contractor is not taking adequate steps to secure the site, the Owner will require that additional protective measures are immediately taken. The Owner shall not have any liability for loss of, and damage to, materials, tools, and equipment of the Contractor or of those employed by him, by contract or otherwise.

3. The Contractor shall initiate a site security system and program, at the time of mobilization onto the work-site, which provides adequate security for site stored and installed material, product, and equipment. The Engineer will review the security system proposed by the Contractor and provide comments. Considerations for the security program shall include, but not be limited to, the following:

- The Contractor shall attempt to use, if available, the existing security entrance on Garfield Avenue for all Contractor and Subcontractor construction traffic to OCSD Plant 1 site. This entrance shall be coordinated with the other entrance on Garfield Avenue for 1) Orange County Sanitation District staff, and 2) Contractors and subcontractors associated with the Orange County Sanitation District. If the gate is not available, the Owner shall provide a location for an alternate entrance and the Contractor shall provide security as noted in this Section.
The Contractor shall attempt to use, if available, the existing security entrance on Brookhurst Street for all Contractor and Subcontractor construction traffic to OCSD’s Plant 2 site. This entrance shall be coordinated with the other entrance on Brookhurst Street for 1) Orange County Sanitation District staff, and 2) Contractors and subcontractors associated with the Orange County Sanitation District. If the gate is not available, the Owner shall provide a location for an alternate entrance and the Contractor shall provide security as noted in this Section.

The Contractor shall provide in advance of starting construction, a list of all employees and vehicles that need access to the site. This list would include employees of subcontractors at all tier levels. The Contractor shall provide periodic updates to this list as needed or required by the Engineer.

The Contractor should be aware that the site may not have adequate space to allow all employee vehicles to be parked on the Project site. All costs associated with off-site employee parking and shuttle to site shall be included in the Contractor’s bid.

The Contractor shall be responsible for furnishing to each employee engaged on the Work, and for requiring each employee engaged on the Work to display, such identification as may be approved and directed by the Engineer. All prescribed identification shall immediately be delivered to the Engineer for cancellation upon the release of any employee.

The Contractor shall ensure that no alcohol, firearm, weapon or controlled substance enters or is used during the completion of the Work. The Contractor shall immediately remove from the site and terminate the employment at this site of any employee found in violation of this provision.

The Contractor’s employees, agents and subcontractors shall be restricted from entry to existing buildings and structures except as may be required by the Work.

All property owned by the Owner is fenced. While it may be necessary for the Contractor to remove some of the existing fencing for construction of the new improvements, the Contractor’s operations shall not reduce the present protection and security. If the present fences are removed, an equivalent temporary continuous perimeter protection shall be provided and new fence, which matches the existing fence, shall be installed to replace the existing fence prior to the completion of the work.
- In the event all or a part of the site is to be permanently fenced, this permanent fence or a portion thereof may be built to serve for protection of the Work site, provided however, that any portions damaged or defaced shall be replaced prior to final acceptance. Temporary openings in existing fences shall be protected to prevent intrusion by unauthorized persons. During night hours, weekends, holidays, and other times when no work is performed at the site, the Contractor shall provide temporary closures during the working hours defined in Work Restrictions Section.

- Provide a security bonded guard and security shack at the second entrance on Garfield Avenue (OCSD Plant 1 site) and the first entrance on Brookhurst Street (OCSD Plant 2 site).

- Provide high security locked box containers in the fenced area for material storage, or off-site approved, bonded storage area required for the Work.

- Ensure that structures associated with the improvements designed with security locks must be capable of being secured with temporary or permanent high security locks prior to installation.

4. Maintain the security program throughout the Contract duration.

5. Be responsible at all times for security of the storage compound and lay-down areas, and for all Contractor plant, material, equipment, and tools, as well as, for those belonging to subcontractors.

6. Provide OCWD, OCSD, and the Engineer with a list of 24-hour emergency phone numbers.

7. Submit to the Engineer an up-dated progressive inventory of materials, equipment, and tools when received on-site.

1-2. Entry Control.

A. The Contractor shall:

1. Be assigned one point of entry and exit at the AWTF project site on Garfield Avenue. This access gate is to remain closed and locked at all times that traffic is not using the gate. If the requirement for a closed and locked manual gate is not deemed practical by the Contractor, the Contractor can employ a full-time guard at the gate as a suitable alternative.

2. Be assigned one point of entry and exit to OCSD’s Plant 2 on Brookhurst Street. This access gate is to remain closed and locked at all times that traffic is not using the gate. If the requirement for a
closed and locked manual gate is not deemed practical by the Contractor, the Contractor can employ a full-time guard at the gate as a suitable alternative.

3. Restrict entry through that entrance to only authorized personnel and vehicles with proper identification associated with the Work.

4. Maintain copies of vehicle insurance cards or other proof of insurance on-site for vehicles permitted on-site from that entrance.

5. Require vehicle passes when vehicles are on-site.

6. Maintain an Employee/Visitor Log, and make the log available to the Engineer on request. The log shall be submitted to the Engineer every two weeks or as necessary.

7. Give jobsite security orientation training to all affected employees including subcontractor employees in accordance with Orange County Water District requirements and Orange County Sanitation District as the case may be. Employee participation in the security orientation shall be acknowledged by their respective individual signatures affixed to an orientation roster.

8. Implement security badge system approved for the Site by the Engineer.

9. The Contractor shall be responsible for gate repairs. If repairs are not made within four hours and the gate remains open, OCSD reserves the right to close and barricade the gate at the Contractor’s expense.

B. The Engineer has the right to refuse access to the site or request that a person or vehicle be removed from the site if found violating any project security rules.


A. The Contractor shall not allow cameras on site, or photographs to be taken except with prior approval of the Owner or Engineer.

1-4. Project Site Security Services.

A. Specific Requirements

1. Security guard(s) shall be neat in appearance and dressed in company uniform at all times. Guard personnel shall be provided by a licensed security company. Each guard shall receive security orientation training from the Engineer and Owner prior to start of work on this project. New guards shall not commence duties on site before receiving this orientation. All guards must be trained vehicle flaggers.
2. During working hours, the post security guard shall be stationed continuously at the Garfield Avenue and Brookhurst Street site entrances to monitor Project-related traffic entering and leaving that entrance. The guard shall inspect all Project-related traffic to ensure that all personnel, vehicles, and equipment possess a current project identification badge approved for entry to the Site. At the direction of the Engineer, the security guard shall perform lunch box and/or vehicle inspections.

B. Other Duties:

At the request of the Engineer, the security guard shall perform additional duties as follows:

1. Direct emergency vehicles or equipment to a pre-designated on-site location.
2. Direct personnel, vehicles, materials, and equipment to the proper gate in the event a multiple gate system is implemented.
3. Direct traffic as requested by the Engineer including off-site traffic as may be required.
4. Monitor security for equipment and/or material temporarily stored along the access road or in the parking area.
5. Maintain records of insurance files for all vehicles permitted on-site.
6. Notify the Engineer of security violations on a daily basis, and enter all facts regarding the incident in a Security Log. The Security Log shall be transmitted to the Engineer.
7. Upon approval by the Owner, the guard shall assist the Engineer to remove personnel denied access to the site for violation of site regulations.
8. Enforce construction related parking area regulations and site speed limit, and obtain the name/vehicle license number of violators and report violators to the Engineer.
9. Inspect area lighting in construction areas on a daily basis and report deficiencies to the Engineer.
10. Call the Engineer to report a fire, hazardous material spill, or medical emergency. Report the emergency to the fire department as directed by the Engineer.
11. Notify the Engineer of all unusual activities/occurrences.
C. Contractor – Provided Facilities/Equipment:

1. The Contractor shall provide a potable self-contained security office to be placed at the entrance to the site as directed by the Engineer.

2. The security shack shall have a cellular telephone until a regular telephone line is installed in the security shack by the Contractor.

3. The security shack shall be equipped with interior and exterior lights. In the event of a power outage, a portable generator shall be provided by the Contractor until a temporary power line is installed by the Contractor or full power is returned to the site.

4. A potable toilet with external hand washing station shall be provided and maintained by the Contractor in the vicinity of the Security Office for use of the security guard.

5. The Contractor shall provide a portable, hand-held radio for on-site communications. If a radio is provided by the Engineer, the Contractor shall be responsible for the radio and the equipment for its charging. Cost of damage or loss while in the Contractor’s control shall be paid by the Contractor.

6. Contractor shall provide a vehicle, if necessary, for the security guard to use after normal working hours to patrol the project area.

2-1. CONTRACTOR SECURITY PLAN.

A. Prior to the performance of any work the Contractor shall submit to OCSD, Owner, and the Engineer for review and comment two copies of the security plan commensurate with the needs of the project, and signed by an officer of the Contractor. Adequacy of the security plan is the responsibility of the Contractor.

OCSD, Owner, and the Engineer will not review the Contractor security plan for adequacy.

The security plan shall:

1. Include employee site security orientation program.

2. Include security measures to protect Contractor employees and other persons from injury, prevent material damages, or avoid financial losses.

3. Cover security procedures related to Contractor tools and equipment that shall be mobilized for the Work.

End of Section
1. **DATUM.** Vertical and horizontal datum is based on the coordinates and benchmarks shown on the Drawings. The Contractor is to locate and protect control points prior to starting the Work and preserve control points during construction. The Contractor shall re-establish all control points disturbed by its operations at no cost to Owner.

The Contractor shall establish other vertical and horizontal control from these Owner and OCSD furnished reference points as required to properly layout and construct the Work. All connections shall be installed based on actual elevations of existing structures to which connections are made.

The Contractor's layout shall be based upon existing structures and the vertical and horizontal datum established by the Owner and OCSD. Contractor shall note that OCWD and OCSD have different coordinate systems and survey control points as discussed in Paragraph 3 of this Specification.

The Contractor shall be responsible for the preservation of all existing survey monuments or permanent bench marks. Any monuments or bench marks disturbed or destroyed by Contractor shall be referenced and replaced by a licensed land surveyor. A corner record or record of survey, as appropriate, shall be filed by the licensed land surveyor as required by the Land Surveyor's Act with the appropriate local government agencies.

2. **QUALITY ASSURANCE.**

The Contractor's Surveyor shall be a land surveyor registered in the State of California with at least five (5) years surveying experience for similar sized projects.

Dimensions for existing structures, piping, paving, and other nonstructural items are taken from the available information during the Owner’s planning and design. The Contractor shall field verify all dimensions and conditions in advance of construction in the area. Any discrepancy between the field survey by the Contractor and the information indicated in the Contract Documents shall be immediately brought to Construction Manager's attention by written notification. In all questions arising as to proper location of lines and grades, the Engineer's decision will be final.

Accuracy of the Contractor’s stakes, alignments and grades may be periodically and randomly checked by the Engineer. If requested by Engineer, the Contractor shall supply field labor as required, at no extra charge to Owner, to aid and assist
the Engineer in checking location and grades of the work as set by the Contractor. The Contractor shall postpone portions of the Work affected by the Engineer’s survey check, and shall also move materials and equipment that interfere with a clear line of sight between horizontal control points and the construction work. The Engineer’s field checks are to confirm compliance of the work with the drawings and specifications, and do not substitute for or complement the Contractor’s required field quality control procedures.

The Contractor's registered land surveyor shall check the line and grade of the slab or footing concrete forms prior to the placement of the first slab or footing at each structure and building.

3. PROJECT SURVEY REQUIREMENTS.

As part of the bid price for the construction of the improvements the Contractor shall provide and be responsible for the layout of all work specified in the contract. The Contractor shall provide all necessary surveys, field staking, and positioning for the construction of all components at the proper alignment, elevations, grades, and positions, as indicated on the Drawings and as required for the proper operation and function.

Basis of Bearing and Benchmark for Contractor’s use for work within and near OCWD and OCSD Plant 1 property boundary is shown on Contract Drawing 100-C-011.

Basis of Bearing and Benchmark for Contractor use for work within OCSD’s Plant 2 property boundary is provided on Contract Drawing 144-C-011.

The Contractor shall stake the work limits and right-of-way lines prior to the start of sitework.

The Contractor shall lay out all work, including structures and pipelines, and shall be solely responsible for executing the Work in accordance with the lines and grades indicated.

A preconstruction survey shall be performed prior to the start of Work. Survey shall indicate limits of existing features, including, but not limited to, buildings, piping, and utilities within the limits of the Work. Survey shall indicate any areas of potential future mitigation of lead paint, asbestos, or other hazardous items within the limits of the Work.

3-1. Submittals.

Contractor to furnish Engineer one copy of all land surveyor notes, calculations, sketches and drawings within 48 hours after completion of each survey task.
Calculations shall be signed and sealed by a land surveyor registered in the State of California.

4. RECORD DOCUMENTS.

The Contractor shall prepare, maintain and submit Record Documents as specified in the Closeout Procedures section. The Contractor’s land surveyor shall affix his signature and registration number to applicable record drawings certifying the accuracy of lines and grades shown.

End of Section
Section 01300

SUBMITTALS

1. GENERAL

Shop Drawings and engineering data (submittals) covering all equipment and all fabricated components and building materials which will become a permanent part of the Work under this Contract shall be submitted to Engineer for review, as required. Submittals shall verify compliance with the Contract Documents, and shall include drawings and descriptive information in sufficient detail to show the kind, size, arrangement, and the operation of component materials and devices; the external connections, anchorages, and supports required; the performance characteristics; and dimensions needed for installation and correlation with other materials and equipment.

Each submittal shall cover items from only one section of the specification unless the item consists of components from several sources. Contractor shall submit a complete initial submittal including all components. When an item consists of components from several sources, Contractor's initial submittal shall be complete including all components.

Submittal review shall be only for general conformance with the design concept and general compliance with the information given in the contract documents. It shall not include review of quantities, dimensions, weights or gages, fabrication processes, construction safety precautions, all of which are the sole responsibility of the Contractor. Review of a specific item shall not indicate acceptance of an assembly of which the item is a component. The Engineer shall not be required to review and shall not be responsible for any deviations from the contract documents not clearly noted by the Contractor, nor shall the Engineer be required to review partial submissions or those for which submissions for correlated items have not been received.

2. CONTRACTOR RESPONSIBILITIES.

All submittals, regardless of origin, shall be approved by Contractor and clearly identified with the name and number of this Contract, Contractor's name, and references to applicable specification paragraphs and Contract Drawings. Each copy of all submittals, regardless of origin, shall be stamped or affixed with an approval statement of Contractor. Each submittal shall indicate the intended use of the item in the Work. When catalog pages are submitted, applicable items shall be clearly identified and inapplicable data crossed out. The current revision, issue number, and date shall be indicated on all drawings and other descriptive data.
Contractor shall be solely responsible for the completeness of each submittal. Contractor's stamp or affixed approval statement of a submittal, per Transmittal Form, is a representation to Owner and Engineer that Contractor accepts sole responsibility for determining and verifying all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto, and that Contractor has reviewed and coordinated each submittal with other Shop Drawings and with the requirements of the Work and the Contract Documents.

All deviations from the requirements of the Contract Documents shall be identified as deviations on each submittal and shall be tabulated in Contractor's letter of transmittal using the Transmittal Form. Such submittals shall, as pertinent to the deviation, indicate essential details of all changes proposed by Contractor (including modifications to other facilities that may be a result of the deviation) and all required piping and wiring diagrams.

The Contractor shall coordinate submittals with the work so that work will not be delayed. Contractor shall coordinate and schedule different categories of submittals, so that one will not be delayed for lack of coordination with another. No extension of time will be allowed because of failure to properly schedule submittals. The Contractor shall not proceed with work related to a submittal until the submittal process is complete.

The Contractor shall certify on each submittal document that it has reviewed the submittal, verified field conditions, and complied with the contract documents.

All shop drawings submitted by subcontractors for approval shall be sent directly to the Contractor for checking. The Contractor shall be responsible for their submission at the proper time so as to prevent delays in delivery of materials.

The Contractor shall check all subcontractors’ shop drawings regarding measurements, size of members, materials, and details to verify that they conform to the intent of the Drawings and Specifications. Shop drawings found to be inaccurate or otherwise in error shall be returned to the Contractor and subcontractors for correction before submission thereof.

Each shop drawing, sample and product data submitted by the Contractor shall have affixed to it the following Certification Statement including the Contractor's Company name and signed by the Contractor:

"Certification Statement: By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements."
Shop drawings and product data sheet 11-in x 17-in and smaller shall be bound together in an orderly fashion and bear the above Certification Statement on the cover sheet. The cover sheet shall fully describe the packaged data and include a listing of all items within the package.

3. **SUBMITTAL AND MATERIAL LIST.**

Within fifteen (15) days after the Notice to Proceed, and prior to the submission of the initial shop drawings, the Contractor shall submit a draft Master Submittal List of all required submittals to the Engineer for favorable review. The Master Submittal List shall include a description of each item, Specification or Drawing reference and the anticipated submittal date. The List shall include all items of equipment and materials for architectural, structural, mechanical, piping, electrical, heating and ventilating, equipment piping, and plumbing work; and the names of manufacturers with whom purchase orders have been placed. Items on the List shall be arranged in the same order as in these Specifications, and shall contain sufficient data to identify precisely the items of material and equipment the Contractor proposes to furnish. After the submission is favorably reviewed and returned to the Contractor by the Engineer, it shall become the basis for the submission of detailed manufacturer’s drawings, catalog cuts, curves, diagrams, schematics, data, and information on each separate item for review. No work shall proceed on any item until it has been submitted and favorably reviewed. An incomplete submittal list is not a basis for avoiding a submittal required by the specifications.

4. **DEFINITIONS**

   A. **Manufacturer’s Instructions:** Instructions, stipulations, directions, and recommendations issued in printed form by the manufacturer of a product addressing handling, installation, erection, and application of the product; Manufacturer’s Instructions are not prepared especially for the Work.

   B. **Shop Drawings:** As defined in the General Provisions, shop drawings include, but are not necessarily be limited to:

      1) Custom-prepared data such as fabrication or erection/installation (working) drawings.

      2) Scheduled information, setting diagrams, actual shop work manufacturing instructions, custom templates, special wiring diagrams, coordination drawings, individual system or equipment inspection and test reports including performance curves and certifications, as applicable to the Work.
C. **Product Data:** Illustrations, standard schedules, performance charts, brochures, diagrams and other information to illustrate materials or equipment for some portion of the Work.

1) **Product data** as specified in individual Sections, and as applicable to the Work shall include, but not necessarily be limited to:
   a. Standard prepared data for manufactured products (sometimes referred to as catalog data or "cuts").
   b. Manufacturer's product specifications.
   c. Installation instructions,
   d. Availability of colors and patterns.
   e. Manufacturer's printed statements of compliance and applicability.
   f. Roughing-in diagrams and templates.
   g. Product photographs.
   h. Standard wiring diagrams.
   i. Performance curves and operational-range diagrams.
   j. Production or quality control inspection and test reports and certifications, and mill reports.
   k. Operating and maintenance instructions and recommended spare parts listing and printed product warranties.

D. **Samples:** Physical examples which illustrate materials, equipment, or workmanship and establish standards by which the Work will be judged. Samples specified in individual Sections, include, but are not necessarily limited to, physical examples of the work such as sections of manufactured or fabricated work, small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens of coordination of visual effect, graphic symbols and units of work to be used by the Engineer or others for independent inspection and testing, as applicable to the Work.

5. **PROCEDURES.**

**In addition to the requirements in the General Provisions:**

A. The Contractor is encouraged to mark the submittal “high”, “normal” or “low” priority to assist the reviewer in prioritizing the submittal reviews during periods of high volume of submissions.

B. Transmittal Form - Unless otherwise specified, submittals regarding material and equipment shall be accompanied by the Shop Drawing
Transmittal Form found at the end of this section. Submittal documents common to more than one piece of equipment shall be identified with all the appropriate equipment numbers. The specification section and subsection or paragraph to which the submittal is related shall be indicated on the transmittal form.

C. A unique number, sequentially assigned, shall be noted on the transmittal form accompanying each item submitted. The Contractor shall utilize a 9-character submittal identification numbering system in the following manner:

1) The first five digits shall be the applicable Specification Section Number.

2) The next three digits shall be the numbers 001-999 to sequentially number each initial separate item or drawing submitted under each specific Section number.

3) The last character shall be a letter, A-Z, indicating the submission, or resubmission of the same drawing, i.e., “A=1st submission, B=2nd submission, C=3rd submission, etc. A typical submittal number would be as follows:

   a. 03300-008-B-P/E
   b. 03300 = Specification Section for Concrete.
   c. 008 = The eighth initial submittal under this specification section.
   d. B = The second submission (first resubmission) of that particular shop drawing.
   e. P = Paper based submittals
   f. E = Electronic submittals

D. The Contractor shall provide four (4) hard copies and two (2) electronic copies of each submittal. Should the Contractor require more returned copies of any particular submittal, the Contractor shall furnish a greater number of copies to the Engineer than is specified.

E. Provide or furnish products and execute the Work in accordance with accepted submittals, unless in conflict with Contract Documents.

F. All deviations from submittals shall be listed in the Bid Form or List of Substitutions as defined in the General and Special Provisions.

G. Resubmittals will be handled in the same manner as first submittals. On resubmittals the Contractor shall direct specific attention in writing on the Shop Drawing Transmittal Form and on resubmitted shop drawings by use
of revision triangles or other similar methods, to revisions other than the corrections requested by the Engineer on previous submissions. Any such revisions which are not clearly identified shall be made at the risk of the Contractor. The Contractor shall make corrections to any work done because of this type revision that is not in accordance to the Contract Documents as may be required by the Engineer.

Contractor shall accept full responsibility for the completeness of each resubmittal. Contractor shall verify that all corrected data and additional information previously requested by Engineer are provided on the resubmittal. Resubmittals shall be in an organized and consistent format.

H. Partial submittals may not be reviewed. The Engineer will be the only judge as to the completeness of a submittal. Submittals not complete will be returned to the Contractor, and will be considered “REJECTED” until resubmitted. The Engineer may at his/her option provide a list or mark the submittal directing the Contractor to the areas that are incomplete.

I. Contractor shall include an overall equipment schedule for submittals containing multiple items. Schedule shall include equipment type and model number.

6. SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

A. The Contractor shall stamp, sign and date submittals indicating review and approval; and submit to Engineer.

1) Stamp and signature indicates Contractor has satisfied shop drawing review responsibilities and constitutes Contractor's written approval of shop drawing.

2) Shop drawings without Contractor's written approval will be returned for resubmission.

B. Paper based submittals shall be provided in:

1) Binders: Commercial quality, 8-1/2 inch by 11 inch (size A4), three D side ring binders with durable plastic covers; 2 inch (50 millimeter) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

2) Cover: Identify each binder with typed project number and name and subject matter of the contents. Titles shall be placed both on the front and binder edge of the binder.

3) Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
4) Text: Manufacturer’s printed data or type written data on 20-pound, minimum, white punched paper. Computer generated data shall be printed by letter quality 150 dpi resolution printers unless approved otherwise.

C. For electronic submittals, drawings and the necessary data shall be submitted electronically to Engineer as specified below. Submittal documents shall be in color to facilitate use of red line markups. All electronic files shall be in Portable Document Format (PDF) as generated by Adobe Acrobat Professional Version 7.0 or higher. The PDF file(s) shall be fully indexed using the Table of Contents, searchable with thumbnails generated. PDF images must be at a readable resolution. For most documents, they should be scanned or generated at 300 dots per inch (dpi). Use of higher resolution is acceptable with Owner and Engineer approval. Optical Character Recognition (OCR) capture must be performed on these images so that text can be searched, selected and copied from the generated PDF file. The PDF documents shall have a bookmark created in the navigation frame for each major entry (“Section” or “Chapter”) in the Table of Contents. Thumbnails shall be generated for each page or graphic in the PDF file.

The opening view for each PDF document shall be as follows:

   Initial View: Bookmarks and Page
   Magnification: Fit in Window

   The file shall open to Contractor’s transmittal letter, with bookmarks to the left. The first bookmark shall be linked to the Table of Contents.

PDF document properties shall include the submittal number for the document title and Contractor’s name for the author.

The Contractor shall provide an "equipment cross reference schedule" for multiple items covered by the same submittal identifying the ordering information associated with the submittal item.

Electronic submittal file sizes shall be limited to 10 MB. When multiple files are required for a submittal the least number of files possible shall be created.

Facsimiles (fax) will not be acceptable. Submittals will not be accepted from anyone but Contractor. Submittals shall be consecutively numbered in direct sequence of submittal and without division by subcontracts or trades.
D. Product Data and Manufacturer's Instructions: Excise or cross out non-applicable information and clearly mark applicable information with citations to and terminology consistent with Contract Documents.

E. Samples: Label will be returned with reviewer's selection when appropriate, comments and stamp. Samples will not be returned unless return is requested in writing and additional sample is submitted. More details on sample requirements are included in the General Provisions.

F. Electronic Copies of Approved Submittals: All approved submittals shall be provided in electronic format per the requirements set forth in the Operation and Maintenance Data and Manuals section of this Specification for Electronic Approved Submittals and Operation and Maintenance Manuals. Additional requirements are provided in the Closeout Procedures section.

7. MANUFACTURER'S INSTRUCTIONS.

Submit manufacturer's instructions whenever made available by manufacturers and when installation, erection, or application in accordance with manufacturer's instructions is required by the Specifications. Submit manufacturer's instructions prior to installation, erection, or application of equipment and other project components. Submit manufacturer's instructions in accordance with requirements for Product Data.

8. ENGINEER'S REVIEW.

The Engineer's review of submittals shall not release Contractor from Contractor's responsibility for performance of requirements of Contract Documents. Neither shall the Engineer's review release Contractor from fulfilling purpose of installation nor from Contractor's liability to replace defective work. The Contractor shall not consider submittals as Contract Documents. The purpose of submittals is to demonstrate how Contractor intends to conform to the Contract documents and design concepts. The Engineer will be entitled to rely upon the accuracy or completeness of designs, calculations, or certifications made by licensed professionals accompanying a particular submittal whether or not a stamp or seal is required by Contract Documents or Laws and Regulations.

The Engineer's review does not extend to:

1. Accuracy of dimensions, quantities, or performance of equipment and systems designed by Contractor.

2. Contractor's means, methods, techniques, sequences, or procedures except when specified, indicated on the Drawings or required by the Contract Documents.
3. Safety precautions or programs related to safety which shall remain the sole responsibility of the Contractor.

4. As permitting any departure from the Contract requirements.

5. As relieving the Contractor of responsibility for any errors, including details, dimensions, and materials.

6. As approving departures from details furnished by the Engineer, except as otherwise provided herein.

9. REVIEW NOTATIONS.

A. REVIEW NOTATIONS. The returned submittal shall indicate one of the following actions:

If the review indicates that the material, equipment or work method complies with the project manual, submittal copies will be marked "NO EXCEPTIONS TAKEN". In this event, the Contractor may begin to implement the work method or incorporate the material or equipment covered by the submittal.

If the review indicates limited corrections are required, copies will be marked "MAKE CORRECTIONS NOTED". The Contractor may begin implementing the work method or incorporating the material and equipment covered by the submittal in accordance with the noted corrections. Where submittal information will be incorporated in O&M data, a corrected copy shall be provided. Engineer reserves the right to request a complete corrected copy of all submittals.

If the review reveals that the submittal is insufficient or contains incorrect data, copies will be marked "AMEND AND RESUBMIT". Except at its own risk, the Contractor shall not undertake work covered by this submittal until it has been revised, resubmitted and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED".

If the review indicates that the material, equipment, or work method does not comply with the project manual, copies of the submittal will be marked "REJECTED - SEE REMARKS". Submittals with deviations that have not been identified clearly may be rejected. Except at its own risk, the Contractor shall not undertake the work covered by such submittals until a new submittal is made and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED".

If the submittal information does not require a review by the Engineer and/or is submitted for information only, copies of the submittal will be marked "Review not Required" and will be returned as “RECORD COPY”.
B. **FABRICATION.** Fabrication of an item shall not be commenced before the Engineer has reviewed the pertinent shop drawings and returned copies to the Contractor marked either "NO EXCEPTIONS TAKEN", or "MAKE CORRECTIONS NOTED". Revisions indicated on shop drawings shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis of claims for extra work. The Contractor shall have no claim for damages or extension of time due to any delay resulting from the Contractor's having to make the required revisions to shop drawings unless review by the Engineer of said drawings is delayed beyond a reasonable period of time and unless the Contractor can establish that the Engineer's delay in review actually resulted in a delay to the critical path of the Contractor's construction schedule. The review of such drawings by the Engineer will be limited to checking for general conformance with the requirements of the Contract Documents, and shall in no way relieve the Contractor of responsibility for errors or omissions contained therein, nor shall such review operate to waive or modify any provision contained in the Contract Documents. Fabricating dimensions, quantities of material, applicable code requirements, and other contract requirements shall be the Contractor's responsibility.

10. **REVIEW COSTS.**

The Owner's cost for review of submittals for the same proposed materials, equipment or work shall be apportioned as follows:

1. The cost of review of the initial submittal and the first revised submittal will be borne by the Owner.

2. The cost to review all additional revised submittals after the first revised submittal will be charged to the Contractor. The cost of review shall include, without limitation, administrative, design and engineering activities directly related to review of submittals.

3. If a submittal is approved and the Contractor elects to submit an alternate item for review for the same application, the Contractor shall be responsible for the review costs for the alternate submittal. The cost of review shall include, without limitation, administrative, design and engineering activities directly related to review of submittals.

11. **OPERATION AND MAINTENANCE DATA AND MANUALS.**

Adequate operation and maintenance information shall be supplied for all equipment requiring maintenance or other attention. The equipment Supplier shall prepare a Project specific operation and maintenance manual for each type of equipment indicated in the individual equipment sections or the equipment schedule.
Unless otherwise agreed by Engineer, the operation and maintenance manual for each type of equipment shall only be submitted for review following completion of review of all shop drawings and engineering data pertaining to that equipment.

Parts lists and operating and maintenance instructions shall be furnished for other equipment not listed in the individual equipment sections or the equipment schedule.

Operation and maintenance manuals shall include the following:

A. Table of contents and index (to be included in each volume of multi-volume manuals)

B. Part 1: Equipment record:
   a. Summary: Provide Equipment Record Form indicating the equipment name, equipment number, and process area in which the equipment is installed.
   b. Form: Complete the Equipment Record Form for each item of mechanical, electrical and instrumentation equipment in the Work (provided at end of this Specification).
   c. Include any performance curves, tests or engineering data not specifically listed on the forms.

C. Part 2: Operational procedures:
   a. Equipment function, normal operating characteristics, and limiting conditions
   b. Assembly, installation, alignment, adjustment, disassembly, and checking instructions.
   c. Operating instructions for startup, routine and normal operation, regulation and control, shutdown, and emergency conditions.
   d. Lubrication and maintenance instructions.
   e. Guide to troubleshooting.
   f. Parts lists and predicted life of parts subject to wear.
   g. Outline, cross section, and assembly drawings; engineering data; and wiring diagrams.
   h. Factory test reports, test data and performance curves, where applicable.
   i. Testing to determine performance efficiency.
   j. Tabulation of proper settings for all pressure relief valves, low and high pressure switches, and other protection devices.
k. List of all electrical relay settings including alarm and contact settings.
l. Safety considerations relating to installation, operation, and maintenance procedures.
m. Calibration procedures
n. Wiring diagrams
o. Operational log sheets and maintenance schedules
p. Material Safety Data Sheets (MSDS) for any applicable item (chemicals, oils, lubricants, etc.)
q. Warranty Information, Bond(s), and Service Contract(s)

D. Part 3: Preventive maintenance procedures:
   a. Identify all manufacturer-recommended procedures to be performed on a periodic basis.
   b. Provide recommended frequency of preventive maintenance procedures. Include lubrication schedules, lubricant SAE grade, type, and temperature ranges.

E. Part 4: Parts list:
   a. Provide a complete parts list, including a generic description and manufacturer’s identification number for each part. Include addresses and telephone numbers of the nearest supplier and parts warehouse.
   b. Provide cross-sectional or exploded view drawings with parts list.

F. Part 5: Wiring diagrams:
   a. Provide complete, color-coded, internal and connection wiring diagrams for electrical equipment.
   b. Provide as-installed control diagrams by controls manufacturer.

G. Part 6: Shop Drawings:
   a. Provide approved Shop Drawings for the piece of equipment included. Shop Drawing marked approved as noted: Indicate all changes necessary.
   b. Mark each sheet to clearly identify specific products and component parts and data applicable to installation.
   c. Delete inapplicable information.
   d. Include only those sheets, which are pertinent to the specific product.
H. Part 7: Safety:

a. Include all safety precautions to be taken when operating and maintaining equipment.

I. Part 8: Documentation:

a. Provide all equipment warranties, affidavits, and certifications required by the Technical Specifications.

b. Provide proper procedures in event of failure.

c. Provide instances which might affect validity of warranties.

d. Provide expiration date of all warranties.

e. Provide contact information.

J. Part 9: Materials and Finishes

1. Content for Products, Applied Materials and Finishes:

a. Manufacturer's data, giving full information on products.

   1) Catalog number, size composition.

   2) Color and texture designations.

   3) Information required for re-ordering special manufactured products.

b. Instructions for care and maintenance.

   1) Manufacturer's recommendations for types of cleaning agents and methods.

   2) Cautions against cleaning agents and methods which are detrimental to product.

   3) Recommended schedule for cleaning and maintenance.

2. Content for Moisture-Protection and Weather-Exposed Products:

a. Manufacturer's data, giving full information on products.

   1) Applicable standards.

   2) Chemical Composition.

   3) Details of installation.

b. Instructions for inspection, maintenance and repair.

3. Additional Requirements for Maintenance Data: Respective sections of the Specifications.
The operation and maintenance manuals shall be in addition to any instructions or parts lists packed with or attached to the equipment when delivered, or which may be required by Contractor.

Preliminary copies of operation and maintenance manuals shall be submitted to Engineer for review before shipment of the equipment. Preliminary copies shall be in hardcopy format. The quantity of preliminary copies shall be as required in the Shop Drawings section of the General Provisions.

After review by Engineer, final copies of operation and maintenance manuals shall be delivered to Engineer no later than thirty (30) days prior to placing the equipment in operation and no later than thirty (30) days after approval of the preliminary operation and maintenance manuals. If electronic and hard copies of final operation and maintenance manuals are not submitted within the timeframes specified, progress payments will be withheld until the required information is submitted. The Contractor shall provide four (4) final hard copies and two (2) final electronic copies of all operation and maintenance manuals. All final hard and electronic copies of operation and maintenance manuals shall be reviewed by Engineer for conformance with the specifications of this section and shall be returned for corrections if required.

Shipment of equipment will not be considered complete until all required manuals and data have been received.

- **Hard Copy Operation and Maintenance Manuals.** Hard copies for preliminary and final manuals shall be temporarily bound in heavy paper covers bearing suitable identification. All manuals and other data shall be printed on heavy, first quality 8-1/2 x 11 inch paper, with standard three-hole punching. Drawings and diagrams shall be reduced to 8-1/2 x 11 inches or 11 x 17 inches. Where reduction is not practicable, larger drawings shall be folded separately and placed in envelopes, which are bound into the manuals. Each envelope shall be suitably identified on the outside. Each volume containing data for three or more items of equipment shall include a table of contents and index tabs. The final hard copy of each manual shall be prepared and delivered in substantial, permanent, three-ring or three-post binders with a table of contents and suitable index tabs. Provide indexed, tabbed flyleaf for each separate product and system, with typed description of product and major component parts of equipment.

- **Electronic Approved Submittals and Operation and Maintenance Manuals.** Each electronic copy shall be delivered on a unique CD-ROM in Adobe Acrobat's Portable Document Format (PDF). The PDF file(s) shall be fully indexed using the Table of Contents, searchable with thumbnails generated.
File names shall use the “eight dot three” convention (XXXXX_YY.pdf), where X is the five digit number corresponding to the specification section, and YY is a two digit number set in sequential order when there are more than one PDF document (more than one O&M manual) per specification section. The initial filename for the O&M submittal will be provided with the request for final O&M manuals.

Scanned images must be at a readable resolution. For most documents, resolution for scanned documents shall be between 300 dots and 600 dots per inch (dpi). Optical Character Recognition (OCR) capture must be performed on these images. OCR settings shall be performed with the “original image with hidden text” option in Adobe Acrobat Exchange.

One PDF document (PDF file) shall be created for each equipment service manual. The entire manual shall be converted to a single PDF file via scanning or other method of conversion. Drawings or other graphics shall also be converted to PDF format and included into the single PDF document. Pages that must be viewed in landscape format shall be rotated to the appropriate position for easy reading on screen.

The PDF documents shall have a bookmark created in the navigation frame for each major entry (“Section” or “Chapter”) in the Table of Contents. Thumbnails shall be generated for each page or graphic in the PDF file.

The opening view for each PDF document shall be as follows:

Initial View: Bookmarks and Page

Magnification: Fit In Window

The file shall open to the cover page of the manual, with bookmarks to the left, and the first bookmark shall be linked to the Table of Contents.

- Labeling. As a minimum, the following information shall be included on all final O&M manual materials, including CD-ROM disks, jewel cases, and hard copy manuals:

  Manufacturer’s name.

  Equipment name and/or O&M title spelled out in complete words.

  Example: “Operations and Maintenance Manual”

  “Vertical Diffusion Vane Pumps”
12. ELECTRONIC RED-LINE DRAWINGS.

Electronic red-line drawing updates shall be submitted with each pay request for the duration of the Contract on a date agreed to by the Owner, Engineer, and Contractor. If electronic red-line drawing updates are not submitted by the due date, progress payments will be withheld until the required information is submitted. Contractor shall refer to the Project Record Documents part of the Closeout Procedures section for requirements on information to be included on red-line drawings. Electronic format and requirements are as follows:

A. Upon Notice to Proceed, a DVD containing Conformed Drawings in electronic PDF format will be provided to the Contractor.

B. Contractor shall use Adobe Acrobat Professional or Revu Bluebeam to red-line PDF drawings to reflect as-built installation of facilities. Line color requirements provided in the Closeout Procedures section shall be used.

C. For each change made to the electronic drawings, the Contractor shall create a link to the document in which the change was approved (RFI, Change Order, etc.).

D. Electronic “RED-LINE” updates shall only include drawings revised during that period, but shall include all changes to date for those drawings submitted.

E. A complete electronic “AS-BUILT” set of drawings shall be provided with the hard copy set of Project Record Documents required in the Closeout Procedures section.
**SHOP DRAWING TRANSMITTAL FORM**

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Complete either (a) or (b) following:

(a) We have verified that the material or equipment contained in this submittal meets all the requirements specified or shown (NO EXCEPTIONS).

(b) We have verified that the material or equipment contained in this submittal meets all the requirements specified or shown, except for the following deviations (ATTACH LIST OF DEVIATIONS:)

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<tr>
<th>Contractor’s or Supplier’s Authorized Signature:</th>
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### OCWD

**Equipment Record**

**EQUIPMENT MAINTENANCE DATA SUMMARY**

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<th>Estimated Life</th>
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**BREAK-IN MAINTENANCE REQUIREMENTS (INITIAL OIL CHANGES, ETC.)**

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**PREVENTIVE MAINTENANCE REQUIREMENTS**

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**RECOMMENDED SPARE PARTS**

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**ELECTRICAL NAMEPLATE DATA**

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SAFETY HAZARDS

Special instructions or warnings associated with this equipment

End of Section
PART 1 - GENERAL

1-1. THE REQUIREMENT.

A. It is expressly understood and agreed that the rate of progress and the time of completion of the Work are of the essence for this Contract. The Work shall be executed with such progress as required to prevent any delay to this Contract and to other Contractors working on other contracts at the site. This includes Contract Milestone dates and constraints, time requirements, and the general completion of the Work as defined in the Contract Documents.

B. The Work specified in this Specification section includes preparation, submittal, and use of a Construction Schedule as a portion of the Contractor’s mobilization. Its subsequent updates and revisions, as reviewed and allowed by the Engineer, shall be a required part of each Progress Payment Application submitted by the Contractor as provided in the Contract Documents.

C. The Contractor shall prepare and submit all required Construction Schedules in accordance with the requirements of this Specification section. By preparing and submitting the schedules and progress period updates, the Contractor represents that it can, and intends to, safely execute the contracted Work and all portions thereof including all activities of SubContractors, equipment vendors, and suppliers including submittals and re-submittals within the specified times and constraints and that its Bid Price includes all costs associated with execution of the Work described in the Contract Documents and as represented in the Construction Schedules.

1-2. RELATED WORK SPECIFIED ELSEWHERE.

A. The requirements of the following sections and divisions apply to the Work of this section. Other sections and divisions of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Section 01140, Work Restrictions.

2. Section 01090, Regulatory Requirements and Permits.
B. Comply with the requirements of the General Provisions, Special Provisions, and General Requirements.

1-3. REFERENCE SPECIFICATIONS, CODES AND STANDARDS.

A. The Contractor shall comply with the reference specifications of the General Requirements.

B. The following publications are cited as references for the Critical Path Method (CPM) scheduling technique described in this Contract:


   2. Association for the Advancement of Cost Engineering International (AACE), latest editions of Recommended Practices as applicable for Engineering, Procurement and Construction.

1-4. PURPOSE OF THE SCHEDULE.

A. This Specification section specifies requirements and procedures for the Contractor to use in preparation of construction schedules, cost-loaded schedules, resource-loaded schedules, cash flow projections, manpower projections, and cost and schedule reports. The purpose of the schedules and reports shall be to:

   1. Ensure adequate planning and timely execution of the Work by the Contractor;

   2. Facilitate coordination and interfacing of the Contractor’s work with others as needed;

   3. Establish a baseline Construction Schedule to which subsequent periodic schedule updates will be compared to determine overall progress and performance toward satisfactory completion of the Contract;

   4. Periodically record the “As-Built” condition of the Contract;

   5. Assist the Engineer in monitoring progress;

   6. Establish the amount of the progress period payment to be made to the Contractor;

   7. Establish the amount of daily manpower required to complete the Contract within the Contract Duration;

   8. Evaluate proposed changes to the Contract and resultant impacts to the construction schedule;

1-5. **MOBILIZATION AND PROGRESS PAYMENTS.**

A. OCWD’s administration of the Contract, its construction program, internal resource coordination, and operations planning may be severely impeded if adoption of the schedule is delayed. Consequently, ten percent of the Contractor’s mobilization payment, as allowed pursuant to the Contract Documents, shall be retained and allocated for payment as follows:

1. The Contractor may request and be paid twenty percent of the retained mobilization in its payment application that follows submittal and acceptance of the Interim Construction Schedule.

2. The Contractor may request and be paid the balance of the retained mobilization in its payment application that follows submittal and acceptance of the Baseline Construction Schedule.

B. The Contractor’s progress payment applications may be deemed improper and may not be accepted and processed for payment by OCWD without periodic Construction Schedule updates submitted in the time and manner required by this Specification section and subsequently accepted by the Engineer.

1-6. **CONTRACTOR SUBMITTALS.**

A. Certifications and other submittal documentation in compliance with Article entitled “Contractor Qualifications” of this Specification.

B. The Contractor shall submit all items as required by Appendix G of this Specification section in the time, quantities, and manner stipulated therein and in accordance with the Contract Documents for submittals unless noted otherwise herein.

1-7. **QUALITY ASSURANCE.**

A. Contractor Qualifications:

1. The Contractor shall provide a qualified construction scheduler to meet on site with the Engineer during an eight-hour day shift one day per week (minimum) and maintain the progress schedule. The scheduler shall have verifiable experience in construction work sequencing, productivity, preparation and maintenance of detailed construction schedules for individual contracts of $50 Million and larger in constructed value. The scheduler shall be proficient in the use of Primavera® Project Management software and shall have a minimum of ten years experience.

   a. Within seven days after Notice to Proceed, the Contractor shall submit the construction scheduler’s resume to the Engineer, including personal references from at least two owner-
representatives familiar with the construction scheduler’s work on previous similar contracts. The Engineer reserves the right to reject the proposed scheduler based on poor references, lack of qualifications as defined in this Specification section, and/or poor performance history on previous OCWD contracts including late schedule submittals, lack of responsiveness to requested clarifications, corrections, re-submittals and/or time impact analysis.

b. The Contractor’s scheduler shall attend all meetings, including progress and special meetings pertaining to scheduling of the Work. The scheduler, along with the Contractor’s management team shall work closely with the Engineer to comply with and deliver the requirements of this Specification section.

c. It is the specific intent of this Specification section that the Contractor and its scheduler shall be wholly responsible for developing, maintaining, updating, checking and providing an accurate and comprehensive representation of the Contractor’s work plan in the required software, related databases and reports to achieve the purposes set forth in the Contract Documents.

1-8. ENGINEER’S REVIEW.

A. The Engineer shall review schedule submittals in accordance with this Specification section and the other Contract Documents for the administrative purposes described herein. However the Engineer’s review, comments or consent to use the Contractor’s schedule shall not be construed as validation or endorsement of the Contractor’s work plan and approach nor shall it relieve the Contractor of any and all responsibility, liability or risk related to its work plan, its work plan as represented by the schedule, or requirements of the Contract.

1-9. GENERAL SCHEDULE REQUIREMENTS.

A. The Contractor shall have sole responsibility for development, maintenance, update, revision, checking and presentation of its work plan in the form of a Critical Path Method (CPM) Construction Schedule for use by the Engineer in meeting the purposes described in the Contract Documents. The Contractor shall provide all information concerning methods, means, sequencing, logic, and duration of all activities as well as providing all CPM logic network diagram and tabular report data.

B. The Contractor shall use Primavera® Project Management, latest version, and a hardware system commensurate with the size of the contract. The system shall be capable of handling, processing, printing, and plotting all data required to satisfy the requirements of this Specification section. Electronic files submitted to OCWD shall be compatible with Primavera® Project Management, latest version.
C. Within fourteen days following Notice to Proceed, the Engineer shall schedule and conduct a Pre-Construction Scheduling Conference to commence development of the required construction schedules. At the meeting, the requirements of this and related Specification sections will be reviewed with the Contractor and the Contractor shall present its proposed:

1. Methodology for the CPM Construction Schedule, illustrating sequence of operations, cost, resource and quantity loading.

2. Work Breakdown Structure (WBS), Activity Coding Structure and Activity Identification numbering system for labeling all Work Activities, correlated with the Contract Agreement Schedule of Prices. At a minimum the Contractor shall provide the data detailed in Appendices B and C of this Specification section.

D. The Engineer shall review the WBS, the coding structure, and activity identification system presented by the Contractor within ten days following the Pre-Construction Scheduling Conference. The Contractor shall make all modifications requested by the Engineer and, following concurrence by the Engineer, shall employ the agreed to coding, structure, and system in its Construction Schedule. In addition the Contractor may be required to develop additional activity codes and values to comply with reporting requirements listed in the Contract Documents, and/or as directed by the Engineer.

E. The Work activities comprising the Construction Schedule shall be of sufficient detail to assure adequate planning and execution of the Work such that, in the judgment of the Engineer, it provides an appropriate basis for predicting, monitoring, evaluating and recording the progress of the Work. Work Activities shall conform to the following requirements:

1. Describe Work Activities using consistent terminology such that the Work is readily identifiable for assessment of progress and completion.

2. Subdivide the Work into activities of duration no longer than fifteen uninterrupted work days each, except as to non-construction activities, such as procurement and delivery of materials and equipment, and any other activities for which the Engineer may accept a longer duration in writing.

3. The construction time, as determined by the schedule, from early start to late finish for any sub-phase, phase, or the entire contract shall not exceed the Contract Duration specified or shown in the Contract Documents. One day shall be the smallest time unit shown unless otherwise directed in writing by the Engineer.
4. Except as provided for in Appendix B for milestones, activities labeled "start", "continue", or "completion" shall not be allowed. Logic relationships between activities shall be limited to finish-to-start (FS) type relationships and the use of lags or durations between activities shall not be permitted unless accepted in writing by the Engineer.

5. The Contractor shall not constrain the schedule with artificial logic ties and/or constraint dates and/or use any other scheduling techniques that may distort the activity float and total float associated with the critical path activities and the schedule in general. The only allowable constraint shall be for Contract Milestone dates using a “Finish On or Before” constraint, unless accepted in writing by the Engineer.

6. Each Work Activity shall contain the following information as elaborated in Appendix B of this Specification section:
   a. WBS coding, activity coding and a unique activity identification number consistent with the structure and system agreed to by the Engineer.
   b. Performance responsibility; General Contractor or SubContractor trade code; GEN, MECH, ELEC, CARP, PLAST, etc.
   c. Work location code and description of the physical plant area involved.
   d. Duration in work days based on the appropriate Activity Calendar.
   e. Cost Data as mandated herein.
   f. Resource Data as mandated herein.

F. The Engineer may require the Contractor, at any time during the Contract, to develop a more detailed schedule and/or fragment than depicted in the Construction Schedule to clearly illustrate the effort needed to complete a specific area or task.

G. The Construction Schedule shall contain the following standard milestones; Notice to Proceed; Mobilization; Construction Start; Specified Contract Milestones for each phase of Work as identified in Contract Documents; Beneficial Occupancy; Substantial Completion and Final Completion

H. Activity Cost Loading:
   1. The schedule shall incorporate cost-loaded activities equal to the Contract Total Price and Sub-Totals set forth in Contract Agreement ‘Exhibit “A” Schedule of Prices’ and as further detailed in the General Conditions section entitled ‘PAYMENT – ITEMIZED BREAKDOWN OF CONTRACT LUMP SUM PRICES’.
2. The Contractor shall further divide its prices to determine and substantiate a fair allocation of costs to each activity of Work in the schedule that is physically incorporated into the facility.

3. The Contractor shall not unbalance the activity cost loading and, except for mobilization costs, shall prorate overhead and profit on all activities for the entire contract term. The Contractor shall furnish the minimum data required in Appendix G of this Specification section to the Engineer for review and agreement prior to integrating cost data into the schedule:

4. Procurement, submittal preparation and submittal review activities shall not be cost-loaded. Payment for material and equipment shall be made in accordance with the Contract Documents.

5. The Payment Application and all periodic payment requests shall be based upon, but may not be limited to, the cost-loaded Construction Schedule update; the Contract Agreement ‘Exhibit “A” Schedule of Prices’; and the General Conditions section entitled ‘PAYMENT – ITEMIZED BREAKDOWN OF CONTRACT LUMP SUM PRICES’.

6. Proposed changes to the authorized Cost-loaded Construction Schedule may only be made with the written acceptance by the Engineer.

I. Activity Resource Loading:

1. The activities contained in the Construction Schedule shall be resource-loaded to show the number of work force employees needed on a work day basis to complete the Work within the Contract Duration.

2. Resource activity loading shall include, at a minimum, the composite crew, the classification (e.g., foreman, journeyman, etc.) of the individuals comprising the crew, materials, and equipment associated with each activity shown on the schedule, plus any other information required by Engineer.

3. Labor resources shall be listed in the Resource Library of the Primavera® Software and the Contractor shall assign labor resource loading by trade for each Work Activity of the schedule.

4. The Contractor may use the Primavera® Resource Leveling function for its own internal analysis and planning, but shall not use it in the contract record or submittal schedule databases to avoid potential distortions resulting from the retained logic function.

5. Proposed changes to the authorized Resource-loaded Schedule may only be made with the written acceptance by the Engineer.
J. The Construction Schedule shall begin with the date of issuance of the Notice to Proceed and not exceed the maximum Contract Duration provided in the Contract. It shall include, but not be limited to, the following items as appropriate to this Contract:

1. All administrative tasks.

2. Type of work to be performed, sequences, and labor trades involved, including performance responsibility and trade code.

3. Quantity loading of activities showing, at a minimum, unit price bid items, estimated quantities to be installed or removed as indicated in the Contract Documents or as determined by the Contractor in preparation of its Bid, and any additional information required by the Engineer.

4. All manufacturer factory tests, material and equipment deliveries, field tests, readiness tests, and installation activities that the Contractor intends to seek payment for, including stored materials.

5. All submittal preparation and reviews including Engineer reviews, and acceptance of shop drawings and material samples shall provide a 25 day minimum duration as specified for the Engineer’s review of submittals, unless the submittal is of the type requiring a longer period of time as specified in the Contract Documents for Shop Drawing Submittals.

6. Delivery, installation, check-out/testing, and startup of OCWD-furnished equipment and/or materials in accordance with the schedule dates set forth in the Specifications or as furnished by the Engineer.

7. Approvals required by regulatory agencies or other third parties, including Contractor obtained permits.

8. Identification of all subcontract Work and assignments of responsibility for performing specific activities.

9. All temporary utilities and construction required by the Contractor to perform the Contract Work.

10. Access to and availability of work areas including all anticipated plant shutdowns, pump station shutdowns, flow diversions, or bypass pumping.

11. All interruptions, shut downs and connections to existing plant systems and equipment.

12. All start up, testing, training, and assistance required under the Contract Documents.

13. Timing of the phased or total takeover of the Work by OCWD as may be required by the Contract.
14. Identification of any work force, material, or equipment restrictions, as well as any activity requiring unusual shift work, such as two shifts, six day weeks, overtime, or work at times other than regular days or hours, shall be clearly identified in the Construction Schedule. Normal work hours are eight hours per day, five days a week, unless specified otherwise in the Contract Documents.

15. Contractor activities that will be coordinated with OCWD and OCSD on-going activities.

16. Material and Equipment Installation including installation, check-out, vendor equipment manuals submittal and acceptance, training lesson plan(s) submittal and acceptance, and OCWD staff training.

17. Contractor-prepared drawings and diagrams such as shoring diagrams.

18. Clearly identify all non-work days such as holidays, or other non-work periods in the schedule.

19. Specific Work activities, including but not limited to, site work, underground piping and electrical ductbanks, structural excavation, soil testing, backfill, placement of sheeting, pile driving, formwork erection, rebar placement, placing of concrete, stripping forms, concrete curing, installation of process piping, electrical conduits and wiring, instrumentation and controls conduits and wiring, terminations, other materials and plant equipment, and cleanup.

20. The Contractor shall provide an activity for Inclement Weather with a duration that reflects the number of inclement weather days provided for in the Contract Documents as follows:

   a. The Inclement Weather predecessor activity shall be the last construction activity that occurs before Substantial Completion.

   b. The Inclement Weather successor activity shall be the Substantial Completion milestone.

   c. The Contractor shall notify the Engineer in writing within seven days when a lost work day has occurred due to inclement weather. The Contractor shall correspondingly reduce the inclement weather activity duration as weather days occur, are recognized and accepted by the Engineer.

   d. The Contractor shall notify the Engineer in writing to request a non-compensable extension of time if the number of actual inclement weather delay days exceeds the number of inclement weather delay days identified in the Contract Documents. Such delays shall not entitle the Contractor to additional compensation.
22. Final cleanup.
23. Specific information required by the Engineer.
24. Required inspections by the Engineer.
25. Progress period updating of Contract Record Drawings and final submittal of As-Built Drawings at contract completion, or as directed by the Engineer.

1-10. INTERIM CONSTRUCTION SCHEDULE REQUIREMENTS.

A. Within 30 days following Notice to Proceed the Contractor shall submit its detailed written work plan for the first 150 days of operation and its general approach to the remainder of the Work. The work plan and approach to the remainder of the Work shall also be submitted in the form of an Interim Construction Schedule that incorporates all applicable elements of this Specification section and the other Contract Documents sufficient to meet its purpose.

B. The Engineer shall meet with the Contractor within ten days of the submittal to review and agree on any necessary adjustments and revisions. When revised and accepted by the Engineer the Interim Construction Schedule shall illustrate the Contractor’s methods, means, logic, sequencing and durations of the Work represented by cost-loaded and resource-loaded activities for the first 150 days of the contract. It shall also include cost loading and resource loading for the balance of all contract Work to a summary level through the Final Completion milestone as forecast by the Contractor.

C. The Interim Construction Schedule shall be updated as provided in this Specification section and used to monitor job progress during the first 150 days of the contract or until acceptance of the Baseline Construction Schedule by the Engineer.

1-11. BASELINE CONSTRUCTION SCHEDULE REQUIREMENTS.

A. Within 90 days following Notice to Proceed the Contractor shall submit its detailed written plan for the Work. The work plan shall also be submitted in the form of a Baseline Construction Schedule that incorporates all applicable elements of this Specification section and the other Contract Documents sufficient to meet its purposes as described therein. It shall demonstrate the final level of detail for each activity, all required relationships completely identified, and the duration of each activity correctly depicted. It shall be developed as follows:
1. The activities shown in the interim schedule shall be integrated into the Baseline Construction Schedule without change to form a comprehensive representation of the Contractor’s execution of the Work from start to finish.

2. The Baseline Construction Schedule submitted for review and acceptance by the Engineer shall be un-statused and the data date shall be the Contract Notice to Proceed date.

3. The Baseline Construction Schedule shall clearly indicate the Longest Critical Path of activities from Notice to Proceed to the Contract Completion date.

4. The Baseline Construction Schedule shall contain all cost information assigned to each discrete activity at the final level of detail. Each activity shall be cost-loaded to permit generation of cash flow curves.

5. The Baseline Construction Schedule shall contain all resource information assigned to each discrete activity at the final level of detail. Each activity shall be resource-loaded to permit generation of resource curves.

6. The Contractor shall collect data and information from subContractors, suppliers, and equipment manufacturers for incorporation into the Baseline Construction Schedule. The baseline schedule submittal shall include signed certification letters from subContractors, suppliers and vendors that they have reviewed, discussed and agreed to the schedule as it relates to their work.

7. The Baseline Construction Schedule shall contain no Contract changes or delays which may have been incurred during the schedule development period. These changes will be entered at the first update after the Baseline Construction Schedule has been accepted by the Engineer and a change to the Contract Duration made as part of an approved Change Order in accordance with the Contract Documents.

8. Once the Baseline Construction Schedule is agreed to and accepted by the Engineer it shall become the schedule of record and shall be the basis for future schedule updates.

9. After adoption of the Baseline Construction Schedule, no changes shall be made therein, including changes to logic, sequence and/or duration, without the agreement of the Engineer.

B. The Engineer will have up to 25 days to evaluate and prepare its comments to the Baseline Construction Schedule submittal before scheduling a meeting with the Contractor to discuss it.

C. Within ten days of returning its submittal response, the Engineer will schedule a meeting with the Contractor to review and discuss any
adjustments and revisions to the Baseline Construction Schedule required to make it acceptable to the Engineer.

D. After acceptance by the Engineer, the Baseline Construction Schedule shall represent the Contractor’s methods, means, logic, sequencing and durations of the Work and include the Contractor’s estimated costs and resources for each discrete activity as required to meet the purposes of this Specification section and the other Contract Documents.

1-12. PROGRESS OF THE WORK.

A. Once the Baseline Construction Schedule is adopted the Contractor shall be responsible for preparing and submitting periodic progress update information in the form of a progress report concurrent with the Progress Payment Application cycle established for the contract. At a minimum the progress report and schedule update shall include:

1. Narrative Progress Report
2. Updated Construction Schedule
3. Reports, tables and diagrams ad described in Appendix G of this Specification section.

B. On a date determined by the Engineer, the Contractor shall meet with the Engineer to review the Contractor’s Progress Payment Application and its required supporting documents, including its Narrative Progress Report and its Construction Schedule Update.

1. Appendix E of this Specification section outlines the update preparation and review sequence to be used for preparation, submittal and review of the Narrative Progress Report and Construction Schedule update.

2. The Contractor and the Engineer will review the Draft submittal, discuss its content and the Engineer will authorize modifications, as appropriate, to facilitate approval of the Payment Application.

3. Following the review meeting, only those revisions authorization by the Engineer shall be incorporated into the electronic file entitled “Update” which shall then be submitted as the record schedule for the progress period update.

4. The Engineer shall be allowed seven days after the meeting to review and determine the acceptability of the Narrative Progress Report and Construction Schedule update. This variance from the typical submittal review period is made specifically to facilitate timely processing of the Contractor’s Progress Payment Application.
5. Narrative Progress Report and Construction Schedule updates returned to the Contractor marked “Revise & Resubmit” or “Not Acceptable” shall constitute a deficient payment application that will not be processed for payment until the schedule report is acceptable to the Engineer.

6. Narrative Progress Report and Construction Schedule updates returned to the Contractor marked “Revise & Resubmit” or “Not Acceptable” shall be resubmitted to the Engineer within seven days, at which time a new seven day review period will begin for the Engineer.

C. The Narrative Progress Report shall summarize the schedule status and be organized as follows:

1. The Contractor's transmittal letter, containing the submittal number.

2. Contents Sheet.

3. Identification of the Update including the Data Date, Update Period and the Schedule File Names as defined in Appendix D to this Specification section.

4. Update Summary including the variance between Contract Milestone dates and their predicted completion dates; Contract Completion variance for the reporting period; the number of days ahead or behind schedule; weather days taken and remaining from the Contract allowance and tables summarizing the status of Contract finances and time. At a minimum the Contractor shall provide the data required by the example in Appendix G of this Specification section.

5. Analysis of Critical Path and each negative Float Path describing the nature of the Critical Path, its impact and the impact of any negative float path on other activities, milestones and completion dates:

6. All current and anticipated time impacts describing the origin of each event; corrective action and schedule adjustments to correct it; recommendations to recover from it and the effect that it may have on other activities, milestones and completion dates.

7. Pending status of outstanding issues such as permits, if any; Contract modifications, RFC’s and or RFP’s containing requests for time adjustment; long-lead procurement items; safety reports and any code violations or warnings.

8. Narrative discussion of contract status including highlights of work by area, progress, completion, impediments, changes to the Work plan, issues and concerns accompanied by OCWD Activities and Schedule Change Tables. At a minimum the Contractor shall provide the data required in Appendix G of this Specification section.
D. Progress Period Schedule Updates:

1. The Contractor shall be responsible for preparing and submitting updated schedules, related reports and diagrams, as part of its periodic update Report.

2. The Construction Schedule update shall measure and record only those facts that have occurred to the Work including physical percent complete type, actual start and finish dates, and duration changes. Modifications to logic, durations of activities not started or to actual dates already recorded in previous updates shall not be allowed unless authorized in writing by the Engineer. An electronic file shall be created and entitled “Pure Progress” and included with the update.

3. With each update the Contractor shall identify any changes to the schedule, such as Field Change Orders, accepted time adjustment requests, new activities, constraint changes, deleted activities, activity duration changes, activity description changes, and changes in logic relationships between activities in a Schedule Change Table as detailed in Appendix G of this Specification section. Logic changes shall be described with an explanation of the rationale for the change provided in the report. Such revisions may be incorporated into an electronic file entitled “Draft Update” for target comparison with the “Pure Progress” update. The Contractor shall provide printed diagrams of the target comparisons as part of its presentation to the review meeting.

4. All progress period schedule updates shall be compared to the Baseline Construction Schedule. In addition, each current progress period update shall be compared to the previous period update. Each update shall be labeled with the OCWD project number, data date and title abbreviation identified on the hard copy and electronic file as described in Appendix G of this Specification section.

5. The schedule shall be updated with actual start and finish dates for every in-progress or completed activity, as documented by the Contractor’s Daily Reports and Three Week Look Ahead schedules. No other basis, including automated software calculations or default mechanisms shall be allowed. Failure of the Contractor to ensure that documented dates as specified herein are incorporated into the schedule update shall constitute cause for disapproval of the update and the inability of the Engineer to accurately evaluate the Contractor’s progress for payment purposes.

6. Activities that have reported progress without predecessor activities being completed such as Finish to Start (FS) Relationships with out of sequence progress will not be allowed except on a case-by-case basis with the written acceptance by the Engineer. A written explanation of each such activity shall be included with each update in the Schedule.
Change Table as detailed in Appendix G of this Specification section. The Engineer may direct that changes in schedule logic be made to correct any or all out-of-sequence Work.

7. Change order work shall be identified in the schedule as a new activity inserted into the affected schedule logic. The schedule activity shall only be added after the Change Order is approved for payment by OCWD.

1-13. CONSTRUCTION SCHEDULE REVISION.

A. If the Contractor decides to make major changes to the sequencing and logic of the accepted work plan it shall prepare a schedule reflecting its proposed changes for submittal to, and review by, the Engineer separate and apart from the periodic schedule updates.

B. The Contractor’s submittal shall be made in accordance with the requirements of the Contract Documents and the Engineer will have a maximum 25 day period for review before scheduling a meeting with the Contractor.

C. A Revised Schedule that results in a predicted completion date later than the Contract Completion date shall be rejected unless the delay is deemed to be excusable or caused by OCWD or OCSD and a time extension is authorized in writing by the Engineer.

D. The Engineer will then arrange a meeting with the Contractor to review the submittal, discuss its content, and authorize modifications required to allow its integration into the Construction Schedule.

1-14. AS-BUILT CONSTRUCTION SCHEDULE.

A. As a condition precedent to release of any retention, the Contractor shall submit its As-Built Construction Schedule. The As-Built Construction Schedule shall reflect the manner in which the contract was actually constructed including start and completion dates, and all activities, sequences, and logic ties.

B. This schedule submission shall be accompanied by a certification, signed by an officer of the Contractor’s company, the Contractor’s Project Manager and Construction Scheduler, stating “To the best of our knowledge, the accompanying As-Built Construction Schedule accurately reflects the actual start and completion dates and logical relationships of all activities contained herein and represents an accurate depiction of the way in which the contract was constructed”.

Orange County Water District 01310 CONSTRUCTION PROGRESS SCHEDULE
Groundwater Replenishment System -15- April 2019
Final Expansion Issued for Bid
1-15. WEEKLY THREE WEEK LOOK AHEAD.

A. The Contractor shall submit an electronic copy of the Three Week Look Ahead schedule to the Engineer no later than 48 hours prior to the weekly construction progress meeting. The Three Week Look Ahead schedule shall be developed maintained and provided using MS Excel® software, shall be in the form shown in Appendix G and include at a minimum actual performance for the previous week compared to the planned work for the previous week, planned work for the current week and planned work for the two weeks following the current week.

B. Each weekly Three Week Look Ahead schedule shall be based on the current Construction Schedule update Four Week Look Ahead Report and fully correlated to the activities planned in its Primavera® counterpart, including submittal reviews, procurement, fabrication and delivery of contract deliverables.

C. The Contractor shall use the Three Week Look Ahead schedule actual performance record in preparing its Construction Schedule update.

1-16. FLOAT OWNERSHIP AND EARLY COMPLETION.

A. Total float, free float, independent float, near-critical float, critical path float, slack time, or contingency within the overall Construction Schedule is not for the exclusive use of either OCWD or the Contractor but is jointly owned by both and is an expiring resource available to and shared by both as needed to meet Contract Milestones and the Contract Completion date.

B. Pursuant to the float sharing requirements of the Contract, use of float suppression techniques such as preferential sequencing, special lead/lag logic restraints, extended activity times, or imposed dates shall be cause for rejection of the Construction Schedule and any revisions or updates thereto.

C. Within fifteen days of Contract award, the Contractor shall formally notify OCWD in writing of its intent to finish the Work earlier than the Contract Completion date. Agreement between the Engineer and the Contractor to adopt an early completion Baseline Construction Schedule shall include agreement by both parties to amend the Contract Milestones, completion dates, and associated liquidated damages, by Change Order, to those completion dates contained in the agreed to schedule.

1-17. TIME ADJUSTMENT REQUESTS.

A. Requests for time adjustments shall be submitted in the time and manner specified in the Contract Documents, as described herein and further elaborated in Appendix F of this Specification section.
B. OCWD initiated changes that extend or shorten the Contract Duration shall be the sole basis to adjust the Contract Completion date. Delays in the critical path not associated with proper requests for time extensions in accordance with the Contract Documents shall be deemed to be the responsibility of the Contractor.

1-18. REMEDIAL MEASURES AND RECOVERY SCHEDULE.

A. The Contractor shall mitigate any potential delay to the Work as efficiently and economically as possible regardless of cause. Where practical the Contractor shall do so without added cost or adverse time impact. Prior to initiating any action for which it expects OCWD to be liable, the Contractor shall notify the Engineer in writing and receive written authorization to proceed.

B. If the Contractor believes the delay may result in a predicted completion date later than the Contract Completion date, it shall review all uncompleted activities on the critical and near critical paths to assess mitigation options and, within seven days of discovering the potential delay it shall submit a written statement to the Engineer describing its plan to recover, including a statement that it has verified the accuracy of all critical and near critical paths. Following acceptance by the Engineer the Contractor shall incorporate its recovery plan into the next schedule update.

C. Whenever it becomes apparent to the Engineer that the current schedule update shows a delay to the critical path, that these delays are through no fault of OCWD and hence, the Contract completion date will not be met, or when so directed by the Engineer, the Contractor shall submit to the Engineer for review a written statement of the steps it intends to take to remove or arrest the delay to the schedule and the Contractor shall promptly provide the requisite level of effort to bring the Work back on schedule. The Contractor shall then incorporate its recovery plan into the next Construction Schedule update.

D. A Recovery Schedule that results in a predicted completion date later than the Contract Completion date shall be rejected unless the Engineer determines that the delay is the responsibility of OCWD, is excusable or that it cannot be mitigated, and authorizes a time extension in writing.

E. The Engineer may require the Contractor to provide reasonable additional resources to recover from any schedule delay, however under no circumstances will the addition of equipment or construction forces, increasing the working hours or any other method, manner, or procedure to recover from delays to the Schedule be considered justification for contract modification for extra Work.
F. The holidays observed by the Owner are as follows:

New Year’s Day
Presidents’ Day
Lincoln’s Birthday (Observed by OCSD only)
Memorial Day
Independence Day
Labor Day
Veteran’s Day
Thanksgiving Day (Thursday and Friday)
Christmas Eve
Christmas Day

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3-1. SUPPLEMENTS.

A. The supplements listed below are attached to and form a part of this Specification section:

Appendix A - Definitions
Appendix B - Work Breakdown and Activity Coding Structure
Appendix C - Activity ID System
Appendix D - Electronic File Naming
Appendix E - Update Preparation Sequence
Appendix F - Time Adjustment Request
Appendix G - Contractor Deliverables

End of Section
APPENDIX A TO SECTION 01310
Definitions

A. Baseline Construction Schedule: the CONTRACTOR’s as bid Work plan for the Contract, prepared using the Critical Path Method, which shows all planned activities, costs, resources and durations, as accepted to by the ENGINEER.

B. Cash Flow: The CONTRACTOR’s estimate of time-phased construction gross billings, before retention, generated from its scheduled cost-loaded activities.

C. Construction Schedule: the CONTRACTOR’s accepted Baseline Construction Schedule, as it evolves through periodic updates that record actual progress of the Work to completion when it shall show the “as-built” record of the CONTRACTOR’s Work plan as executed.

D. Contemporaneous Period Analysis: a methodology, used in conjunction with a CPM schedule, to model the effects of a time impact event in near real time for a ‘forward-looking’ estimate of contract completion. Also referred to as Time Impact Analysis by the AACE.

E. Contract Completion: the final completion milestone date established by adding the duration in calendar days stipulated in the Contract agreement to the Notice to Proceed date, and as amended via change orders.

F. Contract Duration: the performance period provided for in the contract.

G. Contract Milestone: significant performance points in the Work, as provided for in the Contract.

H. Cost-Loaded Schedule: the CONTRACTOR’s allocation of bid estimate costs to each schedule activity which forms the basis for anticipated CONTRACTOR gross billings before retention is withheld.

I. Critical Path: a continuous sequence of schedule network activities with the least amount of total float ending at a Contract Milestone.

J. Critical Path Method (CPM): schedule development that starts with a proper plan sequenced from beginning to end, followed by time driven forward and backward passes to establish the Critical Path and the Float for all other paths.

K. Early Finish: the earliest a schedule activity is expected to finish, based on its relationship (logic) to other activities in the contract.

L. Early Start: the earliest a schedule activity is expected to start, based on its relationship (logic) to other activities in the contract.

M. Float: the flexibility that an activity has against the critical path.

N. Fragnet: a fragment of the schedule network that typically illustrates a particular sequence for thorough analysis.

O. Free Float: the amount of time the start of an activity can be delayed without delaying the start of a successor activity.

P. Independent Float: the amount of time that an activity may be delayed without affecting the early start or early finish of any succeeding activities.

Q. Interim Construction Schedule: the CONTRACTOR’s as bid Work plan for that portion of the Contract that precedes adoption of the Baseline Construction Schedule prepared using the Critical Path Method and showing in detail all planned activities, logic, sequencing, costs, resources and durations planned for the interim period cited in this Specification section. It shall also include cost and resource.
loading to a summary level for the balance of all Contract Work through the Final Completion milestone as forecast by the CONTRACTOR.

R. Late Finish: the latest a schedule activity can finish, based on its relationship (logic) to other activities on the contract, and still permit the contract to be completed on time.

S. Late Start: the latest a schedule activity can start, based on its relationship (logic) to other activities on the contract, and still permit the contract to be completed on time.

T. Longest Critical Path: a continuous sequence of schedule network activities that begins with the notice to proceed milestone and ends at the contract completion milestone.

U. Milestone: a significant schedule event identified in the Contract as a “milestone”.

V. Narrative Progress Report: a written report that summarizes the status of the Contract and narrates in detail progress of the Work during the report period, anticipated for the next reporting period and the outlook for completion of the Contract.

W. Near-Critical Float: is typically defined as float values within a set range just above the critical path float.

X. Original Duration: the amount of time, in calendar days, an activity is expected to take to complete at the beginning of a contract.

Y. Planned Completion: the construction completion milestone date established by the agreed to baseline construction schedule.

Z. Pre-Construction Scheduling Conference: the first meeting between the ENGINEER and the CONTRACTOR to review the requirements of this and related Specification sections, the CONTRACTOR’s proposed methodologies for its work breakdown structure, activity coding, identification, sequencing, cost, resource and quantity loading.

AA. Predicted Completion: a variable date predicted for completion of the Work in each periodic progress update.

BB. Primavera® Project Management, latest version: the latest version of Primavera® scheduling software currently in use by OCWD.

CC. Progress Period: the 28 day progress payment period established by the ENGINEER for the contract.

DD. Project Float: the amount of time between the CONTRACTOR’s planned early completion date and the contract completion date.

EE. Recovery Schedule: the CONTRACTOR’s plan to mitigate its predicted delay to the Contract completion date and conclude the Work as Contracted.

FF. Resource-loaded Schedule: the CONTRACTOR’s allocation of all labor and equipment necessary to complete the Work for each activity as entered into the schedule software database.

GG. Total Float: the amount of time that the actual start and finish of an activity can be delayed along a given network path without delaying the contract completion date.

HH. Work Activity: an activity that requires time and resources to complete and must be performed before the Contract is considered complete.
APPENDIX B TO SECTION 01310

Work Breakdown Structure

The CONTRACTOR shall code the Work Breakdown Structure (WBS) Code Value with the OCWD Contract Number and the WBS Name with the OCWD Project Title at the EPS Root level (Level 1) to facilitate integration into the OCWD database. The Activity Coding Structure shall be used to organize all subordinate levels of the Work.

OCWD Contract No: GWRS-2019-01
OCWD Project Title: Final Expansion of the Groundwater Replenishment System Project

Activity Coding

At a minimum, the CONTRACTOR shall assign codes to each activity in the Construction Schedule, using the activity code names, values and corresponding descriptions outlined in the Activity Codes Dictionary below to give OCWD the ability to sort and select schedule information based on the following categories:

1. Type of Work: Construction and non-construction
2. Performance Responsibility: General and SubContractors
3. CSI Division:
4. Milestone:
5. Tie-In
6. Location

ACTIVITY CODES DICTIONARY

<table>
<thead>
<tr>
<th>Code Name</th>
<th>Length</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TYPE</td>
<td>1-6</td>
<td>TYPE OF WORK</td>
</tr>
<tr>
<td>CONT</td>
<td>4</td>
<td>CONSTRUCTOR / SUB-CONSTRUCTOR</td>
</tr>
<tr>
<td>CSI</td>
<td>4</td>
<td>CSI DIVISION</td>
</tr>
<tr>
<td>MS</td>
<td>4</td>
<td>MILESTONE</td>
</tr>
<tr>
<td>TIE</td>
<td>4</td>
<td>SHUTDOWN / TIE-IN</td>
</tr>
<tr>
<td>LOC</td>
<td>4</td>
<td>WORK LOCATION</td>
</tr>
</tbody>
</table>
**Code Name:**  TYPE  
**Description:**  Type of Work  
**Field Length:**  6

At a minimum, the CONTRACTOR shall assign a Code Value to each activity corresponding to one of the following Code Descriptions:

Examples:

<table>
<thead>
<tr>
<th>Code Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Administration / Submittals</strong></td>
</tr>
<tr>
<td></td>
<td>Submit / Review</td>
</tr>
<tr>
<td></td>
<td>Resubmit / Review</td>
</tr>
<tr>
<td></td>
<td><strong>Procurement / Fabrication / Delivery</strong></td>
</tr>
<tr>
<td></td>
<td>Procure</td>
</tr>
<tr>
<td></td>
<td>Fabricate</td>
</tr>
<tr>
<td></td>
<td>Deliver</td>
</tr>
<tr>
<td></td>
<td><strong>Bid Item 1 – Mobilization/Demobilization</strong></td>
</tr>
<tr>
<td></td>
<td>Mobilization</td>
</tr>
<tr>
<td></td>
<td>Demobilization</td>
</tr>
<tr>
<td></td>
<td><strong>Bid Item 2 – Worker Protection and Safety/Sheeting, Shoring and Bracing</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Bid Item 3 – Builder’s All Risk Insurance</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Bid Item 4 – Prestressed Concrete Equalization Storage Tanks</strong></td>
</tr>
<tr>
<td></td>
<td>Ground Improvements</td>
</tr>
<tr>
<td></td>
<td>Prestressed Storage Tank</td>
</tr>
<tr>
<td></td>
<td>Ladders and Walkways</td>
</tr>
<tr>
<td></td>
<td><strong>Bid Item 5 – Plant 2 Pump Station &amp; Associated Facilities</strong></td>
</tr>
<tr>
<td></td>
<td>Ground Improvements</td>
</tr>
<tr>
<td></td>
<td>Sheet Piling</td>
</tr>
<tr>
<td></td>
<td>Yard Piping</td>
</tr>
<tr>
<td></td>
<td>Yard Structures</td>
</tr>
<tr>
<td></td>
<td>Footings</td>
</tr>
<tr>
<td></td>
<td>Slab on Grade</td>
</tr>
<tr>
<td></td>
<td>Walls</td>
</tr>
<tr>
<td></td>
<td>Masonry</td>
</tr>
<tr>
<td></td>
<td>Metal Decking</td>
</tr>
<tr>
<td></td>
<td>Metal Framing</td>
</tr>
<tr>
<td></td>
<td>Equipment Pads</td>
</tr>
<tr>
<td></td>
<td>Equipment</td>
</tr>
<tr>
<td></td>
<td>Miscellaneous Metal Work</td>
</tr>
<tr>
<td></td>
<td>Doors and Windows</td>
</tr>
<tr>
<td></td>
<td>Finish Hardware</td>
</tr>
<tr>
<td></td>
<td>Fabricated Grating</td>
</tr>
<tr>
<td></td>
<td>Roof Materials</td>
</tr>
<tr>
<td></td>
<td>Flashing Sheet Metal</td>
</tr>
</tbody>
</table>
Bid Item 6 – Microfiltration System Equipment
Bid Item 7 – Microfiltration System Equipment Installation
Bid Item 8 – Trojan Ultraviolet Light System Equipment
Bid Item 9 – RO Elements
Bid Item 10 – Process Control Integration
Bid Item 11 – Allowance - Witness Factory Testing
  Equipment Identified in Contact Documents
Bid Item 12 – Area 100 Yard Piping
  54/66-inch SE

Bid Item 12 – Area 200 - Microfiltration
  Sheet Piling
  Footings
  Slab on Grade
  Walls
  Elevated Slab
  Equipment Pads
  Canopy
  Screen Wall
  Handrail
  Tanks
  Equipment
  Miscellaneous Metal Work
  Mechanical
  Plumbing
  Painting and Coatings
  HVAC
  Electrical
  Instrumentation

Bid Item 12 – Area 400 – Bulk Chemical Storage / Cartridge
  Filter Facility
  Tanks
  Equipment
  Mechanical
  Electrical
  Instrumentation

Bid Item 12 – Area 510 – RO Building
  Prefabricated Electrical Building
  Equipment
Bid Item 12 – Area 600 – UV Facility

- Equipment
- Miscellaneous Metal Work
- Fabricated Grating
- Mechanical
- Electrical
- Instrumentation

Bid Item 12 – Area 700 – Polymer / Post Treatment

- Equipment Pads
- Equipment
- Tank
- Miscellaneous Metal Work
- Mechanical
- Painting and Coatings
- Electrical
- Instrumentation

Bid Item 12 – Area 800 – Product and Barrier Pump Station

- Equipment
- Tanks
- Platform and Ladders
- Mechanical
- Electrical
- Instrumentation
Code Name: CONT
Description: CONTRACTOR / SubContractor
Field Length: 4

At a minimum, the CONTRACTOR shall assign a unique code for each SubContractor. Following are examples of code values and descriptions to illustrate the expected level of detail.

Examples:

<table>
<thead>
<tr>
<th>Code Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELEC</td>
<td>Electrical SubContractor</td>
</tr>
<tr>
<td>GENL</td>
<td>General Contractor</td>
</tr>
<tr>
<td>MECH</td>
<td>Mechanical SubContractor</td>
</tr>
</tbody>
</table>

Code Name: CSI
Description: CSI Division
Field Length: 4

At a minimum, the CONTRACTOR shall assign one of the following values that best describe the division for the Work involved to complete the activity.

<table>
<thead>
<tr>
<th>Code Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0100</td>
<td>General Requirements</td>
</tr>
<tr>
<td>0200</td>
<td>Sitework</td>
</tr>
<tr>
<td>0300</td>
<td>Concrete</td>
</tr>
<tr>
<td>0400</td>
<td>Masonry</td>
</tr>
<tr>
<td>0500</td>
<td>Metals</td>
</tr>
<tr>
<td>0600</td>
<td>Wood and Plastics</td>
</tr>
<tr>
<td>0700</td>
<td>Thermal and Moisture Protection</td>
</tr>
<tr>
<td>0800</td>
<td>Doors and Windows</td>
</tr>
<tr>
<td>0900</td>
<td>Finishes</td>
</tr>
<tr>
<td>1000</td>
<td>Specialties</td>
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<tr>
<td>1100</td>
<td>Equipment</td>
</tr>
<tr>
<td>1200</td>
<td>Furnishings</td>
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<tr>
<td>1300</td>
<td>Special Construction</td>
</tr>
<tr>
<td>1400</td>
<td>Conveying Systems</td>
</tr>
<tr>
<td>1500</td>
<td>Mechanical</td>
</tr>
<tr>
<td>1600</td>
<td>Electrical</td>
</tr>
<tr>
<td>1700</td>
<td>Instrumentation</td>
</tr>
</tbody>
</table>
Code Name       MS
Description: Milestone Activity
Field Length: 4

At a minimum, the CONTRACTOR shall assign a unique code for each Milestone required by the Contract Documents.

<table>
<thead>
<tr>
<th>Code Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Project Award</td>
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<tr>
<td></td>
<td>Notice to Proceed</td>
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<tr>
<td></td>
<td>Mobilization</td>
</tr>
<tr>
<td></td>
<td>Construction Trailers Completion</td>
</tr>
<tr>
<td></td>
<td>Process Control System Completion</td>
</tr>
<tr>
<td></td>
<td>54”/66” Secondary Effluent Pipeline Completion</td>
</tr>
<tr>
<td></td>
<td>Plant 2 Secondary Effluent Pump Station and Flow Equalization Facilities Completion</td>
</tr>
<tr>
<td></td>
<td>Beneficial Occupancy</td>
</tr>
<tr>
<td></td>
<td>Substantial Completion as Established in Bid Form</td>
</tr>
<tr>
<td></td>
<td>Final Completion as Established in Bid Form</td>
</tr>
<tr>
<td></td>
<td>Permit Constraints</td>
</tr>
<tr>
<td></td>
<td>Facility shutdown or outage milestone requirements</td>
</tr>
</tbody>
</table>

Code Name       TIE
Description: Shutdown / Tie-In
Field Length: 4

At a minimum, the CONTRACTOR shall assign a unique code for each Shutdown or Tie-In required to complete the Work.

<table>
<thead>
<tr>
<th>Code Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Outages A through V identified individually per Section 01140</td>
</tr>
<tr>
<td>Code Name</td>
<td>LOC</td>
</tr>
<tr>
<td>-----------</td>
<td>-----</td>
</tr>
<tr>
<td>Description:</td>
<td>Location</td>
</tr>
<tr>
<td>Field Length:</td>
<td>4</td>
</tr>
</tbody>
</table>

At a minimum, the CONTRACTOR shall assign a unique code for each significant area of the Work required by the Contract Documents.

<table>
<thead>
<tr>
<th>Code Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>_________</td>
<td>Area 100 - Yard Piping</td>
</tr>
<tr>
<td>_________</td>
<td>Area 144 – P2 Secondary Effluent Flow Equalization</td>
</tr>
<tr>
<td>_________</td>
<td>Area 200 - Microfiltration</td>
</tr>
<tr>
<td>_________</td>
<td>Area 300 – Green Acres Plant</td>
</tr>
<tr>
<td>_________</td>
<td>Area 400 – Bulk Chemical Storage / Cartridge Filter Facility</td>
</tr>
<tr>
<td>_________</td>
<td>Area 500 – RO Building</td>
</tr>
<tr>
<td>_________</td>
<td>Area 600 – UV Facility</td>
</tr>
<tr>
<td>_________</td>
<td>Area 700 – Decarbonation / Post Treatment</td>
</tr>
<tr>
<td>_________</td>
<td>Area 800 – Product and Barrier Pump Station</td>
</tr>
<tr>
<td>_________</td>
<td>Area 900 – Substation and Switchgear Building</td>
</tr>
</tbody>
</table>
APPENDIX C TO SECTION 01310
Activity ID System

The CONTRACTOR shall assign a unique identification number to each activity in the schedule to facilitate ease of reference and integration into the OCWD database. The CONTRACTOR shall prepare an Activity Identification Dictionary to provide a common key to the structure it employs following the examples provided below.

EXAMPLE ACTIVITY ID STRUCTURE

The 7th, 8th and 9th digits provide a unique designator
The 5th and 6th digit describes location / type detail
The 3rd and 4th digit refers to work type
The 1st and 2nd digit refers to primary work locations

The combination of symbols creates a unique reference ID that allows the same symbol to be used in more than one application.

EXAMPLE ACTIVITY IDENTIFICATION DICTIONARY
Scheduler shall coordinate with OCWD for more concise dictionary

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS</td>
<td>Product / Barrier Pump Station</td>
<td>HV</td>
<td>HVAC</td>
</tr>
<tr>
<td>DP</td>
<td>Decarbonation / Post Treatment</td>
<td>JB</td>
<td>Junction Box</td>
</tr>
<tr>
<td>AD</td>
<td>Administration</td>
<td>MC</td>
<td>Mechanical</td>
</tr>
<tr>
<td>AR</td>
<td>Architectural</td>
<td>ME</td>
<td>Mechanical Equipment</td>
</tr>
<tr>
<td>GA</td>
<td>Green Acres Plant</td>
<td>MP</td>
<td>Mechanical Piping</td>
</tr>
<tr>
<td>MF</td>
<td>Microfiltration Facility</td>
<td>MS</td>
<td>Milestones</td>
</tr>
<tr>
<td>SU</td>
<td>Substation / Switchgear Building</td>
<td>PE</td>
<td>Primary Effluent</td>
</tr>
<tr>
<td>BW</td>
<td>Baffle Walls / Basement Walls</td>
<td>RC</td>
<td>RAS Chlorination</td>
</tr>
<tr>
<td>CB</td>
<td>Catch Basin</td>
<td>RO</td>
<td>RO Building</td>
</tr>
<tr>
<td>CD</td>
<td>Conduits</td>
<td>RW</td>
<td>Retaining Walls / Raw Water</td>
</tr>
<tr>
<td>CS</td>
<td>Bulk Chemical Storage / Cartridge Filter Facility</td>
<td>SB</td>
<td>CONTRACTOR Submittal</td>
</tr>
<tr>
<td>UV</td>
<td>UV Facility</td>
<td>SP</td>
<td>Site Prep</td>
</tr>
<tr>
<td>CM</td>
<td>Commissioning</td>
<td>ST</td>
<td>Structure</td>
</tr>
<tr>
<td>DB</td>
<td>Duct Bank / Diversion Box</td>
<td>SX</td>
<td>Site Excavation</td>
</tr>
<tr>
<td>DL</td>
<td>Drain Line</td>
<td>TI</td>
<td>Tie-In</td>
</tr>
<tr>
<td>DR</td>
<td>Demo / Removal</td>
<td>TL</td>
<td>Trunk Line</td>
</tr>
<tr>
<td>EL</td>
<td>Electrical</td>
<td>TN</td>
<td>Tunnel</td>
</tr>
<tr>
<td>FN</td>
<td>Foundation</td>
<td>XX</td>
<td>No further description</td>
</tr>
<tr>
<td>FD</td>
<td>Fabricate &amp; Deliver</td>
<td>YP</td>
<td>Yard Piping</td>
</tr>
<tr>
<td>SP</td>
<td>SEFE Pump Station</td>
<td>ST</td>
<td>SEFE Tanks</td>
</tr>
</tbody>
</table>

Orange County Water District
Groundwater Replenishment System
Final Expansion

01310 CONSTRUCTION PROGRESS SCHEDULE
-28- April 2019
Issued for Bid
APPENDIX D TO SECTION 01310
Electronic File Naming

ELECTRONIC FILE NAMING

The CONTRACTOR shall assign a unique identification number to each electronic file submittal that will be compatible with the OCWD database. Each file shall be labeled with the OCWD project number, data date, submittal type abbreviation and file name as described below:

EXAMPLE FILE ID STRUCTURE (Primavera®)

_ _-_ _ _ _ YYMMDD _ _ _ _ _

The 17th and 18th digits record the revision, 00, 01, etc.
The 16th digit is left blank
The 15th digit records the submittal type P, D, F or T
The 14th digit is left blank
The 8th through 13th digits express the data date with 2 digits for the year, followed by 2 digits for the month followed by 2 digits for the day
The 7th digit is left blank
The 1st through 6th digits record the OCWD project number.

Submittal types are: Pure Progress: P, Draft Update: D, Final Update: F and TIA: T. The combination of symbols creates a unique ID for each file that can be integrated and managed within the OCWD database. An example would be P1-000 100608 F 00, which identifies Plant 1 project 000, data date June 08, 2010, Final Update, Revision 00.

EXAMPLE FILE NAMING STRUCTURE (Primavera®)

The file name shall be structured to reflect the file content in words as exemplified by the following illustration:

Project ID       Project Name
P1-000 100608 F 00       June 08, 2010 Update - FINAL Rev 00.xer

EXAMPLE FILE NAMING STRUCTURE

Non-Primavera® native files that comprise the balance of the submittal shall be named to reflect the file content in words as exemplified by the following illustrations:

June 08, 2010 Progress Update Narrative Report - FINAL Rev 00.docx

June 08, 2010 Progress Update Tables - FINAL Rev 00.xlsx (all MS Excel® report attachments shall be submitted in one workbook).
APPENDIX E TO SECTION 01310
Construction Schedule Update Preparation and Review

STEP 1 - INFORMAL UPDATE SUBMITTAL:
A. Electronic files:
   1. Unimpeded pure progress update of all work actually occurred during the update period saved in an electronic file entitled “Pure Progress”;
   2. Continuation of the update to include each proposed revision saved in an electronic file entitled “Draft Update”.
B. Printed Informal Update Submittal Report:
   1. Narrative Report including a Schedule Change Table describing each revision that actually took place during the update period, and each proposed revision for discussion and acceptance of by the ENGINEER. This shall also include the following:
      - Target Analysis Schedules comparing the Pure Progress file to the previous months authorized update file and comparing the Draft Update file to the Pure Progress Update file.

STEP 2 - REVIEW MEETING:
A. Review and comment on CONTRACTOR’s periodic payment application
B. Review and comment on CONTRACTOR’s update to critical path schedule
C. Review and comment on CONTRACTOR’s actual and proposed schedule revisions
D. Identify problems that could impede planned progress, and assign action items along with responsible parties
E. Develop corrective measures and procedures to regain planned schedule.

STEP 3 - CONTRACTOR REVISION:
A. Revise the Narrative Report and Construction Schedule update as agreed at the meeting including the Schedule Change Table.

STEP 4 - FINAL UPDATE SUBMITTAL:
A. Revised electronic file incorporating only those comments agreed to by the ENGINEER, saved in an electronic file entitled “Update”;
B. Revised Narrative Report, Tables and Construction Schedule for validation of conformance with the ENGINEER’s meeting comments.
EXAMPLE CALENDAR - UPDATE PREPARATION AND REVIEW SEQUENCE:

The following example calendar illustrates the sequence of tasks required for the CONTRACTOR and ENGINEER to prepare, discuss and complete a review of the Narrative Progress Report and Construction Schedule update and facilitate a timely determination to support the payment application.

<table>
<thead>
<tr>
<th>Action</th>
<th>Day Dur</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Date (Up to 2 Weeks Prior to Due Date)</td>
<td>0</td>
</tr>
<tr>
<td>Informal Review Submittal</td>
<td>7</td>
</tr>
<tr>
<td>Meeting - OCSD &amp; Contractor</td>
<td>0</td>
</tr>
<tr>
<td>Contractor - Update Preparation</td>
<td>7</td>
</tr>
<tr>
<td>Contractor - Revise &amp; Correct Submittal</td>
<td>4</td>
</tr>
<tr>
<td>OCSD Informal Review - Schedule</td>
<td>2</td>
</tr>
<tr>
<td>OCSD Analysis &amp; Report Preparation - Schedule</td>
<td>7</td>
</tr>
<tr>
<td>OCSD Verify Revisions - Schedule</td>
<td>3</td>
</tr>
<tr>
<td>OCSD Informal Review - Payment Application</td>
<td>2</td>
</tr>
<tr>
<td>OCSD Verify Revisions - Payment Application</td>
<td>3</td>
</tr>
<tr>
<td>OCSD Complete &amp; Forward - Payment Application</td>
<td></td>
</tr>
</tbody>
</table>

DATA DATE
(Up to 2 Weeks Prior to Due Date)
Prepare Payment Application & Schedule
Review Meeting
Due to Accounting by 12:00 PM

INFORMAL REVIEW SUBMITTAL
Meetings - OCSD & Contractor
Prepare Submittal
Verify

UPDATE PREPARATION
OCSD Analysis & Report Preparation
OCSD Verify Revisions
OCSD Complete & Forward
APPENDIX F TO SECTION 01310
Time Adjustment Request

APPROACH

It shall be the CONTRACTOR’s sole responsibility to make a full, complete and comprehensive case for each time adjustment request. As part of its request the CONTRACTOR shall demonstrate that no concurrent cause would have equally impacted the Work regardless of OCWD action. The following outline provides an overview of requirements which the CONTRACTOR shall confirm with its own review of Contract Documents.

PREPARATION OF INDIVIDUAL TIME ADJUSTMENT REQUEST

Requests for time adjustments shall be submitted in the time and manner specified in the Contract Documents which require the CONTRACTOR to file a written request for time extension within 15 days “from the beginning of the delay” that includes, at a minimum:

1. A written Time Impact Analysis (TIA)

2. A Fragnet (fragmentary network) showing how the CONTRACTOR proposes to incorporate the change or delay into the current construction schedule.

3. The Contract Documents require the CONTRACTOR’s request for time extension to accompany either a:

   A. Request for Change (RFC) if initiated by the CONTRACTOR

   B. Request for Proposal (RFP) if initiated by OCWD

4. The CONTRACTOR is obligated to promptly request each time extension to inform the ENGINEER that the CONTRACTOR believes a discrete time impact affecting a milestone or contract completion date has been encountered, what steps the CONTRACTOR believes must be taken to mitigate it, and engage the ENGINEER in collaborative mitigation efforts as close in “real time” as possible.

5. The schedule in place at the start or occurrence of the impact event is to be used for analysis of all impacts encountered during the period in which the impact event occurs. For example, if an impact is encountered in April 2020, the schedule to be analyzed is the authorized March 2020 periodic update.

6. The CONTRACTOR shall describe its proposed mitigation plan in a written TIA accompanied by a Fragnet that illustrates the sequence of activities required to accomplish the plan in sufficient detail for the ENGINEER to fully understand the scope and magnitude of impact. The Fragnet shall also illustrate how the mitigation activities impact the critical path by including logic tie(s) to its immediate existing predecessor(s) and logic tie(s) to its immediate existing successor(s).

7. The CONTRACTOR is reminded that notice of potential delay shall be deemed insufficient to meet the requirements of the Contract and that reservation of rights to submit a future request may not be made at the sole discretion of the CONTRACTOR and shall be subject to ENGINEER’s written authorization.
FRAGNET EXAMPLE

<table>
<thead>
<tr>
<th>Activity ID</th>
<th>Activity Name</th>
<th>Dur</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA.BB.CC.012</td>
<td>Predecessor</td>
<td>4D</td>
</tr>
<tr>
<td>AA.BB.CC.013.A</td>
<td>New Activity # 1</td>
<td>3D</td>
</tr>
<tr>
<td>AA.BB.CC.013.B</td>
<td>New Activity # 2</td>
<td>2D</td>
</tr>
<tr>
<td>AA.BB.CC.013.C</td>
<td>New Activity # 3</td>
<td>3D</td>
</tr>
<tr>
<td>AB.BB.CC.002</td>
<td>Successor # 1</td>
<td>5D</td>
</tr>
<tr>
<td>BA.BB.CD.008</td>
<td>Successor # 2</td>
<td>5D</td>
</tr>
</tbody>
</table>

TIA EVALUATION

OCWD utilizes contemporaneous period analysis for time impact evaluations as the method least susceptible to analyst manipulation, thus the most equitable to all parties. This methodology is reliant on timely submittal to ensure its integrity. The CONTRACTOR’s failure to make its submittal in the time and manner required by the Contract may impede effective and equitable evaluation of its assertion of time impact. Consequently, OCWD may be compelled to perform a forensic reconstruction of the event, including subjective speculation and assumptions, to more definitively assess the request.

The CONTRACTOR may find it expedient to prepare the TIA schedule (a parallel schedule) in conjunction with the Construction Schedule update. However, the CONTRACTOR shall submit it separately following the normal processes described in the Contract Documents. The review and status recommendation of the Construction Schedule update, in accordance with its accelerated seven-day review window, will take precedence over review and discussion of the TIA submittal.

OCWD will use the checklist provided in this section to initiate review of the CONTRACTOR’s request and confirm its compliance with Contract requirements before proceeding with a technical review. Should the CONTRACTOR’s request fail to meet Contract requirements the checklist will be returned to the CONTRACTOR with deficiencies noted and a request that the CONTRACTOR comply with the Contract in preparing its TIA.
**RFC/RFP:**

**REVIEW CHECKLIST**

**IMPACT EVENT:** Description

---

### CONTRACT REQUIREMENT

<table>
<thead>
<tr>
<th>Written Request:</th>
<th>YES</th>
<th>NO</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>• RFC:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• RFP:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Time Impact Event:

<table>
<thead>
<tr>
<th>Start:</th>
<th>End:</th>
</tr>
</thead>
</table>

### Request Provided Within 15 days:

<table>
<thead>
<tr>
<th>Discovery Date:</th>
<th>Date TIA Submitted:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Due:</td>
<td>___ days after discovery</td>
</tr>
</tbody>
</table>

### Evaluation Basis:

<table>
<thead>
<tr>
<th>Actual - use all available actual information</th>
<th>Anticipated - estimate if actuals are unavailable</th>
</tr>
</thead>
</table>

### Written TIA Demonstrating:

<table>
<thead>
<tr>
<th>The events of the delay</th>
<th>Status of construction at discovery of event</th>
<th>Event time computation of all activities affected by the change or delay.</th>
</tr>
</thead>
</table>

### Fragnet:

<table>
<thead>
<tr>
<th>Sequence of activities</th>
<th>Logic tie(s) to existing predecessor(s)</th>
<th>Logic tie(s) to existing successor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status of construction at discovery of event</td>
<td>Event time computation of all activities affected by the change or delay.</td>
<td></td>
</tr>
</tbody>
</table>

### Schedule Update:

<table>
<thead>
<tr>
<th>Current at the time the change or delay is encountered DD:</th>
<th>Actual performance of the Work extends:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beyond current contract completion date</td>
<td>Beyond current predicted completion date</td>
</tr>
</tbody>
</table>

---

*In accordance with the Contract a written request for extension of time or the granting of an extension of time shall not, in itself, constitute a basis for any claim against OCWD for additional compensation.*
1.1 SUBMITTAL REQUIREMENTS

A. The CONTRACTOR shall submit the items required by Specification Section 01310 in accordance with this Appendix and the other Contract Documents unless noted otherwise herein.

B. Following Notice to Proceed (NTP) the CONTRACTOR shall submit the following items within the stipulated timeframes:
   1. CONTRACTOR’s Construction Scheduler Qualifications, within seven days following NTP
   2. CPM Construction Schedule methodology, within ten days following NTP
   3. Work Breakdown Structure (WBS) Code, Activity Coding and ID system plans within ten days following NTP
   4. Interim Construction Schedule, within 30 days following NTP
   5. Commence submittal of the first three week look ahead schedule, within 30 days following NTP
   6. Commence submittal of initial Daily Reports, dated from the start of onsite Work, within 30 days following NTP
   7. Narrative Report supported by the Cost-loaded and Resource-loaded Baseline Construction Schedule, including supporting documents, within 90 days following NTP.

C. The CONTRACTOR’s Interim Construction Schedule shall be prepared, maintained and submitted in accordance with this Specification section and the other Contract Documents. It shall be submitted in both electronic and physical forms.

D. The CONTRACTOR’s Baseline Construction Schedule and reports shall be prepared, maintained and submitted in accordance with this Specification section and the other Contract Documents. It shall be submitted in both electronic and physical forms.

E. The CONTRACTOR’s Construction Schedule Update and reports shall be prepared, maintained and submitted in accordance with this Specification section and the other Contract Documents. It shall be submitted in conjunction with the CONTRACTOR’s Progress Period Payment Application and shall be in both electronic and physical forms.

F. The CONTRACTOR’s As-Built Construction Schedule shall be prepared, maintained and submitted in accordance with this Specification section and the other Contract Documents. It shall be submitted in both electronic and physical forms.

G. The CONTRACTOR’s Three Week Look Ahead Schedule shall be prepared, maintained and submitted in accordance with this Specification section and the other Contract Documents no later than 48 hours before each weekly construction
progress meeting. It shall be submitted in electronic form via e-mail or CD at the option of the ENGINEER.

### 1.2 REQUIRED REPORT SUBMITTAL CYCLES AND COMPONENTS

**A.** The CONTRACTOR shall include the following reports and report components with its submittals in the time, quantities and manner described in the following table and the other Contract Documents unless noted otherwise herein.

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Format</th>
<th>Initial Interim &amp; Baseline</th>
<th>Progress Reports</th>
<th>3 Week Look Ahead</th>
<th>Daily Reports</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CPM Interim</td>
<td>CPM Update</td>
<td>As-Built</td>
</tr>
<tr>
<td>Submittal Cycle</td>
<td>--</td>
<td>Per Contract</td>
<td>28 Days</td>
<td>28 Days</td>
<td>Once</td>
</tr>
<tr>
<td>Electronic Files of Submittal</td>
<td>CD</td>
<td></td>
<td>2 CD</td>
<td>2 CD</td>
<td>2 CD</td>
</tr>
<tr>
<td>Elements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>e-mail</td>
</tr>
<tr>
<td>Printed Report Components:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Written Narrative Report</td>
<td>8.5 x 11</td>
<td>4 ea</td>
<td>4 ea</td>
<td>4 ea</td>
<td>--</td>
</tr>
<tr>
<td>• OCWD Activities Report</td>
<td>8.5 x 11</td>
<td>4 ea</td>
<td>4 ea</td>
<td>4 ea</td>
<td>--</td>
</tr>
<tr>
<td>• Schedule Change Table</td>
<td>11 x 17</td>
<td>4 ea</td>
<td>4 ea</td>
<td>4 ea</td>
<td>--</td>
</tr>
<tr>
<td>• Cost Summary</td>
<td>11 x 17</td>
<td>4 ea</td>
<td>4 ea</td>
<td>4 ea</td>
<td>--</td>
</tr>
<tr>
<td>• Cost Curve</td>
<td>11 x 17</td>
<td>4 ea</td>
<td>4 ea</td>
<td>4 ea</td>
<td>--</td>
</tr>
<tr>
<td>• Critical Path Schedule</td>
<td>11 x 17</td>
<td>4 ea</td>
<td>4 ea</td>
<td>4 ea</td>
<td>--</td>
</tr>
<tr>
<td>• Four Week Look Ahead</td>
<td>11 x 17</td>
<td>4 ea</td>
<td>4 ea</td>
<td>4 ea</td>
<td>--</td>
</tr>
<tr>
<td>Schedule</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• CPM Schedule</td>
<td>11 x 17</td>
<td>4 ea</td>
<td>4 ea</td>
<td>4 ea</td>
<td>--</td>
</tr>
<tr>
<td>Required Supplements:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• [Price Breakdown]</td>
<td>11 x 17</td>
<td>4 ea</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>• Schedule of Submittals</td>
<td>11 x 17</td>
<td>4 ea</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>• CPM Schedule Plot</td>
<td>30 x 42</td>
<td>1 ea</td>
<td>--</td>
<td>1 ea</td>
<td>--</td>
</tr>
<tr>
<td>• CPM Logic Diagram Plot</td>
<td>30 x 42</td>
<td>1 ea</td>
<td>--</td>
<td>1 ea</td>
<td>--</td>
</tr>
</tbody>
</table>

### 1.3 REPORT COMPONENTS

**A.** The CONTRACTOR shall provide electronic files for all components of each submittal required by this Specification section. The files shall include all templates used by the CONTRACTOR with screen shots of each for reference. The CONTRACTOR shall name and label its electronic files in accordance with the file naming convention appended to this Specification section.

**B.** The CONTRACTOR shall provide printed and bound reports in the quantities and format described in this Specification section and the other Contract Documents. The reports shall be prepared using Arial font no smaller than 10 points, be divided by component section tabs and be bound in new three ring binders. 11” x 17” pages shall be tri-folded to match the 8.5” x 11” pages.
C. At a minimum, report components shall be comprised of and contain the following:

1. Narrative Report with content as described in this Specification section and as illustrated by Plate 1;

2. OCWD Activities Report, shall be generated by the CONTRACTOR from the scheduling software to list each remaining activity on the CPM Schedule which requires OCWD action such as power supplied equipment, plant shutdowns, permits, inspections, approvals, start-ups, training activities, etc., as illustrated by Plate 4;

3. Schedule Change Table, shall be prepared by the CONTRACTOR in an MS Excel® spreadsheet to describe each Schedule activity that has been added or deleted or had a change in planned sequence, duration, logic and/or relationship(s) during the reporting period as illustrated by Plate 2;

4. Cost Summary, shall be generated by the CONTRACTOR from the scheduling software to support each progress payment application to the requisition level of detail. The cost information shall be updated by activity and summarized for each monthly pay application and the sum of all pay applications shall be shown as costs to date, along with the remaining contract balance. The sum of all monthly costs shall be equal to the Contract Price plus approved Change Orders;

5. Cost Curve, shall be generated by the CONTRACTOR from the scheduling software to show cash flow projections by month and include actual partial payment amounts and cumulative total;

6. Critical Path Schedule shall be a Gantt chart generated by the CONTRACTOR from the scheduling software, sorted by start date and show Logic Ties;

7. Four Week Look-Ahead Schedule, shall be a Gantt Chart generated by the CONTRACTOR from the scheduling software, in WBS form sorted by Start Date (SD) and showing all Work planned by the CONTRACTOR for the next progress reporting period;

8. CPM Schedule shall be a Gantt chart generated by the CONTRACTOR from the scheduling software, in WBS form sorted by Start Date (SD). At a minimum the activity table shall include activity ID number, activity description, original durations, start date, finish date, total float and activity constraints.

D. Required Supplemental Submittals:

1. Price Breakdown shall be prepared and submitted by the CONTRACTOR as provided for in the Contract Documents.

2. Schedule of Submittals shall be prepared and submitted by the CONTRACTOR as provided for in the Contract Documents.

3. Three Week Look Ahead shall be prepared and submitted by the CONTRACTOR in an MS Excel® spreadsheet as provided for in this Specification section and the other Contract Documents and shall, at a minimum, provide the data illustrated in Plate 3;
4. CONTRACTOR Daily Reports shall be prepared and submitted by the CONTRACTOR as provided for in the Contract Documents;

5. CPM Schedule Plot shall be a Gantt chart generated by the CONTRACTOR from the scheduling software, in WBS form sorted by Start Date (SD). At a minimum the activity table shall include activity ID number, activity description, original durations, start date, finish date, total float and activity constraints. The CONTRACTOR shall submit a plot of the schedule on 30” x 42” sheets of the Baseline, at 25%, 50%, 75% completion and of the As-Built submittal, and as directed by the ENGINEER for any major re-sequencing, logic revision, re-baseline and/or integration of the commissioning plan.

6. CPM Logic Diagram Plot shall be a Precedence Diagram generated by the CONTRACTOR from the scheduling software, using the Activity Network icon. At a minimum the activity table shall include the Activity ID, Activity Name, Start Date and Finish Date. The CONTRACTOR shall submit a plot of the diagram on 30” x 42” sheets of the Baseline, at 25%, 50%, 75% completion and of the As-Built submittal, and as directed by the ENGINEER for any major re-sequencing, logic revision, re-baseline and/or integration of the commissioning plan.

1.4 EXAMPLE PLATES

A. At its option, the CONTRACTOR shall use its own forms or the templates available from OCWD to report, at a minimum, the required data illustrated in the following example plates:

- Plate 1 - Example Narrative Report
- Plate 2 - Schedule Change Table
- Plate 3 - Three Week Look-Ahead
- Plate 4 - OCWD Activities Report
1. GENERAL.

1.01. Units of Measurement. When both inch-pound (English) and SI (metric) units of measurement are specified herein, the values expressed in inch-pound units shall govern.

2. SCHEDULE OF VALUES. After review of the preliminary schedule at the preconstruction conference, and before submission of the first Application for Payment, Contractor shall prepare and submit to Engineer a Schedule of Values covering each lump sum item. The Schedule of Values, showing the value of each kind of work, shall be acceptable to Engineer before any Application for Payment is prepared.

The sum of the items listed in the Schedule of Values shall equal the Contract Price. Such items as Bond premium, temporary construction facilities, and plant may be listed separately in the Schedule of Values, provided the amounts can be substantiated. Overhead and profit shall not be listed as separate items.

The Schedule of Values shall have sufficient detail such that partial completion of separable items of work can easily be calculated. The Schedule of Values shall have separate lines for manufacturer's field services, O&M manuals, and performance testing for each item of equipment requiring such services. Payment for submittals (other than O&M Manuals) will not be approved.

An unbalanced Schedule of Values providing for overpayment of Contractor on items of Work which would be performed first will not be accepted. The Schedule of Values shall be revised and resubmitted until acceptable to Engineer. Final acceptance by Engineer shall indicate only consent to the Schedule of Values as a basis for preparation of applications for progress payments, and shall not constitute an agreement as to the value of each indicated item.

3. SCHEDULE OF PAYMENTS. Within 30 days after award of contract, Contractor shall furnish to Engineer a schedule of estimated monthly payments. The schedule shall be revised and resubmitted each time an Application for Payment varies more than 10 percent from the estimated payment schedule.

4. SURVEY DATA. All field books, notes, and other data developed by Contractor in performing surveys required as part of the Work shall be available to Engineer for examination throughout the construction period. All such data
shall be submitted to Engineer with the other documentation required for final acceptance of the Work.

5. **LAYOUT DATA.** Contractor shall keep neat and legible notes of measurements and calculations made in connection with the layout of the Work. Copies of such data shall be furnished to the Construction Manager for use in checking Contractor's layout as provided in the project requirements section. All such data considered of value to Owner will be transmitted to Owner by Engineer with other records upon completion of the Work.

End of Section
PART 1 - GENERAL

1-1. SUMMARY.

A. Section includes:
   1. Requirements for web-based construction document management.

B. Related sections:
   1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.
   2. It is the Contractor’s responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor’s Work.
   3. The following Sections are related to the Work described in this Section. This list of Related Sections is provided for convenience only and is not intended to excuse or otherwise diminish the duty of the Contractor to see that the completed Work complies accurately with the Contract Documents.
      a. Section 01300 – Submittals
      b. Section 01340 – Requests for Information and Clarifications

1-2. REQUIREMENTS.

A. The Owner and Contractor shall utilize PROCORE (PROCORE is a registered trademark of PROCORE LLC) for submission of all data and documents (unless specified otherwise in this Section) throughout the duration of the Contract.
   1. PROCORE is a web-based electronic media site hosted by PROCORE LLC.
   2. PROCORE is paid for by the Owner.
   3. PROCORE will be made available to all Contractor’s personnel, subcontractor personnel, suppliers, consultants, and Engineer.
   4. The joint use of this system is to facilitate electronic exchange of information, automation of key processes, and overall management of Contract Documentation.
5. PROCORE shall be the primary means of project information submission and management.

B. User access limitations:

1. The Engineer will control the Contractor’s access to PROCORE by allowing access and assigning user profiles to accepted Contractor personnel. User profiles will define levels of access into the system; determine assigned function based authorizations and user privileges. Subcontractors and suppliers will be given access to PROCORE by and through the Contractor. Entry of information exchanged and transferred between the Contractor and its subcontractors and suppliers on PROCORE shall be the responsibility of the Contractor.

C. Joint ownership of data:

1. Data entered in a collaborative mode (entered with the intent to share as determined by permissions and workflows within the PROCORE system) by the Engineer and the Contractor will be jointly owned.

D. Automated system notification and audit log tracking:

1. Review comments made (or lack thereof) by the Owner on Contractor submitted documentation shall not relieve the Contractor from compliance with requirements of the Contract Documents. The Contractor is responsible for managing, tracking, and documenting the Work to comply with the requirements of the Contract Documents. Owner’s acceptance via automated system notifications or audit logs extends only to the face value of the submitted documentation and does not constitute validation of the Contractor's submitted information.

E. Computer Requirements:

1. The Contractor shall use computer hardware and software that meets the requirements of the PROCORE system as recommended by PROCORE LLC to access and utilize PROCORE. As recommendations are modified by PROCORE, the Contractor will upgrade their system(s) to meet or exceed the recommendations. Upgrading of the Contractor's computer systems will not be justification for a cost or time modification to the Contract.

2. The Contractor shall ensure that connectivity to the PROCORE system is accomplished through DSL, cable, T-1 or wireless communications systems. The minimum bandwidth requirements for using the system is 128kb/s. It is recommended a faster connection be used when uploading pictures and files into the system.
3. PROCORE supports the current and prior two major versions of Chrome, Mozilla's Firefox, Microsoft's Internet Explorer and Apple’s Safari on a rolling basis.
   a. Each time a new version of one of these browsers is released, PROCORE will begin supporting the update and stop supporting the fourth-oldest version.

F. Contractor responsibility:
   1. The Contractor shall be responsible for the validity of their information placed in PROCORE and for the abilities of their personnel.
   2. Accepted users shall be knowledgeable in the use of computers, including Internet Browsers, email programs, cad drawing applications, and Adobe Portable Document Format (PDF) document distribution program.
   3. The Contractor shall utilize the existing forms in PROCORE to the maximum extent possible. If a form does not exist in PROCORE the Contractor must include a form of their own or provided by the Engineer as an attachment to a submittal.
   4. Adobe PDF documents will be created through electronic conversion rather than optically scanned whenever possible. The Contractor is responsible for the training of their personnel in the use of PROCORE (outside what is provided by the Owner) and the other programs indicated above as needed.

1-3. SUBMITTALS. Preconstruction Submittals List of Contractor's key PROCORE personnel. Include descriptions of key personnel's roles and responsibilities for this project. Contractor should also identify their organizations administrator on the list.

PART 2 - PRODUCTS

2-1. DESCRIPTION.

PART 3 - EXECUTION

3-1. PROCORE UTILIZATION. PROCORE shall be utilized in connection with all document and information management required by these Contract Documents.

3-2. SUBMITTALS

A. Shop drawings:
   1. Shop drawing and design data documents shall be submitted PDF attachments to the PROCORE submittal work flow process and form. Examples of shop drawings include, but are not limited to:
      a. Standard manufacturer installation drawings.
      b. Drawings prepared to illustrate portions of the work designed or developed by the Contractor.
      c. Steel fabrication, piece, and erection drawings.
   2. Hard copy submittals may be allowed, if approved by the Engineer on a case-by-case basis.
      a. Hard copy submittals shall be handled following procedures for Samples defined below.

3-3. PRODUCT DATA.

A. Product catalog data and manufacturer’s instructions shall be submitted as PDF attachments to the PROCORE submittal work flow process and form. Examples of product data include, but are not limited to:
   1. Manufacturer’s printed literature.
   2. Preprinted product specification data and installation instructions.

3-4. SAMPLES.

A. Sample submittals shall be physically submitted as specified in Section 01300. Contractor shall enter submittal data information into PROCORE with a copy of the submittal form(s) attached to the sample. Examples of samples include, but are not limited to:
   1. Product finishes and color selection samples.
   2. Product finishes and color verification samples.
   3. Finish/color boards.
   4. Physical samples of materials.
3-5. **ADMINISTRATIVE SUBMITTALS.**

A. All correspondence and pre-construction submittals shall be submitted using PROCORE. Examples of administrative submittals include, but are not limited to:

1. Permits.
2. Requests for substitutions (RFS).
3. List of contact personnel.
4. Requests for Information (RFI).

B. Network Analysis Schedules and associated reports and updates. Each schedule submittal specified in these Contract Documents shall be submitted as a native backed-up file (.PRX or .STX) of the scheduling program being used. The schedule shall also be posted as a PDF file in the format specified in these Contract Documents.

C. Plans for safety, demolition, environmental protection, and similar activities.

D. Quality Control Plan(s), Testing Plan and Log, Quality Control Reports, Production Reports, Quality Control Specialist Reports, Preparatory Phase Checklist, Initial Phase Checklist, Field Test reports, Summary reports, Rework Items List, etc.

E. Meeting minutes for quality control meetings, progress meetings, pre-installation meetings, etc.

F. Any general correspondence submitted.

3-6. **COMPLIANCE SUBMITTALS.**

A. Test reports, certificates, and manufacture field report submittals shall be submitted on PROCORE as PDF attachments. Examples of compliance submittals include, but are not limited to:

1. Field test reports.
2. Quality Control certifications.
3. Manufacturers documentation and certifications for quality of products and materials provided.
3-7. **RECORD AND CLOSEOUT SUBMITTALS.**

A. Operation and maintenance data and closeout submittals shall be submitted on PROCORE as PDF documents during the approval and review stage as specified, with actual set of documents submitted for final. Examples of record submittals include, but are not limited to:

1. Operation and Maintenance Manuals: final documents shall be submitted as specified.
2. Extra materials, spare stock, etc.: submittal forms shall indicate when actual materials are submitted.

3-8. **CLOSEOUT ACTIVITIES.**

A. Training:

1. The Owner has arranged and paid for training to be provided to the Contractor.
2. Training consists of web-based seminars in conjunction with a conference call.

B. Contractor shall arrange and pay for the facilities and hardware/software required to facilitate his own training.

3-9. **FINANCIAL SUBMITTALS.**

A. Schedule of Value, Pay Estimates, and Change Request Proposals shall be submitted on PROCORE. Supporting material for Pay Estimates and Change Requests shall be submitted on PROCORE as PDF attachments. Examples of compliance submittals include, but are not limited to:

1. Contractor’s Schedule of Values.
2. Contractor’s Monthly Progress Payment Requests.
3. Contract Change proposals requested by the Owner.

End of Section
1. GENERAL. Should the Contractor discover conflicts, omissions, or errors in the contract documents, or have any questions concerning interpretation or clarification of the contract documents, or if it appears to the Contractor that work to be done or any matter relative thereto are not sufficiently detailed or explained in the contract documents, then, before proceeding with the work affected, the Contractor shall immediately notify the Engineer in writing and request interpretation, clarification, or additional detailed instructions concerning the work. In addition to the requirements set forth in the General and Special Provisions, this section details additional procedural requirements for Requests for Information (RFI) and Clarifications.

The Contractor shall be responsible for its costs to implement and administer RFI’s throughout the Contract duration. Regardless of the number of RFI’s submitted, Contractor will not be entitled to additional compensation.

A RFI is not to be used for request for materials/equipment substitutions or value engineering/cost reduction incentive proposals.

2. RFI PROCEDURES.

2-1. Contractor Review and Submittal.

A. Contractor’s review:

Before submitting each RFI, the Contractor shall carefully review the following for relevant information:

1. All field measurements, quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto

2. All materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work

3. All information relative to means, methods, techniques, sequences, and procedures of construction and safety precautions and programs incident thereto

4. The coordination of each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents
5. The Contract Documents

6. The Project correspondence and documentation

B. Submittal requests:

The Contractor shall submit all requests for clarification and/or additional information in writing through the Engineer. Contractor shall provide a detailed written statement that indicates the specific Drawings or Specifications in need of clarification and the nature of the clarification requested.

Contractor shall upload RFI electronically on project website and inform Engineer. Each RFI shall be dated and bear a signed certification that Contractor has performed the review defined above. No consideration for review by Engineer of any RFI will be made for any item which has not been certified by the Contractor. All non-certified RFI’s will be returned to Contractor without action taken by Engineer, and any delays caused thereby shall be the total responsibility of Contractor.

Each RFI shall be limited to one subject.

2-2. RFI Numbering System.

The Engineer will assign blocks of numbers for the Contractor, Engineer, Owner’s Representative, and for substitutions. The Contractor will use the block of numbers consecutively with the date of issue, except for re-issuance of a respective RFI in which the subscript A, B, C, etc., will be added until the RFI is resolved. If Contractor believes the RFI reviewer’s response is incomplete, Contractor shall issue another RFI (with the same RFI number with the letter "A" indicating if it is a follow-up RFI) to Engineer clarifying original RFI. Additionally, Engineer may return RFI requesting additional information should original RFI be inadequate in describing condition.

End of Section
PART 1 – GENERAL

1-1. SCOPE. This section covers the environmental controls required during execution of the work. Further environmental controls are available in the Project’s Environmental Impact Report (EIR) and Mitigated Negative Declaration (MND), available for review at the District.

1-2. SITE MAINTENANCE.

The Contractor shall keep the work site, staging areas, and Contractor’s facilities clean and free from rubbish and debris and shall comply in accordance with the General and Special Provisions. In addition, the contractor shall be responsible for the following activities:

A. Clean-up:

1. To prevent environmental pollution arising from the construction activities related to the performance of this Contract, the Contractor and subcontractors shall comply with all applicable Federal, State and local laws and regulations concerning waste material disposal, as well as the specific requirements stated in this Section and elsewhere in the Specifications.

2. The Contractor shall keep all buildings occupied by the Contractor clear of all refuse, rubbish and debris that may accumulate from any source and shall keep them in a neat condition to the satisfaction of the Engineer.

3. In the event that waste material, refuse, debris and/or rubbish are not so removed from the work by the Contractor, the Owner reserves the right to have the waste material, refuse, debris and/or rubbish removed and the expense of the removal and disposal charged to the Contractor.

4. Paints, solvents, and other construction materials shall be handled with care to prevent entry of contaminants into storm drains, surface waters, or soils.

5. Contractor shall maintain all interiors of buildings and structures in broom sweep clean condition at all times during construction of buildings and structures. Upon enclosing the buildings or structures and installation of process equipment, interior finishes, or fixtures, the
Contractor shall maintain the building or structure in mop or vacuum-clean condition.

B. Street Cleaning:

1. The Contractor shall be responsible for preventing dirt and dust from escaping from trucks departing the project site, by covering dusty loads, washing truck tires before leaving the site, or other reasonable methods.

2. When working dump trucks and/or other equipment on paved streets and roadways, the Contractor will be required to clean said streets as required by the Engineer to remove dirt caused by the Contractor’s activities. The use of water in amounts, which result in mud on public streets, is not acceptable as a substitute for sweeping or other methods. Equipment for this operation shall be on the job site or available at all times.

3. If the above requirements are violated and no action is taken by the Contractor after notification of infraction by the Engineer, the Owner reserves the right to have the streets in question cleaned by others and the expense of the operation charged to the Contractor.

4. Contractor shall broom clean all offsite adjacent roadways, daily during any demolition and disposal, mass excavation and haul off, grading, trenching or any other sitework operations. Contractor shall broom clean all onsite pavement roadway and parking areas within Owner property, and all work areas within Orange County Water District property associated with this contract on a daily basis for the duration of this Contract.

C. Disposal:

1. The Contractor is advised that the disposal of excess excavated material in wetlands, stream corridors and plains is strictly prohibited even if the permission of the property Owner is obtained. Any violation of this restriction by the Contractor or any person or firm employed by Contractor will be brought to the immediate attention of the responsible regulatory agencies, with a request that appropriate action be taken against the offending parties. The Contractor will be required to remove the fill at Contractor’s own expense and restore the area impacted.

1-3. DUST AND AIR POLLUTION CONTROL.

The Contractor shall be required to reduce particulate emissions by complying with the local Air Pollution Control District. The Contractor shall provide the following measures as a minimum:
A. Enclose, cover, or water all soil stockpiles as needed to maintain dampness and prevent visible dust emissions. The amount of watering may depend upon temperature, humidity, and wind speed for any given day. Alternatively, a higher degree of emission reduction can be achieved through installation of sprinklers on all soil stockpiles. Contractor is advised that high wind conditions are prevalent at the site.

B. Water all exposed soil as needed to maintain dampness and prevent visible dust emissions. The amount of watering may vary depending upon temperature, humidity, and wind speed for a given day.

C. Water all haul roads as necessary to maintain dampness and prevent visible dust emissions. The amount of watering may vary depending upon temperature, humidity, and wind speed for a given day.

D. Maintain adequate freeboard or secure covering of all haul/dump trucks sufficient to prevent visible dust emissions and to prevent soil spillage on to surrounding roadways.

E. The Contractor shall not discharge smoke, dust, and other contaminants into the atmosphere that violate the regulations of the local Air Pollution Control District combustion engines shall not be allowed to idle for prolonged periods of time. The Contractor shall maintain construction vehicles and equipment in good repair. Exhaust emissions that are determined to be excessive by the Engineer shall be repaired or replaced.

F. The Contractor shall implement approved odor control plan to prevent offensive odors resulting from the Contractor’s work on existing systems from leaving the site.

G. Furnish one new street sweeper Johnston Sweeper VT650, or equal, for dedicated use at the plant sites and off-site as directed by the Engineer in accordance with this section. The Work area and off-site haul routes shall be kept clean. Street sweeper shall be operated continuously at all times during the Work and at the direction of the Engineer. Street sweeper shall remain the property of the Contractor upon completion and final acceptance of the Work. The contractor shall utilize gravel beds, rumble plates (ribbed/corrugated steel plates), tire wash devices and other methods of dirt control measures to eliminate the tracking of on-site and off-site dirt. No Dirt hauling shall occur during a period of rain and one day after rain.

In addition to all dirt-excavation-haul-placement operations requiring the use of a sweeper vehicle, the Contractor shall, on each Friday toward the end of the work period, clean all roadways throughout the project area as
well as areas impacted by Contractor’s construction operation including the perimeter of the construction area.

H. Additional Dirt Control:

Following final shaping of approved excavated material storage areas, Contractor shall apply a soil binder to limit the amount and degree of free blowing dirt from the job site to adjacent land. The binder shall be applied per manufacturer’s instructions/recommendations. The binder may need to be reapplied following inclement weather periods. The binder shall be Select SoilTite, as manufactured by Select Products, 1131 W. Baker Street, Costa Mesa, CA 92626, or equal.

I. See Regulatory Requirements and Permits section for additional requirements.

1-4. NOISE CONTROL.

A. The Contractor shall comply with applicable laws, regulations, and ordinances which apply to any work performed pursuant to the Contract. If the requirements of this Section are more restrictive than those of the local regulations, the requirements of this Section shall govern. See Regulatory Requirements and Permits section for additional requirements.

B. Each internal combustion engine, used for any purpose on the job or related to the job, shall be enclosed and 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 and enclosure. Use "quiet package" or "hush" equipment which is readily available for such equipment as trailer-mounted compressors, generators, welders, etc. All equipment shall be operated in the quietest manner practicable.

C. Contractor shall be required to locate all fixed construction equipment such as compressors and generators as far as feasibly possible from sensitive receptors. Contractor shall shroud or shield all impact tools.

D. Where possible, the Contractor shall use electric rather than diesel or gas-powered equipment.

E. There shall be no start-up of machines or equipment, no delivery of materials or equipment, no cleaning of machines or equipment and no servicing of equipment except during the permitted hours of construction involving noisy operations as defined in the General Provisions.
F. Amplified sound and other forms of loud communication constituting a nuisance, at the sole discretion of the Engineer, shall not be permitted.

G. Material stockpiles and/or vehicle staging areas shall be located as far as practicable from dwellings.

H. The Contractor shall designate a disturbance coordinator responsible for responding to noise complaints. The name and telephone number of the coordinator shall be clearly posted at the construction site. The disturbance coordinator shall determine causes and implement measures to mitigate the noise impact, including the enforcement of the allowable hours of construction, the identification of poorly muffled equipment and requiring its repair or replacement; and recommending temporary construction noise barriers.

I. Additional Noise Requirements:

1. The Contractor shall comply with all Noise Ordinance provisions of the City of Fountain Valley for work at the AWTF and Plant 1.
   a. Exterior Noise Standards:
      1) The following noise standards, unless otherwise specifically indicated in the City of Fountain Valley Municipal Code, shall apply to all residential property:
         a) Maximum Allowable Noise Standards Noise Level:
            i. 55 dB(A) between 7:00 a.m. and 10:00 p.m.
            ii. 50 dB(A) between 10:00 p.m. and 7:00 a.m.
         b) In the event the alleged offensive noise consists entirely of impact noise, simple tone noise, speech, music, or any combination thereof, each of the above noise levels shall be reduced by 5 dB(A).
         c) It is unlawful under the City of Fountain Valley Municipal Code for any person at any location within the City to create any noise, or to allow the creation of any noise on property owned, leased, occupied or otherwise controlled by such person, when the foregoing causes the noise level, when measured on any other residential property, either incorporated or unincorporated, to exceed:
            i. The noise standard for a cumulative period of more than thirty minutes in any hour; or
            ii. The noise standard plus five dB(A) for a cumulative period of more than fifteen minutes in any hour; or
iii. The noise standard plus ten dB(A) for a cumulative period of more than five minutes in any hour; or

iv. The noise standard plus fifteen dB(A) for a cumulative period of more than one minute in any hour; or

v. The noise standard plus twenty dB(A) for any period of time.

d) In the event the ambient noise level exceeds any of the first four noise limit categories set forth in subsection (c) of this section, the cumulative period applicable to said category shall be increased to reflect said ambient noise level. In the event the ambient noise level exceeds the fifth noise limit category, the maximum allowable noise level under said category shall be increased to reflect the maximum ambient noise level.

b. Special Provisions:

1) The following activities shall be exempted from the provisions of this section:

   a) Noise sources associated with the construction, repair, remodeling or grading of any real property, provided said activities take place between the hours of 7:00 a.m. and 8:00 p.m. Monday through Friday, 9:00 a.m. through 8:00 p.m. on Saturday, and at no time on Sunday or any legal holiday. For purposes of this exception the use of saws, buffers, Sanders, drills and sprayers shall be included, as shall similar activity.

2. The Contractor shall comply with all Noise Ordinance provisions of the City of Huntington Beach for work at Plant 2.

   a. Exterior Noise Standards:

      1) The following noise standards, unless otherwise specifically indicated in the City of Huntington Beach Municipal Code, shall apply to all residential property:

         a) Maximum Allowable Noise Standards Noise Level:

            i. 55 dB(A) between 7:00 a.m. and 10:00 p.m.

            ii. 50 dB(A) between 10:00 p.m. and 7:00 a.m.

         b) In the event the alleged offensive noise consists entirely of impact noise, simple tone noise, speech, music, or any combination thereof, each of the above noise levels shall be reduced by 5 dB(A).
c) It is unlawful under the City of Huntington Beach Municipal Code for any person at any location within the City to create any noise, or to allow the creation of any noise on property owned, leased, occupied or otherwise controlled by such person, which causes the noise level when measured on any residential, public institutional, professional, commercial or industrial property, either within or without the City, to exceed the applicable noise standards:

i. For a cumulative period of more than thirty minutes in any hour;

ii. Plus five dB(A) for a cumulative period of more than fifteen minutes in any hour;

iii. Plus ten dB(A) for a cumulative period of more than five minutes in any hour;

iv. Plus fifteen dB(A) for a cumulative period of more than one minute in any hour; or

v. Plus twenty dB(A) for any period of time.

d) In the event the ambient noise level exceeds any of the first four noise limit categories set forth in subsection (c) of this section, the cumulative period applicable to said category shall be increased to reflect said ambient noise level. In the event the ambient noise level exceeds the fifth noise limit category, the maximum allowable noise level under said category shall be increased to reflect the maximum ambient noise level.

e) Localized sheet piling is required as part of the Work, pile driving will be allowed only between the hours of 10:30 AM and 2:30 PM on regular work days.

f) Sound damping devices shall be placed around or adjacent to pile driving activities to minimize noise impacts to the surrounding community.

g) Diesel driven hammers will not be allowed. The Contractor shall use sound blankets on the west (Brookhurst Street) side of the pile driving hammer.

h) Maximum sound level during pile installation shall be 80dBA at Plant 2 property lines. Requirements listed in e), f), and g) will be enforced even if the sound level at the property line is less than the maximum listed in this paragraph.

b. Special Provisions:

1) The following activities shall be exempted from the provisions of this section:
a) Noise sources associated with construction, repair, remodeling, or grading of any real property; provided a permit has been obtained from the City as provided herein; and provided said activities do not take place between the hours of 8:00 pm and 7:00 am on weekdays, including Saturday, or at any time on Sunday or a federal holiday.

3. All equipment shall meet the OSHA noise standard of 85 db(A) at workstation positions in proximity to the various equipment items except as otherwise specified in equipment technical specifications.

4. Noise barriers, temporary walls, portable panels, acoustical blankets, mufflers on equipment, and other measures shall be utilized by the Contractor as required. Barriers shall be installed around the noise sources or directly between the construction area and the nearest homes to shield these residents from direct noise exposure from the construction activities.

5. Construction techniques designed to reduce noise shall be implemented where feasible. Loud equipment shall be separated and not grouped in one location. Areas reserved for testing and fixing equipment shall be placed away from sensitive receptors.

1-5. WATER CONTROL.

A. Temporary pumping and drainage:

1. The Contractor shall conform to the regulations and requirements of legally authorized surface water management agencies.

2. The Contractor shall be responsible for keeping trenches and other areas free from water as required to permit continuous progress of, or to prevent damage to, its own work or the work of others. The Contractor’s operations shall be conducted in such a manner as to prevent sediment from reaching existing sewers, storm drains, and creeks.

3. The Contractor shall cover exposed excavated areas and spoils piles when runoff from rain is or would be likely to cause turbidity to enter local waterways. The Contractor shall suspend work in the rain if such work cannot be performed without causing turbid runoff.

4. To avoid solids or turbid runoff from entering local waterways, the Contractor shall cover, secure, and/or berm excavated area and spoils piles and employ other methods as necessary such as hay bale around storm drains or around construction sites; use of cut and cover construction method; or use of sedimentation basins.
5. At no time will any water from any source be allowed to enter the Santa Ana River.

B. Water quality measures:

1. Erosion control measures, such as silt fences, filter fabric, sedimentation ponds, placement of hay bales along the peripheries of construction sites, temporary detention ponds, and terraced slopes, shall be employed as appropriate in conformance with the approved Storm Water Pollution Prevention Plan (SWPPP) and shall be in place prior to any clearing or grading activity. SWPPP shall show means and methods to prevent water from entering the Santa Ana River.

1-6. OIL SPILL PREVENTION AND CONTROL.

The Contractor shall be responsible for prevention, containment, and cleanup of spilling of oil, fuel, and other petroleum products used in the Contractor’s operations. All such prevention, containment, and cleanup costs shall be borne by the Contractor. The Contractor shall not discharge oil, fuel, or other petroleum products from equipment or facilities into surrounding waters or onto adjacent land.

The Contractor shall, at a minimum, take the following measures regarding oil spill prevention, containment, and cleanup:

A. Fuel hoses, lubrication equipment, hydraulically operated equipment, oil drums, and other equipment and facilities shall be inspected regularly for drips, leaks, or signs of damage, and shall be maintained and stored properly to prevent spills. Proper security shall be maintained to discourage vandalism.

B. All land-based oil and products storage tanks shall be diked or located so as to prevent spills from escaping to the water. Diking and subsoils shall be lined with impervious material to prevent oil from seeping through the ground and dikes.

C. All visible oils on land shall be immediately contained using dikes, straw bales, or other appropriate means and removed using sand, ground clay, sawdust, or other absorbent material, which shall then be properly disposed of by the Contractor. Waste materials shall be temporarily stored in drums or other leakproof containers after cleanup and during transport to disposal. Waste material shall be disposed of off property at an approved site.
1-7. DISCOVERY OF CULTURAL RESOURCES

The Contractor’s attention is directed to the National Historic Preservation Act of 1966 (16 US C490) and 36 CFR 800 which provides for the preservation of potential architectural, archaeological, or cultural resources. The Contractor shall conform to the applicable requirements of the National Historic Preservation Act of 1966 as it is related to the preservation of cultural resources.

All cultural materials or human remains discoveries that would be disturbed as a result of the Work must be reported immediately to the Owner and all work must immediately halt within two-hundred (200) feet of the discovery to allow inspection by the Owner’s representative and until the area is cleared by the Owner’s representative. Cultural materials include, but are not limited to, bones and bone pieces (both human and animal), rock walls, dump sites (including privies and wells), hearths or ovens, fist size rock concentrations with or without charcoal stains, slabs or grinding rock and obsidian pieces or chips. The Contractor’s attention is directed to general conditions section regarding changes that may be required as a result of the discovery of cultural materials that would be disturbed as a result of the Work.

If discovery is made of items of historical archaeological or paleontological interest, the Contractor is to immediately cease all Work in the area of discovery and promptly notify the Engineer. Archaeological indicators may include, but are not limited to, dwelling sites, locally darkened soils, stone implements or other artifacts, fragments of glass or ceramics, animal bones, human bones and fossils. Do not resume Work in the area of discovery until authorization is received from the Engineer. When work is resumed, excavation or other activities shall be as directed by the Engineer. If the discovery of cultural resources causes a decrease or increase in the Contractor’s cost of, or the time required for, performance of any part of the Work the Owner shall cause to be issued a change order under the procedures provided in the General and Special Provisions.

1-8. MINIMIZE AND REPAIR DAMAGE TO ROADWAYS.

The Contractor shall minimize damage to roadways including haul routes. The Contractor shall be responsible for repairing damage to the roadways caused by construction activities or, as determined by the agency having jurisdiction over the roadway, for reimbursing the agency having jurisdiction on the roadways for damage caused by construction operations. The Contractor shall be responsible for damage directly attributable to its own and its subcontractor’s and material suppliers’ activities and shall be responsible for repairs to return the roadways to the pre-project condition. The Owner will periodically monitor the roadway condition, and will notify the Contractor of damages and repairs that need to be implemented. The Contractor's attention is directed to the Temporary Facilities section.
1-9. **CONSTRUCTION RELATED TRAFFIC.**

Construction of the facilities will cause increased traffic from transporting construction materials to crews to the work areas and traffic delays caused by construction at or adjacent to a roadway. The Contractor shall plan the transportation of materials and crews to limit the project-related impacts on traffic during peak hours. The Owner or Engineer will, to the extent it determines to be needed, direct the Contractor to re-arrange transportation to and from the job site to minimize increased traffic. If transportation does need to be re-arranged, such re-arrangement will be at the Contractor’s expense. The Contractor shall perform construction activities at roadways and at access road entrances and exits to the public roadways in such a manner to eliminate substantial traffic delays and traffic delays or detours that would last more than one week at any location. The Owner will notify the Contractor in the event that traffic delays have or are anticipated to exceed an acceptable level or duration. In such cases, the Contractor shall, at the Contractor’s expense, re-arrange the work activities to reduce the delays caused by the performance of the Work. Allowed access routes are discussed further in the Temporary Facilities section.

1-10. **HAZARDOUS ENVIRONMENTAL CONDITIONS AT SITE.**

A Hazardous Materials Site Investigation (Report) was performed by Shannon & Wilson (subconsultant to the Engineer) as a part of the initial studies to support the Project design. The Contractor shall review the Report and perform its operations considering the findings therein. Mitigation measures that are required as a result of hazardous site materials encountered on the Plant 2 site shall be considered by the Contractor and included in the Project bid amount. The contractor shall include in the bid amount disposal of 2,000 tons of contaminated soil to a licensed hazardous waste disposal facility.

1-11. **SAFETY AND HEALTH.**

A. General:

1. Portions of the existing facilities are exposed to wastewaters of varying degrees of treatment. The Contractor certifies that he is experienced and qualified to anticipate and meet the safety and health requirements of this project.

2. Workmen involved in the removal, renovation, or installation of equipment within the facility may be exposed to disease-producing organisms in wastewater. The Contractor shall require his personnel to observe proper hygienic precautions.

3. Solvents, gasoline, and other hazardous materials enter the facility with incoming sewage, and therefore, certain areas are hazardous to open flame, sparks, or unventilated/poorly ventilated occupancy. The
Contractor shall take measures to assure his personnel observe proper safety precautions when working in these areas.

4. Additional safety and health requirements are specified in the Contract Documents, including, but not limited to, the Contract Agreement, GENERAL CONDITIONS, SPECIAL PROVISIONS, and GENERAL REQUIREMENTS.

B. Safety and Health Regulations:

1. The Contractor shall comply with Safety and Health Regulations for Construction, promulgated by the Secretary of Labor under Section 107 of the Contract Work Hours and Safety Standards Act, as set forth in Title 29, C.F.R. Copies of these regulations may be obtained from Labor Building, 14th and Constitution Avenue N.W., Washington, DC 20013.

2. The Contractor also shall comply with the provisions of the Federal Occupational Safety and Health Act, as amended; and the General Industry Safety Orders of the State of California as implemented by Cal OSHA.

3. The Contractor shall comply with all OCSD Safety and Emergency Procedures and Confined Space Procedures.

End of Section
1. CONSTRUCTION PHOTOGRAPHS BY CONTRACTOR. Contractor shall be responsible for the production of construction photographs as provided herein. Engineer shall designate the subject of each photograph. Photographs before, during and after construction are an important record of site conditions, construction progress, as-built features and significant planned/unplanned events. The Contractor is to employ a competent photographer to record this important factual information. Contractor shall be responsible for the production of construction photographs as provided herein. Engineer shall designate the subject of each photograph. All construction photographs shall be provided in both print and digital format per the requirements in this section.

1-1. Pre-Construction Photographs. The Contractor shall provide one hundred (100) pre-construction photographs prior to commencement of Work on the GWRS and OCSD Plant 1 site. The Contractor shall also provide fifty (50) pre-construction photographs prior to commencement of Work on OCSD Plant 2 site. Preconstruction photographs shall he taken at locations to be designated by the Engineer. These photographs shall be submitted prior to beginning construction.

1-2. During Construction Photographs. The Contractor shall provide construction color photographs showing the progress of the Work. Contractor shall take photos of all Work prior to being buried or covered, including piping, fittings, transitions, tie-ins and valves. Contractor shall take photos of any significant planned or unplanned events. Contractor shall also take photos from the same five locations (GWRS and Plant 1 site, and Plant 2 site) at monthly intervals to record progress of work from same vantage points. These vantage points will be determined by the Engineer.

A minimum of sixty (60) photographs shall be provided every month during construction at the GWRS and Plant 1 site and a minimum of forty (40) photographs shall be provided every month during construction at the OCSD Plant 2 site. Photographs shall be submitted with each month’s Application for Payment.

1-3. Post-Construction Photographs. Upon acceptance of the Work, the Contractor shall provide one hundred (100) photographs of the Work where directed by the Engineer. Post-construction photographs shall be taken at locations to be designated by the Construction Manager. These photographs shall be submitted as part of Contract Closeout.
2. **DELIVERABLE PRODUCTS.**

2-1. **Prints.**

   A. Color:
      1. Paper: Single weight, first quality, fine grain, minimum resolution 100 lines per inch.
      2. Finish: Smooth surface, glossy.
      3. Size: 4-inch x 6-inch minimum.

   B. Identify Each Print on Adhesive Label Placed on Front:
      1. Name of project.
      2. Orientation of view.
      3. Date and time of exposure.
      4. Photo number
      5. Negative identification.

   C. Prints shall be indexed chronologically and provided in a three-ring binder with transparent protective sleeves intended for storage of photographs.

   D. Provide 8-1/2” x 11” color printed page with thumbnail views and file name identification for each photo. All printed pages shall be indexed chronologically and provided in a three-ring binder.

2-2. **Digital.** Digital images shall be compiled on CD and provided with a descriptive index of the images. All CD’s shall be labeled and protected in an individual plastic case.

   End of Section
1. CONTRACTOR’S QUALITY CONTROL.

1-1. General. The Contractor is to ensure that products, services, workmanship and Site conditions comply with the requirements of the Contract Documents by coordinating, supervising, testing and inspecting its Work. The Contractor shall utilize only suitably qualified, skilled and trained personnel experienced in the tasks required to complete the Work in accordance with the quality requirements of the Contract Documents. Should there be no quality basis specifically prescribed for any portion of the Work, the quality and testing procedures shall be in accordance with the best-accepted practices of the construction industry in the State of California, for projects of this type, or standards set by engineering or technical societies (e.g. ASTM or ASHRAE), whichever is more stringent.

1-2. Quality of Work. The Contractor’s quality of Work shall include, but not be limited to, the following requirements:

A. Quality of Products: Unless otherwise indicated or specified, all products shall be new, free of defects, and fit for the intended use.

B. Quality of installation: All Work shall be produced plumb, level, square and true, or true to indicated angle, and with proper alignment and relationship between the various elements, as shown on or required by Contract Documents.

C. Protection of Completed Work: Take all measures necessary to preserve completed Work free from damage, deterioration, soiling, and staining, until acceptance by Owner.

D. Standards and Code Compliance and Manufacturer’s Instructions and Recommendations: Unless more stringent requirements are indicated or specified, comply with manufacturer's instructions and recommendations, reference standards and building code research report requirements in preparing, fabricating, erecting, installing, applying, connecting, and finishing Work.

E. Deviations from Standards and Code Compliance and Manufacturer's instructions and Recommendations: Secure Owner's advanced written consent. Document and explain all deviations from reference standards and building code research report requirements and manufacturer's product installation instructions and recommendations, including
acknowledgement by the manufacturer that such deviations are acceptable and appropriate for the Project.

F. Verification of Quality: Work shall be subject to verification of quality by Owner in accordance with provisions of the Contract Documents.

1-3. **Defective Work.** Defective Work shall be modified, replaced, repaired or redone by the Contractor as described in the General and Special Provisions.

2. **INSPECTION AND TESTING.** Additional requirements for tests are described in the Testing, Startup and Training Requirements section and other Technical Specifications of these Contract Documents.

2-1. **General.** Where the Contract Documents require work to be field tested or approved, it shall be tested in the presence of the Engineer or its authorized representative. The Engineer shall have the right to witness all on-site tests performed by the Contractor and any shop tests. The results of any tests performed by the Contractor shall be made available for the information of the Engineer. Inspections, tests or favorable reviews by the Engineer or others shall not relieve the Contractor from its obligation to perform the work in accordance with the requirements of the Contract Documents or for its sole responsibility for the quality of workmanship and materials.

Except as specifically required under the technical specifications for testing and inspection, all tests for materials furnished by the Contractor will be done in accordance with commonly recognized standards of national organizations. Where tests are to be performed by the Engineer or by an independent laboratory or agency, the Contractor shall furnish such samples of all materials as required by the Engineer without charge.

The sample or samples of materials to be tested shall be selected by such laboratory or agency, or the Engineer, and not by the Contractor. No material for which the Contract Documents require the submittal and approval of tests, certificates of compliance or other documentation shall be incorporated in the Work until such submittal has been made and approved. The Contractor shall provide safe access, including plants where materials or equipment are manufactured or fabricated, for the Engineer and inspectors to adequately inspect the quality of work and the conformance with the Contract Documents. The Contractor shall furnish the Engineer the necessary labor and facilities for such things as excavation in the compacted fill to the depths required to take samples. The Contractor shall provide adequate lighting, ventilation, ladders and other protective facilities as may be necessary for the safe performance of inspections.
Upon completion of the Work the Engineer will conduct a final inspection. Records shall be available at all reasonable hours for inspection by other local or State agencies to ascertain compliance with laws and regulations.

Neither the employment of independent testing and inspection agency nor observations or tests by Owner and Owner’s consultants shall in any manner relieve the Contractor of obligation to perform Work in full conformance to all requirements of the Contract Documents. The Owner reserves the right to reject all Work not in conformance to the requirements of the Contract Documents, or otherwise Defective.

2-2. Notice. The Contractor shall notify the Engineer in writing at least forty-eight (48) hours before any field testing or special inspections are required to be performed by the Engineer or independent laboratory furnished by the Owner. The Contractor shall notify the Engineer at least two hours before any inspection is required to be performed or to witness the Contractor’s on-site field testing.

Whenever the Contractor varies the period during which work is carried on each day, the Contractor shall give due notice to the Engineer so that proper inspection may be provided. Any work done in the absence of the Engineer shall be considered to be rejected. It will be the responsibility of the Contractor to demonstrate to the satisfaction the Engineer that the work meets all conditions of the specification and if such conditions are not met to remove the work.

The Contractor shall give the Engineer written notification at least thirty (30) days prior to the shipment of materials and equipment to be tested and/or inspected at the point of origin. Satisfactory tests and inspections at the point of origin shall not be construed as a final acceptance of the materials and equipment nor shall such tests and inspections preclude retesting or re-inspection at the site of the Work.

2-3. Work Covered Prior to Inspection and/or Testing. Work requiring inspection and/or testing shall not be concealed or buried prior to the acceptance of such inspection or testing. Work covered without the favorable review or consent of the Engineer shall, if required by the Engineer, be uncovered for inspection and/or testing at the Contractor's expense.

2-4. Work Covered With Prior Inspection and/or Testing. If the Engineer considers it necessary or advisable that covered work which was favorably inspected and tested be uncovered for re-inspection and/or retesting, the Contractor, at the Engineer's request, will uncover, expose or otherwise make available for observation, inspection or testing as the Engineer may require, that portion of the work in question, furnishing all necessary labor, materials, tools, and equipment. If it is found that such work is defective, the Contractor will bear all expenses of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction. If, however, such work is not found to be
defective the Contractor will be allowed an increase in the Contract price or an extension of the Contract time, or both, directly attributable to such uncovering, exposure, observation, testing and reconstruction, and a Change Order shall be issued for such additional work.

2-5. Special Tests and Inspections. As provided for in the Contract Documents, laws and regulations, specialized tests and inspections shall be performed by special inspectors certified by the International Conference of Building Officials (ICBO). Unless otherwise stated in the Contract Documents, each of these tests will be performed on site and paid for by the Owner.

2-6. Inspections and Tests by Serving Utilities. Unless otherwise indicated in the Contract Documents, the Contractor shall cause, schedule and conduct inspections and tests by serving Utilities required for the Work under this Contract.

2-7. Inspections and Tests by Serving Manufacturers. Unless otherwise indicated in the Contract Documents, the Contractor shall cause all required tests and inspections to be conducted by materials, equipment or systems manufacturers. Additionally, all tests and inspections required by materials, equipment or systems manufacturers as conditions of warranty or certification of Work shall be made, the cost of which shall be included in the Contractor’s bid.

Each manufacturer’s representative shall furnish to Owner, through Contractor, a written report certifying that the equipment has been properly installed and lubricated; is in accurate alignment; is free from any undue stress imposed by connecting piping or anchor bolts; and has been operated under full load conditions and that it operated satisfactorily.

All costs for these services shall be included in the Contract Price.

2-8. Offsite Inspection. When the Contract Documents require inspection of material or equipment during the production, manufacturing, or fabricating process, or before shipment, such services will be performed by Owner or an independent testing firm or inspection organization acceptable to Owner. The Contractor shall note that offsite inspection is not considered factory witness testing, which is described in the Testing, Startup and Training Requirements section and select equipment specifications.

Contractor shall require the producer, manufacturer, or fabricator to arrange for and pay an independent organization to perform the inspection services specified herein the Contract Documents.

Owner shall send a representative to the factory or shop to review the assembly and witness the factory testing and performance for the equipment specified.
Contractor shall give appropriate written notice to Owner not less than 10 days before offsite inspection services are required, and shall provide for the producer, manufacturer, or fabricator to furnish safe access and proper facilities and to cooperate with inspecting personnel in the performance of their duties.

The inspection organization will submit a written report to Owner, with a copy to Contractor, at least once each week.

2-9. Transmittal of Test Reports. Written reports of tests and engineering data furnished by Contractor for Owner’s review of materials and equipment proposed to be used in the Work shall be submitted as specified for Shop Drawings.

The laboratory retained by Owner will furnish four copies of a written report of each test. Three copies of each test report will be transmitted to the Owner and one copy to Contractor, within 3 days after each test is completed.

End of Section
PART 1 - GENERAL

1-1. SCOPE. The purpose of this specification section is to define the scope of work for the special inspections and tests, and reporting to be performed by the approved agency or approved agencies to comply with requirements of Chapter 17, titled, “Special Inspections and Tests”, of the California Building Code 2016. The approved agencies performing the special inspections and tests will be retained by Owner, or Registered Design Professional in Responsible Charge acting as Owner’s Agent. The Owner or registered design professional in responsible charge will engage one or more Approved Agencies to conduct tests and special inspections specified in this section and related sections, and as may be specified in other sections of these specifications. The Approved Agency shall not be employed by Contractor or a supplier materially participating in the project.

The Contractor shall cooperate with and aid as needed the approved agency. Where action is required of Contractor, it is identified in the applicable paragraphs of this specification. Nothing in the scope of work items defined in this specification for special inspections and tests by approved agencies shall be construed to supersede the requirements of the General Conditions or any other portions of the Contract Documents.

Reports and testing results from Approved Agencies shall have precedence over reports and test results provided by Contractor.

1-2. GENERAL. This Section includes administrative and procedural requirements indicated in the governing building code.

Structural testing and special inspection services are required to verify compliance with the construction documents and standards referenced herein. These services do not relieve Contractor of responsibility for compliance with the construction documents.

Specific quality-assurance and quality-control requirements for individual construction activities are also referenced in other Sections. Requirements in those Sections may also cover production of standard products.

Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the construction documents.
Requirements for Contractor to provide quality-assurance and quality-control services required by Engineer, Owner, or Authority Having Jurisdiction (AHJ) are not limited by provisions of this Section.

1-3. DEFINITIONS.

Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved by the Authority Having Jurisdiction.

Approved Fabricator: An established and qualified person, firm or corporation registered and approved by the Authority Having Jurisdiction to perform work without Special Inspection.

Authority Having Jurisdiction (AHJ): The officer or other designated authority charged with the administration and enforcement of the building code, or a duly authorized representative. Also, commonly known as the Building Official.

Contract Documents: Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit. Construction documents include all supplemental instructions, sketches, addenda, and revisions to the drawings and specifications issued by the Registered Design Professional beyond those issued for a building permit. Also, commonly referred to as “Approved Plans”.

Demand Critical Welds: Welds associated with SFRS element, as identified on the drawings and require Special Inspection and Testing. Welds are designated on drawings as Seismic Weld Demand Category A, B, or C and as Seismic Weld Consequence Category H, M, and L. These classifications are shown on drawings in the form “AH/T”, where the first letter (A, B or C) represents the Seismic Weld Category, the second letter (H, M, or L) represents the Seismic Weld Consequence category and the last letter (T or L) represents the primary loading direction.

Pre-Engineered Structural Elements: Structural elements specified by the Registered Design Professional but which may be designed by another Registered Design Professional. (Examples are items such as open web steel joists and joist girders, metal joists, pre-cast concrete elements, pre-fabricated metal buildings, pre-stressed wire wrapped tanks, tilt-up concrete panel reinforcement and lifting hardware.)

Registered Design Professional (RDP): An individual who is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed.

Registered Design Professional in Responsible Charge (RDPRC): A Registered Design Professional engaged by Owner to review and coordinate certain aspects of the project,
as determined by the AHJ and Construction Documents, for compatibility with the design of the buildings or structure, including submittal documents prepared by others, deferred submittal documents and phased submittal documents.

Seismic Force Resisting System (SFRS): As indicated on drawings and subject to specific inspections and testing requirements described within this section.

Special Inspection: Inspection and/or testing required by the governing building code, as amended by the AHJ, of the materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with approved Construction Documents and referenced standards.

Special Inspection, Continuous: The full-time observation or testing of work requiring special inspection by an approved Special Inspector who is present in the area where the work is being performed.

Special Inspection, Periodic: The part-time or intermittent observation or testing of work requiring Special Inspection by an approved Special Inspector who is present in the area where the work has been or is being performed and at the completion of the work.

Special Inspector: A qualified person demonstrating competence, to the satisfaction of the AHJ and RDPRC, for inspection of the construction or operation requiring special inspection. The Special Inspector will be qualified as specified herein.

Structural Observations: Visual observation of the structural system by a Registered Design Professional for general conformance to the approved Construction Documents. Structural observations are not considered part of the tests and special inspections and do not replace inspections and testing by the Approved Agency. Owner will employ a RDP to perform Structural Observations.

Testing Agency: A qualified materials testing laboratory under the responsible charge of a Registered Design Professional, approved by the AHJ and the RDPRC, to measure, examine, test, calibrate, or otherwise determine the characteristics or performance of construction materials and verify confirmation with construction documents.

Quality Assurance Plan (QAP): Describes and identifies specific tasks required to meet the Quality Control and Quality Assurance welding requirements for the project.

1-4. INSPECTION AND TESTING AGENCY QUALIFICATIONS. Special Inspectors and testing agencies will be employed or retained by Owner, and will have the minimum qualifications as described in this section. The qualifications of all personnel performing special inspection and testing activities are subject to the approval of the AHJ.

Minimum qualifications of inspection and testing agencies and their personnel will comply with ASTM E329 "Standard Specification for Agencies Engaged in Construction
Inspectors and individuals performing tests will be certified for the work being performed as listed below and in Table 1 of IAS AC291, or by alternate certifications when acceptable to the AHJ. The AHJ may have additional requirements.

<table>
<thead>
<tr>
<th>Abbreviation used in this Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIA</td>
<td>Architect licensed in the state of the project, specializing in the design of building structures</td>
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<tr>
<td>Licensed Engineers</td>
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</tr>
<tr>
<td>PE/SE</td>
<td>Structural Engineer (SE) or Professional Engineer (PE) licensed in the state of the project, specializing in the design of building structures</td>
</tr>
<tr>
<td>PE/GE</td>
<td>Geotechnical Engineer (GE) or Professional Engineer (PE) licensed in the state of the project, specializing in soil mechanics and foundations</td>
</tr>
<tr>
<td>PE/EE</td>
<td>Electrical Engineer (EE) or Professional Engineer (PE) licensed in the state of the project, specializing in electrical systems</td>
</tr>
<tr>
<td>PE/ME</td>
<td>Mechanical Engineer (ME) or Professional Engineer (PE) licensed in the state of the project, specializing in mechanical systems</td>
</tr>
<tr>
<td>EI/EIT</td>
<td>Engineering Intern or Engineer-in-Training: a graduate engineer who has passed the Fundamentals of Engineering examination working under the direct supervision of a Professional Engineer licensed in the state of the project and with a minimum of one year of experience performing inspections.</td>
</tr>
<tr>
<td>American Concrete Institute (ACI) Certification</td>
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<tr>
<td>ACI-CFTT</td>
<td>Concrete Field Testing Technician – Grade 1</td>
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<tr>
<td>ACI-CCI</td>
<td>Concrete Construction Inspector</td>
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<tr>
<td>ACI-LTT</td>
<td>Laboratory Testing Technician – Grade 1 or 2</td>
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<td>ACI-STT</td>
<td>Strength Testing Technician</td>
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<td>American Welding Society (AWS) Certification</td>
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<tr>
<td>AWS-CWI</td>
<td>Certified Welding Inspector</td>
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<tr>
<td>AWS/AISC-SSI</td>
<td>Certified Structural Steel Inspector</td>
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<tr>
<td>Abbreviation used in this Section</td>
<td>Description</td>
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<tr>
<td>American Society of Non-Destructive Testing (ASNT) Certification</td>
<td>Non-Destructive Testing Technician For Ultrasonic Testing (UT) and Radiographic Testing (RT) Certified as Level III through examination by ASNT or certified as Level II by their employer for flaw detection. For Magnetic Particle Testing (MT) and Liquid Penetrant Testing (PT) certified as Level II by their employer or certified as Level III through examination by ASNT and certified by their employer</td>
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<tr>
<td>ASNT-TC-1A</td>
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<tr>
<td>International Code Council (ICC) Certification</td>
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<tr>
<td>ICC-SMSI</td>
<td>ICC-SMSI Structural Masonry Special Inspector</td>
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<tr>
<td>ICC-SWSI</td>
<td>ICC-SWSI Structural Steel and Welding Special Inspector</td>
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<tr>
<td>ICC-SFSI</td>
<td>ICC-SFSI Spray-Applied Fire-proofing Special Inspector</td>
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<td>ICC-PCSI</td>
<td>ICC-PCSI Prestressed Concrete Special Inspector</td>
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<td>ICC-RCSI</td>
<td>ICC-RCSI Reinforced Concrete Special Inspector</td>
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<td>ICC-SBSI</td>
<td>ICC-SBSI Structural Steel and Bolting Special Inspector</td>
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<td>ICC-WSI</td>
<td>ICC-WSI Structural Welding Special Inspector</td>
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<td>National Concrete Masonry Association</td>
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<tr>
<td>NCMA</td>
<td>NCMA Concrete Masonry Testing Technician</td>
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<td>National Institute for Certification in Engineering Technologies (NICET)</td>
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<tr>
<td>NICET-CT</td>
<td>NICET-CT Concrete Technician – Levels II, III &amp; IV</td>
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<tr>
<td>NICET-ST</td>
<td>NICET-ST Soils Technician - Levels II, III &amp; IV</td>
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<tr>
<td>NICET-GET</td>
<td>NICET-GET Geotechnical Engineering Technician - Levels II, III &amp; IV</td>
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<td>Exterior Design Institute (EDI) Certification</td>
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<tr>
<td>EDI-EIFS</td>
<td>EDI-EIFS EIFS Third Party Inspector</td>
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<tr>
<th>Inspection or Testing Item</th>
<th>Qualification Standards</th>
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<tr>
<td>Fabricators</td>
<td>Varies by product as listed below</td>
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<tr>
<td>Steel Construction – Welding Inspection</td>
<td>ICC-SWSI, ICC-WSI, AWS-CWI or AWS/AISC-SSI</td>
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<tr>
<td>Steel Construction – Non-Destructive Weld Testing</td>
<td>ASNT</td>
</tr>
<tr>
<td>Steel Construction – Details</td>
<td>PE/SE, ICC-SWSI, ICC-SBSI or AWS/AISC-SSI</td>
</tr>
<tr>
<td>Steel Construction – High Strength Bolts</td>
<td>PE/SE or ICC-SBSI</td>
</tr>
</tbody>
</table>
### Inspection or Testing Item | Qualification Standards
--- | ---
Concrete Construction - Field Tests | ACI-CFTT or NICET-CT
Concrete Construction - Field Inspection | PE/SE, ICC-RCSI, ACI-CCI or NICET-CT
Concrete Construction - Laboratory Testing | ACI-LTT, ACI-STT or NICET-CT
Prestressed Concrete Construction | ICC-PCSI
Masonry Construction - Field Inspection | PE/SE or ICC-SMSI
Masonry Construction - Laboratory Testing | NCMA
Soils (special grading, excavation and filling) | PE/GE, NICET-ST or NICET-GET under the direct supervision of Registered Civil (geotechnical) Engineer
Pile Foundations | PE/GE, Appropriate structural material inspection and NICET-ST or NICET-GET under the direct supervision of Registered Civil (geotechnical) Engineer
Wall Panels and Veneers | ICC-SMSI
Sprayed Fire-Resistant Materials | ICC-SFSI
Post Installed Anchors in Concrete | ICC Building Inspector, ICC-RCSI, or PE/SE
Post Installed Anchors in Masonry | ICC Building Inspector, ICC-SMSI, or PE/SE
Smoke Control Systems | IBC 1705.18.2
Other Architectural Systems | ICC Building Inspector, AIA, or PE/SE
Mechanical Systems | ICC Building Inspector or PE/ME
Electrical Systems | See NFPA 70

1-4.01. **Structural Steel Testing Agency Requirements.** Submit the following to the RDPRC and the AHJ prior to beginning testing:

**Written practices for monitoring and control of the inspection and testing agency operations including**

- Inspection and testing agency’s procedures for the selection and administration of inspection personnel, describing the training, experience, and examination requirements for qualification and certification of inspection personnel.

- Inspection and testing agency’s inspection procedures, including general inspection, material controls, and visual welding inspection.

- Qualifications of management and quality assurance personnel designated for the project.
Qualification records for inspectors and NDT technicians designated for the project.

NDT procedures and equipment calibration records for NDT to be performed and equipment to be used for the project.

1-5. **CONFLICTING REQUIREMENTS, REPORTS AND TEST RESULTS.**

1-5.01. **General.** If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to the RDPRC for a decision before proceeding.

1-5.02. **Minimum Quantity or Quality Levels.** The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to the RDPRC for a decision before proceeding.

1-5.03. **Precedence.** The Approved Agency reports and testing results shall have precedence over reports and test results provided by Contractor.

1-5.04. **Conflict.** Where a conflict exists between the construction documents and approved shop drawings/submittal data, the construction documents shall govern unless the shop drawings/submittal data are more restrictive. All conflicts shall be brought to the attention of the RDPRC.

1-6. **TECHNICAL ATTACHMENTS.** The following forms are required as part of the comprehensive administrative, testing and inspection requirements. The forms are available from the AHJ, or are included herein, as indicated:

<table>
<thead>
<tr>
<th>Form Title</th>
<th>AHJ Provided</th>
<th>Included Herein</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statement of Special Inspections (SSI)</td>
<td></td>
<td>x</td>
<td>To be completed jointly by the RDPRC and the Approved Agency, and sealed by the RDPRC after completion. Contractor or Owner shall submit the form to the AHJ as part of the building permit application process.</td>
</tr>
</tbody>
</table>
Request for Approval of Special Inspector | x | To be completed by Approved Agency. Approved Agency will submit the form to the AHJ and RDPRC for their approval of individual inspectors.

Request for Approval to Provide Special Inspection of Non-Local Fabrication | x | To be completed by Approved Agency and submitted to Owner, AHJ and RDPRC.

Contractor’s Statement of Responsibility | x | To be completed by Contractor and his relevant suppliers and submitted to Owner and AHJ.

Fabricator's Certificate of Compliance | x | To be completed by Contractor’s fabricators, as applicable, and submitted to AHJ.

Final Report of Special Inspections | x | To be completed and sealed by Approved Agency. Approved Agency or Owner will submit to AHJ at the completion of construction.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION

3-1. CONTRACTOR AND FABRICATOR RESPONSIBILITIES. Each Fabricator or Contractor responsible for the construction of a seismic-force-resisting system, designated seismic system, seismic resisting component, main wind force-resisting system, or a wind-resisting component listed in the SSI shall submit a Contractor’s Statement of Responsibility to the AHJ and to Owner prior to the commencement of work.

To be considered an Approved Fabricator that may perform work without Special Inspection, the Fabricator shall submit copies of certifications from the International Accreditation Service (IAS) or other recognized and acceptable accreditation organization a minimum of 30 days prior to the start of fabrication. Acceptance as an Approved Fabricator is subject to approval by the AHJ. If the project specifications required an Approved Fabricator, and the AHJ does not accept the Fabricator as an Approved Fabricator, special inspection may become necessary in the fabricator’s shop.
Such inspections will be performed by Approved Agency and Contractor shall reimburse Owner for the cost for the inspections.

Contractor shall assist in coordination of the inspection and testing services with the progress of the work. Contractor shall provide sufficient notice to allow proper scheduling of all inspection and testing personnel. Contractor shall provide safe access to inspection and testing personnel and shall ensure that all work requiring special inspection is inspected and/or tested prior to concealment.

Contractor shall submit schedules to Owner, RDPRC and testing and inspecting agencies. Schedules will note milestones and durations of time for materials requiring tests and special inspections.

Contractor shall provide the Special Inspector access to approved plans at the job site or fabrication shop as applicable.

Contractor shall retain at the job site or fabrication shop, as applicable, all special inspection records submitted by an Approved Agency or Special Inspector and shall provide these records for review by the AHJ’s inspector upon request.

Contractor shall repair and/or replace work that does not meet the requirements of the construction documents.

Contractor shall engage an engineer to prepare repair and/or replacement procedures for any deficiencies identified. Contractor’s engineer shall be registered in the state in which the project is located. Contractor’s engineer shall be acceptable to the RDPRC, AHJ, and Owner. Procedures shall be submitted for review and acceptance by the RDPRC, AHJ, and Owner before proceeding with corrective action.

Contractor shall be responsible for costs of:

- Re-testing and re-inspection of materials, work, and/or products that do not meet the requirements of the Contract Documents or shop drawing/submittal data.

- Review of proposed repair and/or replacement procedures by the RDPRC and the inspectors and testing agencies.

- Repair or replacement of work that does not meet the requirements of the Construction Documents.

3-2. APPROVED AGENCY AND SPECIAL INSPECTOR RESPONSIBILITIES.

3-2.01. Preliminary Approvals. The Approved Agency will submit a “Request for Approval of Special Inspector” form to the AHJ for each proposed Special Inspector or testing technician. The form will include the individual’s credentials, which as a
minimum will meet the requirements indicated in Paragraph 1-4 in this Section. Inspector certifications by organizations other than those listed herein will not be acceptable without approval of the AHJ. The AHJ may have additional requirements to those specified herein. It is the responsibility of the testing and inspection agencies to meet local requirements and comply with local procedures.

When fabrication will take place away from the local proximity of the project, Approved Agency will submit a “Request for Approval to Provide Special Inspection of Non-Local Fabrication” form for review and approval by Owner, the RDPRC, and the AHJ prior to subcontracting with an inspection/testing agency in the locale of the fabricating plant.

3-2.02. Perform Inspections and Tests. Be present for and perform continuous or periodic inspections and tests as listed in the SSI for conformance of the work to the AHJ approved Construction Documents. Notify Contractor personnel of their presence and responsibilities. Reference the applicable “Code or Standard Reference” column in the SSI for the minimum level of inspections and testing. When the SSI column titled “Code or Standard Reference” indicates “Manufacturer’s research reports”, inspector will obtain the most current ICC-ES Report, or IAPMO UES Evaluation Report (as applicable) prior to the applicable inspection, for the type and brand of products or materials being inspected.

Provide additional inspections and testing as necessary to determine compliance with the Construction Documents. Perform special inspections in a timely manner to avoid delay of work.

The Approved Agency shall be responsible to ensure that any non-local inspection/testing agency fully complies with this Section and the SSI.

3-2.03. Defective Work. Immediately notify Contractor of the need for corrective action when work does not conform to Construction Documents.

3-2.04. Uncorrected Defective Work. Notify the AHJ and RDPRC when deficiencies have not been corrected. Notice will be made prior to the completion of that phase of the work.

3-2.05. Interim Inspection Reports. Furnish interim inspection reports to the AHJ, the RDPRC, Contractor, Engineer, and Owner during the progress of the work. Frequency of reports will be as established in the SSI. Reports will indicate that work inspected was done in conformance to the approved Construction Documents, or that the work was defective, as applicable.

Special inspection reports and test results will include, but not be limited to, the following:

Project name and address.
Permit number.

Special Inspection Agency name, address, and phone number.

Unique identification of the report and of each page.

Date and time of inspection.

Description of inspections or tests performed, including item description and location (reference grid lines, floors, elevations, etc.). Identify approved agencies employed to carry out tests.

Identification of test/inspection equipment used.

Statement noting that the work, material, and/or product conforms or does not conform to the construction document requirements. Describe defective items.

Name and signature of Contractor’s representative who was notified of work, material, and/or products that do not meet the construction document requirements.

Name and signature of Special Inspector and/or testing agency representative performing the work.

3-2.06. Report of Defective Work. Each agent will maintain a log that identifies work that does not meet the requirements of the construction documents. Include:

Description and exact location.

Reference to applicable drawings and specifications.

Reference to original inspection/test report and subsequent dates of re-inspection/retesting.

Name and title of each individual notified and method of notification.

How defective items were resolved or unresolved, as applicable.

Itemized changes authorized by the RDPoRC and AHJ if not included in a defective item.

3-2.07. Submittal Schedule. Documentation of reports, test results, and non-compliant work will be submitted at the frequency indicated in the SSI.
3-2.08. **Final Report of Special Inspections.** Each agent listed in the SSI shall submit a final report to the Approved Agency documenting the performed special inspections and the correction of any discrepancies noted. The Approved Agency shall cumulate the reports and submit a comprehensive final report at a point in time as agreed upon by the permit applicant and the AHJ prior to the start of work.

3-3. **STRUCTURAL OBSERVATION.** Owner, or RDP on Owner’s behalf, shall employ a RDP to perform Structural Observation. Prior to the commencement of observations, the structural observer shall submit to the AHJ a written statement identifying the frequency and extent of structural observations. Structural observations may be made periodically as determined by the Registered Design Professional.

At the conclusion of the Work requiring observation, the structural observer shall submit to the AHJ a written statement that the site visits have been made and identify any reported deficiencies which, to the best of the structural observer’s knowledge, have not been resolved.
Statement of Special Inspections

Project:
Project Address:
Permit Applicant:
Applicant Address:
Owner:
Owner Address:

Registered Design Professional in Responsible Charge (RDPRC):

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Name</th>
<th>License Number</th>
<th>Expiration Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural Engineer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geotechnical Engineer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanical Engineer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical Engineer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Architect</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This Statement of Special Inspections includes a Schedule of Special Inspections applicable to the above referenced project as well as the identity of the individuals, agencies, or firms intended to be retained for conducting these inspections.

The Special Inspector(s) shall keep records of all inspections and shall furnish interim inspection reports to the Authority Having Jurisdiction (AHJ) and to the Registered Design Professional in Responsible Charge (RDPRC). Discrepancies shall be brought to the immediate attention of the Contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the AHJ and the RDPRC prior to completion of that phase of work. A Final Report of Special Inspections documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted by each agent.

The Special Inspection program does not relieve the Contractor of the responsibility to comply with the Contract Documents. Jobsite safety and means and methods of construction are solely the responsibility of the Contractor.

Inspection work shall be performed in accordance with the following codes and standards. Unless otherwise indicated within the Statement of Special Inspections, the applicable edition for all codes and standards shall be as follows.

<table>
<thead>
<tr>
<th>Work</th>
<th>In Accordance With</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seismic Criteria for Nonstructural Components</td>
<td>ASCE 7-10</td>
</tr>
<tr>
<td>Standard Tests and Practices</td>
<td>Listed ASTM International (ASTM) specifications</td>
</tr>
<tr>
<td>Concrete</td>
<td>ACI 318-14 and ACI 350-06</td>
</tr>
<tr>
<td>Masonry</td>
<td>ACI 530-13 and ACI 530.1-13</td>
</tr>
<tr>
<td>Work</td>
<td>In Accordance With</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Structural Steel</td>
<td>AISC 360-10 and AISC 341-10</td>
</tr>
</tbody>
</table>
| Structural steel welding               | AWS D1.1 Structural Welding Code – Steel  
AWS D1.8 Structural Welding Code - Seismic Supplement  
ANSI/ASSIC 358 – Prequalified Connection for Special and Intermediate Steel Moment Frames for Seismic Applications |
| Aluminum welding                       | AWS D1.2 Structural Welding Code – Aluminum                                        |
| Sheet steel welding                    | AWS D1.3 Structural Welding Code – Sheet Steel                                     |
| Structural steel bolting               | Research Council on Structural Connections Specification for Structural Joints Using High Strength Bolts, |

<table>
<thead>
<tr>
<th>RDPRC - Structural</th>
<th>RDPRC - Civil/Geotechnical</th>
<th>RDPRC - Mechanical</th>
</tr>
</thead>
<tbody>
<tr>
<td>RDPAC – Electrical</td>
<td>RDPAC - Architect</td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td>-------------------</td>
<td></td>
</tr>
</tbody>
</table>

**Owner’s Acknowledgement:**

<table>
<thead>
<tr>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
</table>

**Acceptance by Authority Having Jurisdiction:**

<table>
<thead>
<tr>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
</table>

**Permit No.**

**Frequency of interim report submittals to AHJ:**

- [ ] 1-week
- [ ] 2 weeks
- [ ] Monthly
- [ ] Bi-Monthly
- [ ] At Completion
- [ ] Per attached Schedule
Statement of Special Inspections  
(Schedule of Inspections)

The attached tables as listed below define the applicable Special Inspections and Procedures.

| Table 1 of 9 | Geotechnical Special Inspections |
| Table 2 of 9 | Structural Special Inspections |
| Table 3 of 9 | Architectural Special Inspections |
| Table 4 of 9 | Inspections for Special Cases |
| Table 5 of 9 | Testing for Special Inspections |
| Table 6 of 9 | Special Inspections for Seismic Resistance |
| Table 7 of 9 | Testing for Seismic Resistance |
| Table 8 of 9 | Special Inspections for Wind Resistance |
| Table 9 of 9 | Inspection Agents |

The Seismic Design Category for the project is F, with exceptions for structures that have fundamental period of less than 0.50 seconds and can be designated as D.

The nominal design wind speed, V_{asd}, for the project is 115 mph (3 second gust) and the wind exposure category is (C).
<table>
<thead>
<tr>
<th>System or Material</th>
<th>Building Code Reference</th>
<th>Code, Specification, or Standard Reference</th>
<th>Frequency</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soils</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify material below foundation is adequate to achieve design bearing capacity, free of loose, deleterious or foreign material.</td>
<td>1705.6</td>
<td>excavation and fill for structures specification</td>
<td>X (foundation excavation complete)</td>
<td>Verify soil conditions consistent with those depicted in the geotechnical report and comply with requirements of excavation and fill for structures specification.</td>
</tr>
<tr>
<td>Verify excavations are extended to proper depth, proper size and material.</td>
<td>1705.6</td>
<td>excavation and fill for structures specification</td>
<td>X (foundation excavation complete)</td>
<td></td>
</tr>
<tr>
<td>System or Material</td>
<td>Building Code Reference</td>
<td>Code, Specification, or Standard Reference</td>
<td>Frequency</td>
<td>Remarks</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------------------------</td>
<td>------------------------------------------</td>
<td>-----------</td>
<td>---------</td>
</tr>
<tr>
<td>Prior to placement of controlled fill, inspect subgrade and verify site is properly prepared.</td>
<td>1705.6</td>
<td>excavation and fill for structures specification</td>
<td>X (prior to placement of fill)</td>
<td></td>
</tr>
<tr>
<td>System or Material</td>
<td>Building Code Reference</td>
<td>Code, Specification, or Standard Reference</td>
<td>Frequency</td>
<td>Remarks</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------</td>
<td>-------------------------</td>
<td>---------------------------------------------</td>
<td>-----------</td>
<td>-----------------------------------------------------</td>
</tr>
<tr>
<td>Perform classification and testing of compacted fill material.</td>
<td>1705.6</td>
<td>excavation and fill for structures specification</td>
<td>X</td>
<td>(during placement of fill)</td>
</tr>
<tr>
<td>Verify materials, densities, and lift thicknesses during placement and compaction of controlled fill for foundations.</td>
<td>1705.6</td>
<td>excavation and fill for structures specification</td>
<td>X</td>
<td>Note the exception of Article 1705.6.</td>
</tr>
</tbody>
</table>
## Schedule of Special Inspections - Table 1 of 9 (Geotechnical Special Inspections)

<table>
<thead>
<tr>
<th>System or Material</th>
<th>Building Code Reference</th>
<th>Code, Specification, or Standard Reference</th>
<th>Frequency</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep Soil Mixing Elements</td>
<td>1705.7</td>
<td>deep soil mixing specification</td>
<td>X</td>
<td>Refer to Table 2 for additional material-specific requirements.</td>
</tr>
<tr>
<td>Verify used of accepted grout mix design.</td>
<td>1705.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify soil mixed material achieves specified unconfined compressive strength.</td>
<td>1705.7</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Maintain installation records for each element.</td>
<td>1705.7</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Installation: Location, plumbness, tip and cutoff elevations.</td>
<td>1705.7</td>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
### Schedule of Special Inspections - Table 2 of 9 (Structural Special Inspections)

<table>
<thead>
<tr>
<th>System or Material</th>
<th>Inspection</th>
<th>Building Code Reference</th>
<th>Code or Standard Reference</th>
<th>Frequency</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Concrete (inspections not required for nonstructural concrete slabs supported directly on the ground)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reinforcing steel and prestressing tendon condition (free of oil, dirt and loose rust and that properly coated and/or sheathed) and placement. Verify size, spacing, bar clearances, cover, and adequate support to prevent displacement during concrete placement. Verify lap splices, mechanical splices, and embedment lengths. Verify dowels for work above are properly aligned and spaced to match other work.</td>
<td></td>
<td>1705.3</td>
<td>ACI 318 (Ch. 20) ACI 318 (25.2-25.3) ACI 318 (26.6.1-26.6.3)</td>
<td>X (prior to closing of forms or delivery of concrete, for each placement)</td>
<td></td>
</tr>
<tr>
<td>Cast-in-place anchor bolts prior to and during placement of concrete.</td>
<td></td>
<td>1705.3</td>
<td>ACI 318 (17.8.2)</td>
<td>X</td>
<td>All bolts visually inspected to verify anchor diameter, location, and embedment length.</td>
</tr>
<tr>
<td>Verify use of approved mix design(s).</td>
<td></td>
<td>1705.3 1904.1</td>
<td>ACI 318 (Ch. 19) ACI 318 (26.4.3-26.4.4)</td>
<td>X</td>
<td>RDPRC to approve contractor’s proposed mix design prior to construction. Inspector to verify from concrete delivery ticket that the appropriate mix has been provided prior to placement.</td>
</tr>
<tr>
<td>Formwork shape, location, and dimensions of the concrete member being formed, construction joints properly prepared.</td>
<td></td>
<td>1705.3</td>
<td>ACI 318 (26.11.1.2(b))</td>
<td>X (prior to delivery of concrete for each placement)</td>
<td></td>
</tr>
<tr>
<td>System or Material</td>
<td>Building Code Reference</td>
<td>Code or Standard Reference</td>
<td>Frequency</td>
<td>Remarks</td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td>-------------------------</td>
<td>----------------------------</td>
<td>-----------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content test, and determine the temperature of the concrete.</td>
<td>1705.3</td>
<td>ASTM C31, ASTM C172, ACI 318(26.12)</td>
<td>X</td>
<td>Sampling and testing frequency shall be as indicated in the cast-in-place concrete specification 03300.</td>
<td></td>
</tr>
<tr>
<td>Concrete placement.</td>
<td>1705.3</td>
<td>ACI 318(26.5.2)</td>
<td>X</td>
<td>Verify that water added at the site does not exceed that allowed by the mix design. Verify conveying, depositing, and consolidation of concrete. Observe placement procedures for evidence of segregation, possible cold joints, displacement of reinforcing or forms, and proper support of embedded items, anchor bolts, etc.</td>
<td></td>
</tr>
<tr>
<td>Concrete curing – maintain temperature and techniques.</td>
<td>1705.3</td>
<td>ACI 318(26.5.3-26.5.5)</td>
<td>X (during hot, cold, and windy conditions)</td>
<td>For wet-curing, check at the beginning of each day during 7-day curing period</td>
<td></td>
</tr>
<tr>
<td>Reinforcing steel and prestressing tendon condition (free of oil, dirt and loose rust and that properly coated and/or sheathed) and placement. Verify size, spacing, bar clearances, cover, and adequate support to prevent displacement during shotcrete placement. Verify lap splices, mechanical splices, and embedment lengths. Verify dowels for work above are properly aligned and spaced to match other work.</td>
<td>1705.3, 1908.4</td>
<td>ACI 318 (Ch. 20), ACI 318 (25.2-25.3), ACI 318 (26.6.1-26.6.3)</td>
<td>X (prior to delivery of shotcrete, for each placement)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cast-in-place anchor bolts prior to and during placement of shotcrete.</td>
<td>1705.3</td>
<td>ACI 318 (17.8.2)</td>
<td>X</td>
<td>All bolts visually inspected to verify anchor diameter, location, and embedment length.</td>
<td></td>
</tr>
<tr>
<td>System or Material</td>
<td>Building Code Reference</td>
<td>Code or Standard Reference</td>
<td>Frequency</td>
<td>Remarks</td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------------</td>
<td>-------------------------</td>
<td>---------------------------</td>
<td>-----------</td>
<td>---------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Verify use of required mix design(s).</strong></td>
<td>1705.3 1904.1 1908.2 1908.3</td>
<td>ACI 318 (Ch. 19) ACI 318 (26.4.3-26.4.4)</td>
<td>X</td>
<td>RDPRC to approve contractor's proposed mix design prior to construction. Inspector to verify from shotcrete delivery ticket that the appropriate mix has been provided prior to placement.</td>
<td></td>
</tr>
<tr>
<td><strong>Shape, location, and dimensions of the shotcrete member, construction joints properly prepared.</strong></td>
<td>1705.3</td>
<td></td>
<td>X (prior to delivery of shotcrete for each placement)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>At the time fresh shotcrete is sampled to fabricate test panels for strength tests, perform slump and air content test, and determine the temperature of the shotcrete.</strong></td>
<td>1705.3 1908.10</td>
<td>ASTM C172 ACI 318 (26.12)</td>
<td>X</td>
<td>Sampling and testing frequency shall be as indicated in the shotcrete specification.</td>
<td></td>
</tr>
<tr>
<td><strong>Shotcrete placement.</strong></td>
<td>1705.3 1908.6 1908.7 1908.8</td>
<td>ACI 506.2</td>
<td>X</td>
<td>Verify that water added at the site does not exceed that allowed by the mix design. Verify spray distance, thickness control measures, and rebound control of shotcrete, as well as proper support of embedded items. Observe placement procedures for evidence of sagging, sloughing, segregation, and sand pockets.</td>
<td></td>
</tr>
<tr>
<td><strong>Shotcrete curing – maintain temperature and techniques.</strong></td>
<td>1705.3 1908.9</td>
<td>ACI 506.2</td>
<td>X (during hot, cold, and windy conditions)</td>
<td>For wet-curing, check at the beginning of each day during 7-day curing period.</td>
<td></td>
</tr>
<tr>
<td><strong>Prestressed shotcrete: application of prestressing forces.</strong></td>
<td>1705.3</td>
<td>ACI 318 (26.10.2)</td>
<td>X</td>
<td>Review current calibration data on the proposed stressing equipment.</td>
<td></td>
</tr>
<tr>
<td>System or Material</td>
<td>Building Code Reference</td>
<td>Code or Standard Reference</td>
<td>Frequency</td>
<td>Remarks</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------------</td>
<td>-------------------------</td>
<td>---------------------------</td>
<td>----------------</td>
<td>------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Masonry for Occupancy Category I, II, or III Structures</td>
<td></td>
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</tr>
<tr>
<td>Verification of proportions for site-prepared mortar and grout.</td>
<td>1705.4</td>
<td>ACI 530.1 (2.1)</td>
<td>X (at beginning of masonry construction and prior to grouting)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verification of proportions for site-prepared prestressing grout for bonded tendons.</td>
<td>1705.4</td>
<td>ACI 530.1 (2.4G.1.b)</td>
<td>X (at beginning of masonry construction and prior to grouting)</td>
<td>RDPRC to approve contractor’s proposed mix designs prior to construction. Inspector to verify from grout delivery ticket that the appropriate mix has been provided prior to placement.</td>
<td></td>
</tr>
<tr>
<td>Verification of proportions of materials in premixed or preblended mortar and grout as delivered to the site.</td>
<td></td>
<td>ACI 530.1 (2.6B)</td>
<td>X (at beginning of masonry construction and prior to grouting)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verification of slump flow and VSI as delivered to the site for self-consolidating grout.</td>
<td>1705.4</td>
<td>ACI 530.1 (1.5B.1.b.3)</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verification of $f_m$ and $f_{AAC}$ prior to construction and for every 5000 square feet during construction.</td>
<td>1705.4</td>
<td>ACI 530.1 (1.4B)</td>
<td>X</td>
<td>Verification by unit strength or prism testing, see masonry specification.</td>
<td></td>
</tr>
<tr>
<td>Placement of masonry units and mortar joint construction.</td>
<td>1705.4</td>
<td>ACI 530.1 (3.3B)</td>
<td>X (at beginning of masonry construction, once daily for each crew, and prior to grouting)</td>
<td>Inspect size, layout, bonding and placement of masonry units. Inspect construction of mortar joints including tooling and filling of head joints.</td>
<td></td>
</tr>
<tr>
<td>System or Material</td>
<td>Building Code Reference</td>
<td>Code or Standard Reference</td>
<td>Frequency</td>
<td>Remarks</td>
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<td></td>
</tr>
<tr>
<td>Verification of prestressing technique.</td>
<td>1705.4</td>
<td>ACI 530.1 (3.6B)</td>
<td>X (at beginning of masonry construction)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type, grade, and size of prestressing tendons and anchorages.</td>
<td>1705.4</td>
<td>ACI 530.1 (2.4B) ACI 530.1 (2.4H)</td>
<td>X (when staged and prior to installation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verification of size and location of structural elements.</td>
<td>1705.4</td>
<td>ACI 530.1 (3.3F)</td>
<td>X (at beginning of masonry construction and prior to grouting)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anchors grouted in masonry and anchorage of masonry to frames, structural members, and diaphragms including type, size, and location of anchors.</td>
<td>1705.4</td>
<td>ACI 530 (6.2)</td>
<td>X (at beginning of masonry construction and prior to grouting)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type, grade, and size of reinforcing steel.</td>
<td>1705.4</td>
<td>ACI 530 (6.1) ACI 530.1 (2.4) ACI 530.1 (3.4)</td>
<td>X (when staged and prior to installation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application and measurement of prestressing force.</td>
<td>1705.4</td>
<td>ACI 530.1 (3.6B)</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verify grout space is clean prior to grouting.</td>
<td>1705.4</td>
<td>ACI 530.1 (3.2D) ACI 530.1 (3.2F)</td>
<td>X (prior to each grouting operation) Verify that cells and starting beds are clean.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reinforcing steel and connector placement: verify size, spacing, surface condition, correct location, type of embedments.</td>
<td>1705.4</td>
<td>ACI 530 (6.1) ACI 530.1 (3.2E) ACI 530.1 (3.4)</td>
<td>X (at beginning of masonry construction and prior to grouting) Verify dowels and inserts are secured in place, particularly at roof lines, floor lines, and intersecting wall lines.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>System or Material</td>
<td>Building Code Reference</td>
<td>Code or Standard Reference</td>
<td>Frequency</td>
<td>Remarks</td>
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</tr>
<tr>
<td>Grout placement.</td>
<td>1705.4</td>
<td>ACI 530.1 (3.5)</td>
<td>X</td>
<td>Verify that the grout lift height is in conformance with the code and specifications. Verify installation of cleanout closures. Verify that grouting operations are held below the top if keying is required for subsequent lifts, as required by code and specifications. Verify mechanical vibration during placement, and later during reconsolidation. Verify that curing requirements are being followed.</td>
<td></td>
</tr>
<tr>
<td>Cold/hot weather masonry protection.</td>
<td>1705.4 2104.3 2104.4</td>
<td>ACI 530.1 (1.8C) ACI 530.1 (1.8D)</td>
<td>X (at beginning of each day's work)</td>
<td>When temperatures are expected to be below 40 degrees F or above 90 degrees F.</td>
<td></td>
</tr>
<tr>
<td>Observe preparation of required grout specimens, mortar specimens, and/or prisms.</td>
<td>1705.4 2105.2.2 2105.3</td>
<td>ACI 530.1 (1.4)</td>
<td>X</td>
<td>Verification by unit strength or prism testing, see masonry specification.</td>
<td></td>
</tr>
</tbody>
</table>

**Masonry for Occupancy Category IV Structures – NOT USED**

**Steel**

<p>| Material verification of high strength bolts: Identification markings to conform to specified ASTM standards. | 1705.2.1 | Applicable ASTM material specifications AISC 360 (A3.3) AISC 360 (N3) | X (3 bolts from each lot) | Verified at jobsite. |
| Material verification of high strength bolts: Manufacturer's certificate of compliance. | 1705.2.1 | AISC 360 (A3.3) AISC 360 (N3) | X (each lot) | |
| Material verification of structural steel: Identification markings to conform to specified ASTM standards. | 1705.2.1 2203.1 | AISC 360 (A3.1) AISC 360 (N3) | X (3 pieces from each lot) | Verified at fabricator's shop prior to cutting. |</p>
<table>
<thead>
<tr>
<th>System or Material</th>
<th>Building Code Reference</th>
<th>Code or Standard Reference</th>
<th>Frequency</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material verification of structural steel: Certified mill test reports.</td>
<td>1705.2.1 2203.1</td>
<td>AISC 360 (A3.1) AISC 360 (N3)</td>
<td>X (each mill order)</td>
<td></td>
</tr>
<tr>
<td>Material verification of anchor rods and threaded rods: Manufacturer's certified test reports.</td>
<td>1705.2.1</td>
<td>AISC 360 (A3.4) AISC 360 (N3)</td>
<td>X (each lot)</td>
<td></td>
</tr>
<tr>
<td>Material verification of welding consumables: Identification markings to conform to specified AWS standards.</td>
<td>1705.2.1</td>
<td>AISC 360 (A3.5) AISC 360 (N3) AWS A5 documents</td>
<td>X (3 rods from each lot)</td>
<td>Verified at fabricator's shop and at jobsite.</td>
</tr>
<tr>
<td>Material verification of welding consumables: Manufacturer's certificate of compliance.</td>
<td>1705.2.1</td>
<td>AISC 360 (A3.5) AISC 360 (N3) AWS D1.1 (6.2)</td>
<td>X (each lot)</td>
<td></td>
</tr>
<tr>
<td>Verify use of proper WPS's.</td>
<td>1705.2.1</td>
<td>AISC 360 (N3) AWS D1.1 (6.3)</td>
<td>X (prior to start of work)</td>
<td>Obtain copy of welding procedure specifications.</td>
</tr>
<tr>
<td>Verify welder qualifications.</td>
<td>1705.2.1</td>
<td>AISC 360 (N3) AWS D1.1 (6.4)</td>
<td>X (prior to start of each welder's work)</td>
<td>Obtain copy of qualification records.</td>
</tr>
<tr>
<td>Complete and partial penetration groove welds.</td>
<td>1705.2.1</td>
<td>AISC 360 (N5.4) AWS D1.1 (Section 6)</td>
<td>X</td>
<td>Inspect pre-heat, post-heat and surface preparation between passes.</td>
</tr>
<tr>
<td>Multipass fillet welds.</td>
<td>1705.2.1</td>
<td>AISC 360 (N5.4) AWS D1.1 (Section 6)</td>
<td>X</td>
<td>Inspect pre-heat, post-heat and surface preparation between passes.</td>
</tr>
<tr>
<td>Single pass fillet welds greater than 5/16&quot;.</td>
<td>1705.2.1</td>
<td>AISC 360 (N5.4) AWS D1.1 (Section 6)</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Plug and slot welds.</td>
<td>1705.2.1</td>
<td>AISC 360 (N5.4) AWS D1.1 (Section 6)</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>System or Material</td>
<td>Building Code Reference</td>
<td>Code or Standard Reference</td>
<td>Frequency</td>
<td>Remarks</td>
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</tr>
<tr>
<td>Single pass fillet welds less than or equal to 5/16&quot;.</td>
<td>1705.2.1</td>
<td>AISC 360 (N5.4) AWS D1.1</td>
<td>Continuous</td>
<td>X (observe once daily for each welder and visually inspect all</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Section 6)</td>
<td>Periodic</td>
<td>welds at the completion of each weld)</td>
</tr>
<tr>
<td>Installation of steel form decking:</td>
<td></td>
<td>Manufacturer’s research</td>
<td></td>
<td>X (when staged prior to installation, at completion, and as required by Mfr’s research report)</td>
</tr>
<tr>
<td>Verify deck type, depth, and gage.</td>
<td>1703.4.2</td>
<td>report</td>
<td></td>
<td>Mfr’s research report)</td>
</tr>
<tr>
<td>Installation of steel roof decking:</td>
<td>1703.4.2</td>
<td>Manufacturer’s research</td>
<td></td>
<td>X (when staged prior to installation, at completion, and as required by Mfr’s research report)</td>
</tr>
<tr>
<td>Verify deck depth and gage, powder actuated fasteners, screws, proprietary side</td>
<td>1705.1.1.3</td>
<td>report</td>
<td></td>
<td>Mfr’s research report)</td>
</tr>
<tr>
<td>System or Material</td>
<td>Building Code Reference</td>
<td>Code or Standard Reference</td>
<td>Frequency</td>
<td>Remarks</td>
</tr>
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</tr>
<tr>
<td>Floor and roof deck welds.</td>
<td>1705.2.2</td>
<td>SDI QA/QC inspection</td>
<td>X (observe once daily for each welder and visually inspect all welds at the completion of each weld)</td>
<td>X (observe once daily for each welder and visually inspect all welds at the completion of each weld)</td>
</tr>
<tr>
<td>Welding stair and railing systems.</td>
<td>1705.2.1</td>
<td>AWS D1.1 (Section 6.9)</td>
<td>X (observe once daily for each welder and visually inspect all welds at the completion of each weld)</td>
<td>Welding of the railing system required only at the base of cantilevered rail posts.</td>
</tr>
<tr>
<td>Snug-tight high strength bolt installation: All connections visually inspected. Connected materials drawn together and properly snugged.</td>
<td>1705.2.1</td>
<td>AISC 360 (M2.5) AISC 360 (N5.6) RCSC Specification for Structural Joints Using High-Strength Bolts (Section 9)</td>
<td>X (observe once daily for each bolting crew and at completion of assembly installation)</td>
<td>X (at 50% complete and 100% complete, for each structure)</td>
</tr>
<tr>
<td>Verification of frame joint details including application, component locations, bracing, and stiffening, proper application of joint details at each connection.</td>
<td>1705.2.1</td>
<td>AISC 360 (N5.7)</td>
<td>X (at 50% complete and 100% complete, for each structure)</td>
<td>X (at 50% complete and 100% complete, for each structure)</td>
</tr>
<tr>
<td>System or Material</td>
<td>Building Code Reference</td>
<td>Code or Standard Reference</td>
<td>Frequency</td>
<td>Remarks</td>
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</tr>
<tr>
<td>Cold-Formed Steel Framing</td>
<td></td>
<td></td>
<td>Continuous</td>
<td>X (observe once daily for each welder and visually inspect all welds at the completion of each weld)</td>
</tr>
<tr>
<td>Welded framing connections.</td>
<td></td>
<td></td>
<td>Periodic</td>
<td></td>
</tr>
<tr>
<td>Post-Installed Anchors – Expansion Anchors into Concrete</td>
<td>1705.3</td>
<td>1703.4.2</td>
<td>X</td>
<td>Continuous inspection is required if mandated by manufacturer’s research report.</td>
</tr>
<tr>
<td>System or Material</td>
<td>Building Code Reference</td>
<td>Code or Standard Reference</td>
<td>Frequency</td>
<td>Remarks</td>
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</tr>
<tr>
<td>Adhesive anchors installed in other positions: Verify anchor type, size, dimensions, location, spacing, edge distance, embedment depth, tightening torque, hole dimensions, hole cleaning procedure, concrete compressive strength, concrete thickness, adhesive identification, adhesive expiration date, and adherence to the manufacturer’s installation instructions.</td>
<td>1705.3 1703.4.2 1705.1.1</td>
<td>Manufacturer’s research report</td>
<td>X</td>
<td>Inspection required at start of job for each type and size of adhesive anchor by construction personnel on site. Subsequent installations of the same anchor type and size by the same personnel shall be inspected periodically, unless continuous inspections are mandated by the manufacturer’s research report. Any change in the anchor product being installed or the personnel performing the installation shall require another initial inspection.</td>
</tr>
<tr>
<td>Post-Installed Anchors – Expansion Anchors into Grouted Masonry</td>
<td>1703.4.2 1705.1.1</td>
<td>Manufacturer’s research report</td>
<td>X</td>
<td>Continuous inspection is required if mandated by the manufacturer’s research report.</td>
</tr>
<tr>
<td>Post-Installed Anchors – Adhesive Anchors into Grouted Masonry</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>System or Material</td>
<td>Building Code Reference</td>
<td>Code or Standard Reference</td>
<td>Frequency</td>
<td>Remarks</td>
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</tr>
<tr>
<td>Verify anchor type, size, dimensions, location, spacing, edge distance, embedment depth, tightening torque, hole dimensions, hole cleaning procedure, masonry compressive strength, masonry thickness, adhesive identification, adhesive expiration date, and adherence to the manufacturer’s installation instructions.</td>
<td>1703.4.2 1705.1.1</td>
<td>Manufacturer’s research report</td>
<td>X</td>
<td>Inspection required at start of job for each type and size of adhesive anchor by construction personnel on site. Subsequent installations of the same anchor type and size by the same personnel shall be inspected periodically. Any change in the anchor product being installed or the personnel performing the installation shall require another initial inspection. Continuous inspection is required if mandated by the manufacturer’s research report.</td>
</tr>
<tr>
<td>Aluminum</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Material verification of structural aluminum: Certified mill test reports.</td>
<td>1705.1.1</td>
<td></td>
<td>X (each mill order)</td>
<td></td>
</tr>
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</table>
## Schedule of Special Inspections - Table 3 of 9 (Architectural Special Inspections)

<table>
<thead>
<tr>
<th>System or Material</th>
<th>Building Code Reference</th>
<th>Code or Standard Reference</th>
<th>Frequency</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mastic and Intumescent Fire-Resistive Coatings</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Surface conditions, application:</td>
<td>1705.15</td>
<td>Manufacturer’s research report., AWCI Technical Manual 12-B</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Fire-Resistant Penetrations and Joints</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Penetration firestops (locations indicated on drawings).</td>
<td>1705.17.1</td>
<td>X</td>
<td>Systems that are tested and listed in accordance with IBC Sections 714.3.1.2 and 714.4.2 shall be inspected in accordance with ASTM E2174.</td>
<td></td>
</tr>
<tr>
<td>Fire-resistant joint systems (locations indicated on drawings).</td>
<td>1705.17.2</td>
<td>X</td>
<td>Systems that are tested and listed in accordance with IBC Sections 715.3 and 715.4 shall be inspected in accordance with ASTM E2393.</td>
<td></td>
</tr>
<tr>
<td>Smoke Control Systems</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Installation</td>
<td>1705.18</td>
<td></td>
<td>Record device location(s)</td>
<td></td>
</tr>
</tbody>
</table>
### Schedule of Special Inspections - Table 4 of 9 (Inspections for Special Cases)

<table>
<thead>
<tr>
<th>System or Material</th>
<th>Inspection</th>
<th>Frequency</th>
<th>Remarks</th>
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</thead>
<tbody>
<tr>
<td></td>
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</tr>
<tr>
<td><strong>Pre-Engineered Structures</strong></td>
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</tr>
<tr>
<td>Fabrication and erection</td>
<td>1705.1.1</td>
<td>X</td>
<td>Refer to Table 2 for fabricator, welding, and high strength bolting special inspection requirements</td>
</tr>
</tbody>
</table>

### Schedule of Special Inspections - Table 5 of 9 (Testing for Special Inspections)

<table>
<thead>
<tr>
<th>System or Material</th>
<th>Inspection</th>
<th>Frequency</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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</tr>
<tr>
<td><strong>Geotechnical</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classification of controlled fill material.</td>
<td>1705.6</td>
<td>ASTM D2488</td>
<td>One per stratum of on-site excavated material. One per common supply of off-site material.</td>
</tr>
<tr>
<td>Foundation subgrade, in-place density.</td>
<td>1705.6</td>
<td>ASTM D2922 ASTM D1556 or ASTM D2167 (10% of tests to be ASTM D1556 or ASTM D2167)</td>
<td>One test per 1,000 SY, or as required in the excavation and fill for structures specification. Min one per foundation for foundations over 10 SY. Per placement and compaction requirements of excavation and fill for structures specification.</td>
</tr>
<tr>
<td>Controlled fill beneath foundations, in-place density.</td>
<td>1705.6</td>
<td>ASTM D2922 ASTM D1556 or ASTM D2167 (10% of tests to be ASTM D1556 or ASTM D2167)</td>
<td>One test per 200 CY, or as required in the excavation and fill for structures specification. Min one per foundation for foundations over 10 SY.</td>
</tr>
</tbody>
</table>
### Schedule of Special Inspections - Table 5 of 9 (Testing for Special Inspections)

<table>
<thead>
<tr>
<th>System or Material</th>
<th>Building Code Reference</th>
<th>Code or Standard Reference</th>
<th>Frequency</th>
<th>Remarks</th>
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<tbody>
<tr>
<td><strong>Concrete</strong></td>
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</tr>
<tr>
<td>Concrete strength.</td>
<td>1705.3</td>
<td>ASTM C31</td>
<td></td>
<td>See concrete specification</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ASTM C39</td>
<td></td>
<td>See concrete specification for quantity of cylinders.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ASTM C172</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concrete slump, air content,</td>
<td>1705.3</td>
<td>ASTM C31</td>
<td></td>
<td>See concrete specification</td>
</tr>
<tr>
<td>temperature, unit weight, water</td>
<td></td>
<td>ASTM C138</td>
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<td></td>
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<tr>
<td>soluble chloride ion, shrinkage.</td>
<td></td>
<td>ASTM C143</td>
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<td>ASTM C157</td>
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<td>ASTM C172</td>
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<td>ASTM C231</td>
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<td>ASTM C1064</td>
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<tr>
<td></td>
<td></td>
<td>ASTM C1218</td>
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<td></td>
</tr>
<tr>
<td><strong>Shotcrete</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preconstruction tests.</td>
<td>1704.5 1908.5</td>
<td>ASTM C1140</td>
<td></td>
<td>See shotcrete specification for required scope of preconstruction testing.</td>
</tr>
<tr>
<td>Shotcrete strength.</td>
<td>1705.3 1908.10</td>
<td>ASTM C1140</td>
<td></td>
<td>See shotcrete specification.</td>
</tr>
<tr>
<td><strong>Masonry</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit strength.</td>
<td>2105.1</td>
<td>ASTM C140</td>
<td></td>
<td>See masonry specification</td>
</tr>
<tr>
<td>Mortar strength.</td>
<td>2105.1</td>
<td>ASTM C270</td>
<td></td>
<td>See masonry specification</td>
</tr>
<tr>
<td>Grout strength.</td>
<td>2105.1</td>
<td>ASTM C1019</td>
<td></td>
<td>See masonry specification</td>
</tr>
<tr>
<td>Prism strength.</td>
<td>2105.1</td>
<td>ASTM C1314</td>
<td></td>
<td>Partially grouted walls require a set of tests for both the grouted and ungrouted conditions.</td>
</tr>
</tbody>
</table>
## Schedule of Special Inspections - Table 5 of 9 (Testing for Special Inspections)

<table>
<thead>
<tr>
<th>System or Material</th>
<th>Inspection</th>
<th>Building Code Reference</th>
<th>Code or Standard Reference</th>
<th>Frequency</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
<td>PT – AWS D1.1 (6.10 &amp; 6.14.5)</td>
<td>1705.2</td>
<td>MT - AWS D1.1 (6.10 &amp; 6.14.4)</td>
<td>Test all Demand Critical field welds as indicated on approved plans at beam-column joints</td>
<td>See RBS connections at MF Electrical Building.</td>
</tr>
<tr>
<td>Smoke Control Systems</td>
<td>Leakage and pressure differential and flow measurement.</td>
<td>1705.18.1</td>
<td>Determined by jurisdiction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detection and control verification.</td>
<td>1705.18.1</td>
<td>Determined by jurisdiction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>System or Material</td>
<td>Building Code Reference</td>
<td>Code or Standard Reference</td>
<td>Frequency</td>
<td>Inspection Agent No.</td>
<td></td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------------</td>
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<td></td>
</tr>
<tr>
<td>Visually inspect the following before welding: material type and grade; welder identification system; fit up of groove welds including joint preparation, dimensions, cleanliness, tacking, backing type and fit; configuration and finish of access holes; fit up of fillet welds including dimensions, cleanliness and tacking.</td>
<td>1705.12.1</td>
<td>AISC 341 (J6.1) AWS D1.8</td>
<td>X (Once daily for each individual welder)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visually inspect during welding: WPS followed, use of qualified welders, control and handling of welding consumables, environmental conditions, welding techniques, no welding over cracked tacks.</td>
<td>1705.12.1</td>
<td>AISC 341 (J6.1) AWS D1.8</td>
<td>X (Once daily for each individual welder)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visually inspect after welding: Welds cleaned, size, length, and location of welds.</td>
<td>1705.12.1</td>
<td>AISC 341 (J6.1) AWS D1.8</td>
<td>X (Once daily for each individual welder)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Schedule of Special Inspections - Table 6 of 9 (Special Inspections for Seismic Resistance)

<table>
<thead>
<tr>
<th>System or Material</th>
<th>Building Code Reference</th>
<th>Code or Standard Reference</th>
<th>Frequency</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visually inspect welds after welding to acceptance criteria for: crack prohibition, weld/base metal fusion, crater cross section, weld profile, weld size, undercut, and porosity.</td>
<td>1705.12.1</td>
<td>AISC 341 (J6.1) AWS D1.8</td>
<td>X</td>
<td>Periodic inspection (observe once daily for each welder and visually inspect all welds at the completion of each weld) is permitted only for single pass fillet welds not exceeding 5/16&quot; and for floor and roof deck welding.</td>
</tr>
<tr>
<td>Visually inspect welds after welding for placement of reinforcement fillets, removal of backing bars and weld tabs and finish (where required on drawings or per specifications), and repair activities.</td>
<td>1705.12.1</td>
<td>AISC 341 (J6.1) AWS D1.8</td>
<td>X</td>
<td>Periodic inspection (observe once daily for each welder and visually inspect all welds at the completion of each weld) is permitted only for single pass fillet welds not exceeding 5/16&quot; and for floor and roof deck welding.</td>
</tr>
<tr>
<td>At Reduced Beam Sections (RBS), verify contour, finish, and dimensional tolerances.</td>
<td>1705.12.1</td>
<td>AISC 341 (J8) AWS D1.8</td>
<td>X (at completion of fabrication of applicable beam)</td>
<td></td>
</tr>
<tr>
<td>Verify no holes or unapproved attachments made in protected zone noted on the drawings.</td>
<td>1705.12.1</td>
<td>AISC 341 (J8) AWS D1.8</td>
<td>X (observe once daily)</td>
<td></td>
</tr>
<tr>
<td>System or Material</td>
<td>Building Code Reference</td>
<td>Code or Standard Reference</td>
<td>Frequency</td>
<td>Remarks</td>
</tr>
<tr>
<td>--------------------------------------------</td>
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<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Architectural Components</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Erection and fastening of exterior cladding.</td>
<td>1705.12.5</td>
<td></td>
<td>Continuous</td>
<td>X (observe once daily for each crew and visually inspect all connections at completion)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Periodic</td>
<td>Not required for cladding weighing 5 psf or less or for buildings less than 30 feet in height.</td>
</tr>
<tr>
<td>Installation and anchorage of vibration isolation systems, where nominal clearance between equipment and support frame and restraint is 0.25 inches or less.</td>
<td>1705.12.6</td>
<td></td>
<td>Continuous</td>
<td>X (observe once daily for each crew and completed installation of each applicable piece of equipment)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Periodic</td>
<td></td>
</tr>
<tr>
<td><strong>Electrical</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anchorage of electrical equipment for emergency and standby power.</td>
<td>1705.12.6</td>
<td></td>
<td>Continuous</td>
<td>X (observe completed installation of each applicable piece of equipment)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Periodic</td>
<td>See the Meteorological and Seismic Design Criteria section (Non-Structural Components Schedule) for the specific components that must be anchored.</td>
</tr>
<tr>
<td>System or Material</td>
<td>Building Code Reference</td>
<td>Code or Standard Reference</td>
<td>Frequency</td>
<td>Remarks</td>
</tr>
<tr>
<td>--------------------------------------------------------</td>
<td>-------------------------</td>
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<td>-----------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Anchorage of other electrical equipment.</td>
<td>1705.12.6</td>
<td></td>
<td>X</td>
<td>(observe completed installation of each applicable piece of equipment)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>See the Meteorological and Seismic Design Criteria section (Non-Structural Components Schedule) for the specific components that must be anchored.</td>
</tr>
<tr>
<td>Nonstructural Components</td>
<td>1705.12.4</td>
<td>ASCE 7 (13.2.2)</td>
<td>X</td>
<td>(Each applicable piece of equipment)</td>
</tr>
<tr>
<td>For non-structural components that are qualified by means of shake table testing or experience data, verify that the label, anchorage, and mounting conform to the certificate of compliance furnished by the product manufacturer.</td>
<td></td>
<td></td>
<td></td>
<td>See the Meteorological and Seismic Design Criteria section (Non-Structural Components Schedule) for the specific components and their anchorages that must be qualified.</td>
</tr>
<tr>
<td>System or Material</td>
<td>Code or Standard Reference</td>
<td>Inspection Code or Standard Reference</td>
<td>Frequency</td>
<td>Remarks</td>
</tr>
<tr>
<td>---------------------</td>
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<td>-----------</td>
<td>---------</td>
</tr>
<tr>
<td>Structural Steel and Structural Steel Elements Within the Seismic Force-Resisting System (systems identified on the drawings)</td>
<td>AWS D1.1 (6.13 &amp; 6.14.3)</td>
<td>AISC 341 (J6.2)</td>
<td>Each plate location</td>
<td>Test the web for cracks using magnetic particle testing (MT). In structures designed as ordinary moment frames, testing is only required for demand critical welds (locations identified on the drawings). See AISC 341 for permitted reduction in testing frequency.</td>
</tr>
<tr>
<td>Structural Steel and Structural Steel Elements Within the Seismic Force-Resisting System (systems identified on the drawings)</td>
<td>AWS D1.8</td>
<td>AISC 341 (J6.2)</td>
<td>Each plate location</td>
<td>Test the web for cracks using magnetic particle testing (MT). In structures designed as ordinary moment frames, testing is only required for demand critical welds (locations identified on the drawings). See AISC 341 for permitted reduction in testing frequency.</td>
</tr>
<tr>
<td>Structural Steel and Structural Steel Elements Within the Seismic Force-Resisting System (systems identified on the drawings)</td>
<td>1705.13.1</td>
<td>AISC 341 (J6.2)</td>
<td>Each weld</td>
<td>Each weld location</td>
</tr>
<tr>
<td>Structural Steel and Structural Steel Elements Within the Seismic Force-Resisting System (systems identified on the drawings)</td>
<td>1705.13.1</td>
<td>AISC 341 (J6.2)</td>
<td>Each weld</td>
<td>Each weld location</td>
</tr>
<tr>
<td>Structural Steel and Structural Steel Elements Within the Seismic Force-Resisting System (systems identified on the drawings)</td>
<td>1705.13.1</td>
<td>AISC 341 (J6.2)</td>
<td>Each weld</td>
<td>Each weld location</td>
</tr>
<tr>
<td>Structural Steel and Structural Steel Elements Within the Seismic Force-Resisting System (systems identified on the drawings)</td>
<td>1705.13.1</td>
<td>AISC 341 (J6.2)</td>
<td>Each weld</td>
<td>Each weld location</td>
</tr>
<tr>
<td>Structural Steel and Structural Steel Elements Within the Seismic Force-Resisting System (systems identified on the drawings)</td>
<td>1705.13.1</td>
<td>AISC 341 (J6.2)</td>
<td>Each weld</td>
<td>Each weld location</td>
</tr>
<tr>
<td>Structural Steel and Structural Steel Elements Within the Seismic Force-Resisting System (systems identified on the drawings)</td>
<td>1705.13.1</td>
<td>AISC 341 (J6.2)</td>
<td>Each weld</td>
<td>Each weld location</td>
</tr>
<tr>
<td>Structural Steel and Structural Steel Elements Within the Seismic Force-Resisting System (systems identified on the drawings)</td>
<td>1705.13.1</td>
<td>AISC 341 (J6.2)</td>
<td>Each weld</td>
<td>Each weld location</td>
</tr>
</tbody>
</table>

Weld discontinuities shall be accepted or rejected based on criteria of AWS D1.1 Table 6.2. In structures designed as ordinary moment frames, testing is only required for demand critical welds (locations identified on the drawings). See AISC 341 for permitted reduction in testing frequency.

For CJP groove welds in material 5/16" thick and greater, perform ultrasonic testing (UT). For beam to column CJP groove welds, perform magnetic particle testing (MT). In structures designed as ordinary moment frames, testing is only required for demand critical welds (locations identified on the drawings). See AISC 341 for permitted reduction in testing frequency.

When welding doubler, continuity, or stiffener plates in the k-area of a web, test the web for cracks using magnetic particle testing (MT). See AISC 341 for permitted reduction in testing frequency.

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<table>
<thead>
<tr>
<th>System or Material</th>
<th>Building Code Reference</th>
<th>Code or Standard Reference</th>
<th>Frequency</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>For welded splices and connections, perform magnetic particle testing (MT) or liquid penetrant testing (PT) at thermally cut surfaces of beam copes and access holes when the flange thickness exceeds 1-1/2” for rolled shapes or the web thickness exceeds 1-1/2” for built-up shapes.</td>
<td>1705.13.1</td>
<td>AISC 341 (J6.2) AWS D1.8</td>
<td>Each weld</td>
<td><strong>Remarks:</strong> Each weld or location</td>
</tr>
<tr>
<td>For reduced beam section (RBS) plastic hinge regions repaired by welding, or on the base metal of reduced beam section (RBS) plastic hinge region if a sharp notch has been removed by grinding, perform magnetic particle testing (MT) on the weld and the adjacent area.</td>
<td>1705.13.1</td>
<td>AISC 341 (J6.2) AWS D1.8</td>
<td>Each weld or location</td>
<td><strong>See AISC 341 for permitted reduction in testing frequency.</strong></td>
</tr>
<tr>
<td>For welds where weld tabs have been removed, except for continuity plate weld tabs, perform magnetic particle testing (MT) on the ends of the weld.</td>
<td>1705.13.1</td>
<td>AISC 341 (J6.2) AWS D1.8</td>
<td>Each weld or location</td>
<td><strong>See AISC 341 for permitted reduction in testing frequency.</strong></td>
</tr>
</tbody>
</table>

**Non-Structural Components (Architectural, Mechanical and Electrical)**

For non-structural components and their anchorage that are qualified by means of analysis, testing, or experience data, examine the certificate of compliance furnished by the product manufacturer.

<table>
<thead>
<tr>
<th>Building Code Reference</th>
<th>Code or Standard Reference</th>
<th>Frequency</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1705.13.2</td>
<td>ASCE 7 (13.2.1, part 2), ASCE 7 (13.2.2 parts 1, 2)</td>
<td>Each applicable piece of equipment</td>
<td>See the Meteorological and Seismic Design Criteria section (Non-Structural Components Schedule) for the specific components and their anchorages that must be qualified.</td>
</tr>
<tr>
<td>AGENT NAME</td>
<td>LICENSE NO.</td>
<td>FIRM</td>
<td>ADDRESS</td>
</tr>
<tr>
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<td>6.</td>
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<tr>
<td>9.</td>
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<tr>
<td>10.</td>
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</tbody>
</table>
Request for Approval of Special Inspector

Project:
Project Address:
Name of Inspection/Testing Agency:
Address:
Phone Number:
Testing agency manager/supervisor responsible for this project:

Special Inspector Name:

Special Inspector Signature: ____________________________________________________ (as it will appear on reports)

This individual is qualified to inspect:

[ ] Verification of Soils [ ] Prestressing Concrete [ ] Metal Building
[ ] Earth Retaining Structure [ ] High Strength Bolting [ ] EIFS Inspection
[ ] Excavation and Filling [ ] Structural Welding [ ] Smoke Control
[ ] Piling [ ] Steel Frame Inspection [ ] Seismic Resistance
[ ] Drilled Piers [ ] Structural Masonry [ ] Sprayed Fireproofing
[ ] Testing of Concrete [ ] Erection of Precast [ ] Architectural Systems
[ ] Placement of Concrete [ ] Inspection of Fabricators [ ] Mechanical Systems
[ ] Placement of Shotcrete [ ] Precast Fabrication [ ] Electrical Systems
[ ] Placement of Rebar [ ] Structural Fabrication

Current certifications and/or professional licenses retained by the individual:

[ ] Professional Engineer [ ] ICC Structural Masonry
[ ] Geotechnical Engineer [ ] ICC Structural Steel and Welding
[ ] Structural Engineer [ ] ICC Spray-Applied Fire Proofing
[ ] Registered Architect [ ] ICC Prestressed Concrete
[ ] Registered Geologist [ ] ICC Reinforced Concrete
[ ] EI/EIT (min. of 1 yr. related experience) [ ] ICC Structural Steel and Bolting
[ ] GIT (min. of 1 yr. related experience) [ ] ICC Structural Welding
[ ] ACI Concrete Field Testing Technician Grade 1 [ ] NCMA Concrete Masonry Testing Technician
[ ] ACI Concrete Construction Inspector [ ] NICET Concrete Technician Level II, III, or IV
[ ] ACI Laboratory Testing Technician, Grade 1 or 2 [ ] NICET Soils Technician Level II, III, or IV
[ ] ACI Strength Testing Technician [ ] NICET Geotechnical Engineering Technician
[ ] AWS Certified Welding Inspector [ ] Other ________________________________
[ ] AWS/AISC Certified Structural Steel Inspector [ ] EDI EIFS
[ ] ASNT NDT Technician Level II or III [ ] Other ________________________________
[ ] ICC Building Inspector

Copies of current certifications and/or professional licenses and a resume showing the special inspector's work experience are attached.

I hereby certify that in my judgment the individual is qualified to inspect and/or test the items indicated above.

Special Inspection Agency:

Signed:_________________________________________ Date:___________________

(Testing agency manager/supervisor responsible for this project)
Request for Approval to Provide Special Inspection of Non-Local Fabrication

Project:
Project Address:

Testing / Inspection Agent:
Testing / Inspection Agent Address:
Scope of Testing / Inspections:

We propose to have the following testing agency provide special inspection of fabrication of:

Fabricator name:
Fabricator address:

Name of Testing Agency:
Address:
Phone Number:
Testing agency manager/supervisor responsible for this project:
Primary special inspector for this project:

Copies of the Request for Approval of Special Inspector, resumes, and certifications are attached.

The fabrication inspections to be performed are:

The undersigned hereby acknowledge that they have read, understand and will properly enforce the inspection and testing requirements for the above referenced project, as specified in the Code-Required Special Inspections and Procedures section. Further, the undersigned acknowledge that they have no interest (financial, personal or otherwise) in the performance or management of the above identified Fabricator.

__________________________________________  ________________________
Signature of Primary Special Inspector              Date

__________________________________________  ________________________
Signature of Responsible Agency Manager/Supervisor  Date

__________________________________________  ________________________
Signature of Responsible Manager for Approved Agency employed by the Owner  Date
Contractor’s Statement of Responsibility

Each Fabricator, Contractor, or Supplier responsible for the construction or fabrication of a system or component designated in the Statement of Special Inspections shall submit this Statement of Responsibility.

Project:
Contractor’s or Supplier’s Name:
Address:
License No.:

Description of designated building systems and components included in the Statement of Responsibility:

Acknowledgment of Special Requirements

I hereby acknowledge that I have received, read, and understand the Code Required Special Inspections and Tests program and the Schedule of Special Inspections.

I hereby acknowledge that control will be exercised to obtain conformance with the construction documents approved by the Authority Having Jurisdiction.

______________________________________________  ________________________
Signature                                      Date

Title

Provisions for Quality Control

Procedures for exercising control within the Fabricator’s, Contractor’s, or Supplier’s organization, the method and frequency of reporting and the distribution of reports are attached to this Statement.

Identification and qualifications of the person(s) exercising such control and their position(s) in the organization are attached to this Statement.
Fabricator’s Certificate of Compliance

Each approved fabricator that is exempt from Special Inspection of shop fabrication and implementation procedures per the governing building code shall submit this Fabricator’s Certificate of Compliance at the completion of fabrication.

Project:
Fabricator’s Name:
Address:
Certification or Approval Agency:
Certification Number:
Date of Last Audit or Approval:

Description of structural members and assemblies that have been fabricated:

I hereby certify that items described above were fabricated in strict accordance with the approved construction documents.

__________________________________________________________________________
Signature                                          Date

__________________________________________________________________________
Title

Attach copies of fabricator’s certification or building code evaluation service report and fabricator’s quality control manual.
Final Report of Special Inspections

To the best of my information, knowledge, and belief, the special inspections or testing required for this project, and designated for this Agent in the Statement of Special Inspections submitted for permit, have been completed in accordance with the contract documents. Based upon my personal observations and written reports, it is my judgment that the inspected work was performed, to the best of my knowledge, in accordance with the building department approved design drawings, specifications, approved change orders, and applicable workmanship provisions of the governing building code.

Interim reports submitted prior to this final report and numbered ____ to ____ , form a basis for, and are to be considered an integral part of this final report.

The following discrepancies that were outstanding since the last interim report dated have been corrected:

Items not in conformance, unresolved items or any discrepancies in inspection coverage (i.e., missed inspections, periodic inspections when continuous was required, etc.) are as follows:

Prepared By:

Type or print name

Signature Date

Special Inspector's Seal

(Licensed Professional)
1. **OFFICE AT SITE OF WORK.** During the performance of this Contract, Contractor shall maintain a suitable office at or near the Site which shall be the headquarters of its representative authorized to receive drawings, instructions, or other communication or articles. Any communication given to the said representative or delivered at Contractor's office at the Site in the representative's absence shall be deemed to have been delivered to Contractor.

Copies of the Drawings, Specifications, and other Contract Documents shall be kept at Contractor's office at the Site and available for use at all times.

In addition, the Contractor shall provide a modular field office meeting the requirements of Exhibit A and Exhibit A Figures adjacent to the Contractor's office at the Site, for use by the Construction Manager and Engineer. The partitioning off of the Contractor's own office space for use by the Construction Manager and Engineer will not be permitted. Each office shall be provided with an outside entrance door with a substantial lock; glazed windows suitable for light and ventilation; stairs with handrail; a concrete stoop with boot scraper; and adequate heating, air conditioning, and lighting facilities. Gravel shall be placed and maintained throughout the life of the project in a 10-foot-wide area around the office perimeter. Skirting shall be installed around the entire perimeter of each office, and each office shall be provided with the necessary tie downs. A pole mounted light shall be provided to adequately illuminate the area outside each office.

Windows for light and ventilation shall be provided in the Construction Manager and Engineer's office. All windows shall be equipped with blinds. Adequate indoor lighting and thermostatically controlled heating and air conditioning shall be provided.

Contractor shall pay all electricity, water, sewer, cleaning services, cable, and heating bills and shall provide telephone and internet service to the Contractor's field office(s) and Construction Manager and Engineer's field offices, and shall provide connections to all required field office utilities. Each office shall, at least, be furnished with all items as specified in Exhibit A. The general arrangement of the offices and facilities provided shall be acceptable to Engineer.

Maintenance of the Construction Manager and Engineer's office shall be by Contractor throughout the duration of the project. Maintenance requests not resolved in 48 hours may be resolved by the Construction Manager and the cost of such maintenance backcharged to Contractor.
The office for the Construction Manager and Engineer shall be provided and installed, fully furnished, fully equipped and all utilities connected within sixty (60) calendar days after the Notice to Proceed, and shall remain on site for a minimum of thirty (30) calendar days after final acceptance of the Work. Contractor shall maintain such equipment and provide supplies for the entire specified period. Thirty (30) days after final acceptance, all equipment and supplies provided shall become the property of the Contractor. All data and document files shall remain the property of the Owner.

2. **CONSTRUCTION WATER.** Owner will furnish, with charge to the Contractor, potable water required for and in connection with the Work to be performed on the GWRS site at a connection to the existing water supply system on the northwest side of the Switchgear Building (Building 910).

OCSD will furnish, with charge to the Contractor, potable water required for and in connection with the Work to be performed on the OCSD Plant 2 site at a connection the fire hydrant located near northwest side of TFSC Clarifier F.

The maximum volume of water available at these locations will be up to half (0.5) million gallons per day at a cost of $150 per acre-foot.

Contractor shall use a flowmeter when connected to the OCWD DW/IW system.

The Contractor shall install an approved Backflow Prevention System at each of the connection points along with a flow meter with totalizer to track water usage. Contractor shall be responsible for transporting water from the designated connection point location to the location of use. The Backflow Prevention System shall be approved by the Engineer, Owner, and OCSD.

Contractor shall furnish necessary pipe, hose, nozzles, meter, and tools and shall perform all necessary labor. Contractor shall make arrangements with the Owner as to the amount of water required and the time when the water will be needed. Unnecessary waste of water will not be tolerated.

3. **CONSTRUCTION POWER.** Power required for and in connection with the Work to be performed shall be provided by the Contractor.

Power for operation of the expanded facilities during startup and testing shall be provided by the Owner in accordance with the requirements set forth in the Testing, Startup and Training Requirements section, and shall be subject to the following conditions:

a. Contractor shall meet local power provider requirements for temporary construction power.

b. The existing transformer must have the capacity and voltage needed by the Contractor for construction power.
c. Contractor at its own expense shall make authorized connections to the existing power sources and shall extend temporary service lines to the required areas. Temporary wiring shall conform to Article 305 of the NEC.

d. Contractor shall at all times provide adequately against waste and needless use of power. Electrical power shall be used only in such quantities as will not interfere with Owner’s requirements, and care shall be taken not to overload the existing facilities. Contractor shall provide any additional or temporary electrical power or power of other voltages it may require for prosecution of the Work.

These provisions shall not be construed as a guarantee by Owner of the uninterrupted supply of power, and interruptions beyond the control of the Owner shall not be reason for claims for additional costs nor for extensions of time. Contractor shall provide, at no additional cost to Owner, any necessary power required for prosecution of the Work during such interruptions.

Contractor shall provide sufficient standby power and automatic power transfer to provide continuous operation of all dewatering systems in the event of an outage.

Contractor shall provide all power for heating, lighting, operation of Contractor’s plant or equipment, or for any other use by Contractor. Temporary heat and lighting shall be maintained until the Work is accepted.

4. **VOICE AND DATA SERVICES.** Contractor shall make all necessary arrangements and pay all installation charges and monthly or periodic service for voice and data lines in its offices at the Site and for separate voice and data lines in the office of the Construction Manager and Engineer, and shall provide all telephone instruments.

Data communications in the form of a standard T-1 data line shall be provided to each office. Data service shall be capable of full T-1 bandwidth and shall be independent of any data services provided to the Contractor’s office facilities. Contractor shall provide and install CSU/DSU within an Integrated Services Router (ISR) to terminate T-1 line in each Engineer’s office. ISR shall be of type for use in small business and enterprise branch office with security features. At least two static IP addresses shall be provided by the data communications provider for the exclusive use of the Engineer’s staff. Contractor shall install up to 12 Standard RJ-45 Ethernet wall jacks at locations in each of the Engineer’s two offices to be determined after the office is set up on the site and one TIA/EIA-568-A-5 Category 5e patch panel with at least 24 ports within 10 feet of the ISR in each of the Engineer’s two offices. Contractor shall provide concealed Category 5e wiring between each wall jack and the patch panel. Contractor shall supply, install, and configure Wireless Access Point (WAP) to support at least 10 connections. Additional data communications devices necessary to complete the installation will be provided by others.
Contractor shall verify the availability and costs of telecommunications service at and near the site with the local telecommunications provider. The Contractor is responsible for all costs associated with installing and maintaining telephone and data communications.

It shall be the Contractor’s responsibility, and at its own cost, to route and install cable and new telephone poles if service is required further inside within the plant.

5. **SANITARY FACILITIES.** Contractor shall furnish temporary sanitary facilities at the Site, as provided herein, for the needs of all construction workers and others performing work or furnishing services on the Project.

Sanitary facilities shall be of reasonable capacity, properly maintained throughout the construction period, and obscured from public view to the greatest practical extent. If toilets of the chemically treated type are used, at least one toilet will be furnished for each 20 persons. Contractor shall enforce the use of such sanitary facilities by all personnel at the Site.

6. **CONSTRUCTION AIDS.** Contractor shall furnish, install, maintain, and operate all construction aids required by it and its Subcontractors in the performance of the Work, except as otherwise provided herein.

Contractor shall provide construction aids necessary for the performance of work by other contractors on the Project. Such construction aids shall be suitable for conditions encountered and shall include:

A. Railings, kick plates, enclosures, safety devices, and controls required by Laws and Regulations and as required for adequate protection of life and property.

B. Construction hoists, elevators, scaffolds, stages, shoring, and similar temporary facilities of ample size and capacity to adequately support and move loads.

C. Temporary supports with adequate safety factor to assure adequate load bearing capability under all construction conditions.

When requested, submit design calculations by professional registered engineer prior to application of loads. Submitted design calculations are for information and record purposes only.

D. Accident Prevention:

1. Exercise precautions throughout construction for protection of persons and property in accordance with this Section and the Contract Documents.
2. Guard machinery and equipment, and eliminate other hazards.
3. Make reports required by authorities having jurisdiction, and permit safety inspections of the Work.
4. Before commencing construction Work, take necessary action to comply with provisions for safety and accident prevention.

E. Warning Devices and Barricades:

1. Place barriers at ends of excavations and along excavations to warn pedestrian and vehicular traffic of excavations.
2. Provide barriers with flashing lights after dark.
3. Barricade excavations to prevent persons from entering excavated areas in streets, roadways, parking lots, treatment plants, or other public or private areas.
4. Adequately identify and guard hazardous areas and conditions by visual warning devices and, where necessary, physical barriers.
5. Warning devices shall conform to OSHA and State agency requirements, which administers OSHA regulations where the Project is located.

F. Hazards in Public Right-of-Way:

1. Mark at reasonable intervals trenches and other continuous excavations in public right-of-way, running parallel to general flow of traffic, with traffic cones, barricades, or other suitable visual markers during daylight hours.
   During hours of darkness, provide markers with flashers, or other adequate lights.
2. At intersections or for pits and similar excavations, where traffic may reasonably be expected to approach head on, protect excavations by continuous barricades.
   During hours of darkness, provide warning lights at close intervals.

G. Hazards in Protected Areas: Mark or guard excavations in areas from which public is excluded, in manner appropriate for hazard.

H. Above Grade Protection: On multi-level structures, provide safety protection that meets requirements of OSHA and State agency which administers OSHA regulations where the Project is located.

I. Protect existing structures, trees, shrubs, and other items to be preserved on Project site from damage or destruction by vehicles, equipment, worker
or other agents with substantial barricades or other devices commensurate with hazards.

Construction aids shall be furnished without charge to the other contractors, and all necessary erection, maintenance, and operating personnel shall be included. In the event of conflict, the contractor furnishing the equipment shall determine priorities in the best interest of the Project.

The use of plant equipment, whether furnished and installed under this Contract or not, including elevators, shop cranes, heating, ventilating, air conditioning, and plumbing fixtures, shall be only with Owner's written permission.

7. MAINTENANCE OF TRAFFIC. Contractor shall conduct its work to interfere as little as possible with public travel, whether vehicular or pedestrian. Whenever it is necessary to cross, obstruct, or close roads, driveways, and walks, whether public or private, Contractor shall provide and maintain suitable and safe bridges, detours, or other temporary expedients for the accommodation of public and private travel, and shall give reasonable notice to owners of private drives before interfering with them. Such maintenance of traffic will not be required when Contractor has obtained permission from the owner and tenant of private property, or from the authority having jurisdiction over public property involved, to obstruct traffic at the designated location.

In making open-cut street crossings, Contractor shall not block more than one-half of the street at a time. Whenever possible, Contractor shall widen the shoulder on the opposite side to facilitate traffic flow. Temporary surfacing shall be provided as necessary on shoulders.

Contractor shall under no circumstances use residential tract streets adjacent to the Project site for stockpiling construction materials or equipment or for access to the Work site or for parking.

7.01. GWRS and Plant 1 Site Access. All construction traffic, including, but not limited to, Contractor's employees, subcontractors, and deliveries of equipment and materials shall use the second access road from Garfield Avenue through the south entrance on Orange County Sanitation District's property to the plant site. The Contractor may need to coordinate access through this entrance with the Contractor at Orange County Sanitation District if construction is continuing at the adjacent site.

No construction traffic will be allowed on Ward Street or Ellis Street.

7.02. Plant 2 Site Access. All construction traffic, including, but not limited to, Contractor's employees, subcontractors, and deliveries of equipment and materials shall use the designated construction access gate from Brookhurst
Street as shown on the drawings. Contractor shall provide security at this access gate as specified in the Site Security section.

7.03. **Detours.** Where required by the authority having jurisdiction that traffic be maintained over any construction work in a public street, road, bike trail, or highway, and the traffic cannot be maintained on the alignment of the original roadbed or pavement, Contractor shall, at its own expense, construct and maintain a detour around the construction work. Each detour shall include a bridge across the pipe trench and all necessary barricades, guardrails, approaches, lights, signals, signs, and other devices and precautions necessary for protection of the Work and safety of the public.

8. **BARRICADES AND LIGHTS.** All streets, roads, highways, bike paths, and other public thoroughfares which are closed to traffic shall be protected by effective barricades on which shall be placed acceptable warning signs. Barricades shall be located at the nearest intersecting public highway or street on each side of the blocked section.

All open trenches and other excavations shall have suitable barricades, signs, and lights to provide adequate protection to the public. Obstructions, such as material piles and equipment, shall be provided with similar warning signs and lights.

All barricades and obstructions shall be illuminated with warning lights from sunset to sunrise. Material storage and conduct of the Work on or alongside public streets and highways shall cause the minimum obstruction and inconvenience to the traveling public.

All barricades, signs, lights, and other protective devices shall be installed and maintained in conformity with applicable statutory requirements and, where within railroad and highway rights-of-way, as required by the authority having jurisdiction.

**Warning devices, at a minimum, shall conform to the requirements of Cal/OSHA.**

9. **FENCES.** All existing fences affected by the Work shall be maintained by Contractor until completion of the Work. Fences which interfere with construction operations shall not be relocated or dismantled until written permission is obtained from the owner of the fence, and the period the fence may be left relocated or dismantled has been agreed upon. Where fences must be maintained across the construction easement, adequate gates shall be installed. Gates shall be kept closed and locked at all times when not in use. Gates shall be kept closed and locked at all times when not in use.

On completion of the Work across any tract of land, Contractor shall restore all fences to their original or to a better condition and to their original locations.
10. **PROTECTION OF PUBLIC AND PRIVATE PROPERTY.** Contractor shall protect, shore, brace, support, and maintain all underground pipes, conduits, drains, and other underground construction uncovered or otherwise affected by its construction operations. All pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy wires, fences, and other surface structures affected by construction operations, together with all sod and shrubs in yards, parkways, and medians, shall be restored to their original condition, whether within or outside the easement. All replacements shall be made with new materials.

No trees shall be removed outside the permanent easement, except where authorized by Engineer. Whenever practicable, Contractor shall tunnel beneath trees in yards and parking lots when on or near the line of trench. Hand excavation shall be employed as necessary to prevent injury to trees. Trees left standing shall be adequately protected against damage from construction operations.

Contractor shall be responsible for all damage to streets, roads, highways, shoulders, ditches, embankments, culverts, bridges, and other public or private property, regardless of location or character, which may be caused by transporting equipment, materials, or workers to or from the Work or any part or site thereof, whether by Contractor or its Subcontractors. Contractor shall make satisfactory and acceptable arrangements with the owner of, or the agency or authority having jurisdiction over, the damaged property concerning its repair or replacement or payment of costs incurred in connection with the damage.

All fire hydrants and water control valves shall be kept free from obstruction and available for use at all times.

11. **DAMAGE TO EXISTING PROPERTY.** Contractor will be held responsible for any damage to existing structures, Work, materials, or equipment because of his operations and shall repair or replace any damaged structures, Work, materials, or equipment to the satisfaction of, and at no additional cost to, Owner.

Contractor shall protect all existing structures and property from damage and shall provide bracing, shoring, or other work necessary for such protection.

12. **TREE AND PLANT PROTECTION.** All trees and other vegetation which must be removed to perform the Work shall be removed and disposed of by Contractor; however, no trees or cultured plants shall be unnecessarily removed unless their removal is indicated on the Drawings. All trees and plants not removed shall be protected against injury from construction operations.

Trees considered by Engineer to have any significant effect on construction operations are indicated on the Drawings and those which are to be preserved are so indicated.
Contractor shall take extra measures to protect trees designated to be preserved, such as erecting barricades, trimming to prevent damage from construction equipment, and installing pipe and other Work by means of hand excavation or tunneling methods. Such trees shall not be endangered by stockpiling excavated material or storing equipment against their trunks.

When injuring or removal of trees designated to be preserved cannot be avoided, or when removal and replacement is indicated on the Drawings, each tree injured beyond repair or removed shall be replaced with a similar tree of the nearest size possible.

All trimming, repair, and replacement of trees and plants shall be performed by qualified nurserymen or horticulturists.

13. ACCESS ROADS. Contractor shall establish and maintain temporary access roads to various parts of the Site as required to complete the Project. Such roads shall be available for the use of all others performing work or furnishing services in connection with the Project.

A. General:

1. The Contractor shall maintain access roads in accordance with this Section, the Contract Drawings, and the General Requirements section.
2. Build and maintain dust free roads, which are suitable for travel at 20 miles per hour.

B. On-site Access Roads:

1. Maintain access roads to storage areas and other areas to which frequent access is required.
2. Maintain similar roads to existing facilities on site of the Work to provide access for maintenance and operation.
3. Protect buried vulnerable utilities under temporary roads with steel plates, wood planking, or bridges.
4. Maintain on-site access roads free of dirt and mud. Under no circumstances shall vehicles leaving the site track dirt or mud off the site onto the public right-of-way.
5. The Contractor shall provide flagmen to control traffic where construction traffic and OCSD or public traffic share the same roadway.
14. PARKING. Contractor shall provide and maintain suitable parking areas for the use of all workers and others performing work or furnishing services in connection with the Project, as required to avoid any need for parking personal vehicles where they may interfere with public traffic, Owner's operations, or construction activities.

Contractor may be required to, at its own cost, make its own arrangements for off-site parking and storage provided the locations shown on the Drawings are not sufficient for the Contractor.

15. DUST CONTROL. Contractor shall take reasonable measures to prevent unnecessary dust. Earth surfaces subject to dusting shall be kept moist with water or by application of a chemical dust suppressant. When practicable, dusty materials in piles or in transit shall be covered to prevent blowing dust.

Buildings or operating facilities which may be affected adversely by dust shall be adequately protected from dust. Existing or new machinery, motors, instrument panels, or similar equipment shall be protected by suitable dust screens. Proper ventilation shall be included with dust screens.

16. TEMPORARY DRAINAGE PROVISIONS. Contractor shall provide for the drainage of storm water and such water as may be applied or discharged on the Site in performance of the Work. Drainage facilities shall be adequate to prevent damage to the Work, the Site, and adjacent property.

Existing drainage channels and conduits shall be cleaned, enlarged, or supplemented as necessary to carry all increased runoff attributable to Contractor's operations. Dikes shall be constructed as necessary to divert increased runoff from entering adjacent property (except in natural channels), to protect Owner's facilities and the Work, and to direct water to drainage channels or conduits. Ponding shall be provided as necessary to prevent downstream flooding.

Water for flushing and disinfection work, and water used for hydrostatic testing of structures, shall be treated as specified and properly discharged by Contractor. Contractor shall be responsible for obtaining a discharge permit.

17. EROSION CONTROL. Contractor shall prevent erosion of soil on the Site and adjacent property resulting from its construction activities. Effective measures shall be initiated prior to the commencement of clearing, grading, excavation, or other operation that will disturb the natural protection.

Work shall be scheduled to expose areas subject to erosion for the shortest possible time, and natural vegetation shall be preserved to the greatest extent practicable. Temporary storage and construction buildings shall be located, and construction traffic routed, to minimize erosion. Temporary fast-growing
vegetation or other suitable ground cover shall be provided as necessary to control runoff.

18. **Pollution Control.** Contractor shall prevent the pollution of drains and watercourses by sanitary wastes, sediment, debris, and other substances resulting from construction activities. No sanitary wastes shall be permitted to enter any drain or watercourse other than sanitary sewers. No sediment, debris, or other substance shall be permitted to enter sanitary sewers, and reasonable measures shall be taken to prevent such materials from entering any drain or watercourse.

19. **Temporary Lighting.** Contractor shall provide temporary lighting in all work areas sufficient to maintain a lighting level during working hours not less than the lighting level required by Cal/OSHA standards. As permanent lighting facilities are completed, they may be used in lieu of temporary facilities, provided however, that bulbs, lamps, or tubes of such facilities used by the Contractor shall be replaced prior to final acceptance of the Work.

20. **Heating and Ventilation.** Contractor shall provide means for heating and ventilating all work areas as may be required to protect the Work from damage by high temperatures, weather, or to provide a safe environment for workers. Un-vented direct fired heaters shall not be used in areas where freshly placed concrete will be exposed to the combustion gases until at least two (2) hours after the concrete has attained its initial set.

21. **Chemicals and Energy.** Owner will provide chemicals, water, and energy required for testing and regular operation of the expanded Plant and Flow Equalization facilities as described in the Testing, Startup and Training Requirements section. Contractor shall notify the Engineer forty-five (45) days prior to any startup activities to allow the Owner time to order chemicals and have them delivered to the site for startup procedures.

Contractor shall furnish all additional chemicals required for other uses (i.e., disinfection activities following construction) and not specifically for regular operation of the plant.

End of Section
PART 1 – GENERAL

1-1. SCOPE OF WORK. The Owner has available an existing modular field office located on the GWRS site as shown on the drawings that was constructed in 2011. The existing modular field office has been sitting empty and unused for about four (4) years. The Contractor shall 1) inspect the existing modular field office and implement repairs, 2) purchase and install furnishing and equipment, 3) install water and power services, and 4) provide janitorial and building maintenance services. The location of the modular office is shown in Drawing 100-G-041. A footprint of the existing modular field office including required furnishing and equipment is shown in Exhibit A Figures.

The modular field office will be used by the Construction Manager and Engineer. This Exhibit includes materials and installation requirements for Type V, non-rated, B-occupancy, mobile office construction. Contractor shall supply and install mobile office with overall dimensions, and layout, as shown on Figure 1, which is attached at the end of this specification section. Contractor shall provide materials and complete installation needed for all wet and dry utilities for District Modular Field Office, including but not limited to, wiring and plumbing not shown on drawings, but needed for connections to outlets and fixtures.

1-2. REFERENCE SPECIFICATIONS, CODES AND STANDARDS. In addition to the requirements of the Project Requirements section, the mobile office shall also conform to the latest revision of the American Disabilities Act.

1-3. SUBMITTALS. Submittals shall be in accordance with the submittals section. At a minimum the following information shall be submitted for review.

- A communications wiring plan for office trailer. Diagram shall show locations of communications receptacles. A minimum of one phone port and three data ports shall be provided for each work station.
- An electrical wiring diagram for office trailer. Diagram shall show location of all lights, receptacles and power boards.
- Contractor shall provide for fire detection and alarm in accordance with Uniform Fire Code, Latest Revision.
- Catalog cuts, color and fabric samples for following items to be approved by District:
  - Furniture
1-4. **MOBILE OFFICE CONSTRUCTION.** All materials used in the construction shall be new as specified herein.

**PART 2 - PRODUCTS**

2-1. **TRAILER MANUFACTURER.**

2-2. **TRAILER FRAME.**

2-3. **TRAILER FLOORING.**

2-4. **ROOF AND CEILING.**

2-5. **WALLS.**

2-6. **EXTERIOR DOORS.**

2-7. **INTERIOR DOORS.**

2-8. **WINDOWS.**

2-9. **FURNITURE AND PANELING.** Contractor shall provide office furniture and paneling for the common areas, office and cubicle workstations. Furniture and paneling shall be as shown on Figure 2 and specified in the table below. Contractor shall submit catalog cuts to District for approval.

- Paneling systems shall be manufactured by AIS, or equal.
- Metal furniture shall be manufactured by McDowell-Craig, or equal.
- Chairs shall be manufactured by ECD, or equal.
- Panels shall be steel framed, covered with Guilford of Maine Terratex panel fabric, or equal, made from 100% recycled materials. Work surfaces shall be steel framed with the laminated surface. All other parts/components shall be steel framed with powder-coated paint. The color of the fabric and paint will be selected by the District to match existing.
- All Steelcase remanufactured products shall be warranted to be free of defects in design, material, and workmanship, given normal use, for a period of 10 years from the date of original purchase. The manufacturer shall provide support and responsiveness to the District as required.

Suppliers for furniture and paneling equipment shall be:
1. Harbor Business Interiors Mr. Ruben Rivera 3600 West Carriage Drive
   Santa Ana, CA 92706 (714) 668-0615
2. McMahan Business Interiors Mr. Jeffrey Schiom 8645 Research Drive
   Irvine, CA 92618 (949)727-1234
3. Swedlow Distributors Mr. Mark S. Swedlow 1061 South Prospero Drive
   Glendora, CA 91740 (626) 488-0522
4. or equal

Partition heights shall be a minimum height of 60” and a maximum height of 66”.
Contractor shall include office partitions as part of the seismic restraint design
and layout for mobile office clusters. Any additional furniture required by the
District shall be coordinated by the Contractor with the District, with additional
compensation to be negotiated.

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Furnish and install AIM M-Wall 65” And 41” High Fabric Non-</td>
<td>7 Cubicles</td>
</tr>
<tr>
<td>Powered Cubicle Panel System for each cubicle as shown on the</td>
<td></td>
</tr>
<tr>
<td>Contract Drawings. Furnish all necessary hardware, trim and</td>
<td></td>
</tr>
<tr>
<td>accessory items required to complete each cubicle installation.</td>
<td></td>
</tr>
<tr>
<td>McDowell DL-7224-112, single pedestal desk 72”w x 24”d with</td>
<td>13 Each</td>
</tr>
<tr>
<td>box/box/file pedestal, locking</td>
<td></td>
</tr>
<tr>
<td>McDowell DL 7230-112, single pedestal desk 72”w x 30”d with</td>
<td>6 Each</td>
</tr>
<tr>
<td>box/box/file pedestal, locking</td>
<td></td>
</tr>
<tr>
<td>McDowell BT-4220 bridge unit 42”w x 20”D with flat brackets</td>
<td>12 Each</td>
</tr>
<tr>
<td>McDowell BT-4820 bridge unit 48”w x 20”D with flat brackets</td>
<td>1 Each</td>
</tr>
<tr>
<td>McDowell CL-7230, plan table 72’w x 30”d with C-legs, no</td>
<td>7 Each</td>
</tr>
<tr>
<td>pedestal</td>
<td></td>
</tr>
<tr>
<td>McDowell MFP-112-14, mobile pedestal units box/box/file, locking</td>
<td>6 Each</td>
</tr>
<tr>
<td>Carter BC6536-12, bookcase unit 65”h x 36”w x 12”d with adjustable</td>
<td>13 Each</td>
</tr>
<tr>
<td>shelves</td>
<td></td>
</tr>
<tr>
<td>McDowell P36-401DHF, P-series lateral file cabinet, 36”w/4</td>
<td>7 Each</td>
</tr>
<tr>
<td>drawers, locking, keyed to desk, paint: black</td>
<td></td>
</tr>
<tr>
<td>McDowell P42-401DHF, P-series file cabinet 42”w/4 drawers,</td>
<td>23 Each</td>
</tr>
<tr>
<td>locking letter or legal filing, paint: black</td>
<td></td>
</tr>
<tr>
<td>McDowell over-desk cabinet 42”w x 16”h x 12”d w/under-cabinet</td>
<td>5 Each</td>
</tr>
<tr>
<td>work light</td>
<td></td>
</tr>
</tbody>
</table>
McDowell over-desk cabinet 24"w x 16"h x 12"d w/under-cabinet work light 2 Each

McDowell under desk pencil drawer 20"w x 20"d or equal 6 Each

Carter OFO-4230-15, overfile organizer 42"w x 30"h x 15"d with 2 upright supports equally spaced, with 4 adjustable shelves in each section, paint: black 6 Each

Sisneros CT7230-BT, conference table 72"w x 30"d with T-leg support, banded edge, laminate. Top, color to be selected by District 4 Each

Plan Hold mobile plan rack 32"w x 16" d x 42" h 5 Each

ECD 1409JS-D, 1400 series ergonomic task chair, high back, fully adjustable, fabric: grade D, color: District selected, or equal 13 Each

ECD 102-D, 100 series guest side chair, fully adjustable, grade D, color: District selected, or equal 22 Each

La-Z-Boy L9105-042-B, Sequel series conference room chair, standard tilt, black frame, Grade B, Color: District selected, or equal 12 Each

42" Diameter round table with X-base, laminated plastic top, commercial grade 1 Each

Graybeal MB4836 marker board 4’w x 3’h w/black frame, porcelain steel 5 Each

Quartet QRT 3641 TE total erase mobile easel, 4’h x 6’w graphite finish 1 Each

Kitchen cork bulletin board 4’w x 3’d w/black frame 1 Each

Precision SAF 3953 72”w x 37 ½”w drafting table with SAF 3962GR stand 1 Each

Safeco SAF 1850GR 30”h x 28”w x 20”d wood mobile machine stand 1 Each

Rubbermaid RUB3540-00 gray 23-gallon slim waste receptacle 3 Each

Rubbermaid RUB29561 black 7-gallon office waste receptacle 14 Each

2-10. HVAC. Contractor shall hire HVAC maintenance company for initial service of complete HVAC system including AC unit and temperature control systems.
2-11. PLUMBING FIXTURES FOR BATHROOMS, KITCHEN, AND JANITOR’S ROOM.

2-12. KITCHEN CABINETS AND COUNTERTOPS.

2-13. KITCHEN APPLIANCES. Contractor shall supply the following kitchen appliances:

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water coolers to house 5 gallon bottles of water. Water cooler shall provide both hot and cold taps. Contractor shall pay for delivery service for 5-gallon bottles of water to Engineer’s trailer. Number of bottles shall be adequate to meet the needs of Engineer’s fully occupied trailer.</td>
<td>2 Each</td>
</tr>
<tr>
<td>GE Profile™ Energy Star® 21.7 Cu. Ft. Top-Freezer Refrigerator (Model No. PTS22LCSCC), or equal.</td>
<td>1 Each</td>
</tr>
<tr>
<td>Amana commercial grade countertop microwave (model no. RCS10MPS), or equal.</td>
<td>1 Each</td>
</tr>
<tr>
<td>One horsepower stainless Waste King (model no. 9980), or equal, disposer.</td>
<td>1 Each</td>
</tr>
<tr>
<td>Bunnomatic (model no. VP17-2) commercial type coffeemaker, or equal.</td>
<td>1 Each</td>
</tr>
<tr>
<td>Faberware (model no. FST200) toaster, or equal.</td>
<td>1 Each</td>
</tr>
<tr>
<td>Hamilton Beach (model no. 31169) toaster oven with convection cooking, or equal.</td>
<td>1 Each</td>
</tr>
</tbody>
</table>

2-14. IDENTIFICATION.

2-15. DECKING, STAIRS AND RAILINGS.

2-16. Office Equipment. Contractor shall provide the following items:

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>72-inch combination Television with DVD player wall mounted in Conference Room</td>
<td>1 Each</td>
</tr>
<tr>
<td>Two-line telephones with speaker, memory, intercom, and conference call features</td>
<td>12 Each</td>
</tr>
</tbody>
</table>
Two-line administrative telephone 1 Each

Hands free speaker phone for conference room, with two (2) extension microphones 1 Each

Printer / Fax Machine / Scanner / Copier / Email. XEROX WorkCentre 7132 all-in-one series with the following minimum features:

- One-touch speed dial buttons – 75
- Memory capacity – 40 GB
- Automatic document feeder – 50 pages
- Monthly volume – 100,000 pages
- Color printing and copying
- Copy speed (normal):
  - Black – Up to 32 ppm
  - Color – Up to 8 ppm
- Contract for immediate site service

Ethernet switches, hubs, and drop cables for a Local Area Network. As Required

Workplace First Aid Cabinet for General Business (25-person) 1 Each

Carbon Dioxide fire extinguishers 4 Each

Cisco 2960-24 port 10/100 Switch 1 Each

WS-C2960-24TT-L; Catalyst 2960 24 10/100 + 2 1000BT LAN Base Image

CAB-AC; Power Cord, 110V 1 Each

CON-OS-C29602TT, ONSITE 8X5XNBD Catalyst 2960 24 10/100 + 2 1000BT LAN 3 Each

Cisco 1941 Router 1 Each

CISCO1941-SEC/K9; Cisco 1941 Security Bundle w/SEC license PAK 1 Each

S19UK9-15001M; Cisco 1941 IOS UNIVERSAL 1 Each

SL-19-DATA-K9; Data License for Cisco 1900 1 Each

MEM-CF-256U512MB; 256MB to 512MB CF Upgrade for Cisco 1900, 2900, 3900 ISR 1 Each
<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC Power Cord (North America), C13, NEMA 5-15P, CAB-AC; 2.1m</td>
<td>1 Each</td>
</tr>
<tr>
<td>PWR-1941-AC; Cisco 1941 AC Power Supply</td>
<td>1 Each</td>
</tr>
<tr>
<td>ISR-CCP-EXP; Cisco Config Pro Express on Router Flash</td>
<td>1 Each</td>
</tr>
<tr>
<td>MEM-1900-512MB-DEF; 512MB Default DRAM for Cisco 1941 ISR</td>
<td>1 Each</td>
</tr>
<tr>
<td>SL-19-IPB-K9; IP Base License for Cisco 1900</td>
<td>1 Each</td>
</tr>
<tr>
<td>SL-19-SEC-K9; Security License for Cisco 1900</td>
<td>1 Each</td>
</tr>
<tr>
<td>CON-SNT-1941SEC; SMARTNET 8X5XNBD Cisco 1941 Security Bundle w/SEC license</td>
<td>3 Each</td>
</tr>
<tr>
<td>AIR-AP1142N-A-K9</td>
<td>1 Each</td>
</tr>
<tr>
<td>AIR-AP1131AG-A-K9; 802.11a, .11g AP, Int Radios, Ants, FCC Cnfg</td>
<td>1 Each</td>
</tr>
<tr>
<td>AIR-AP1142N-A-K9; AIR Line Cord North America</td>
<td>1 Each</td>
</tr>
<tr>
<td>S114W7K9-12421JA; Cisco 1140 Series IOS WIRELESS LAN</td>
<td>1 Each</td>
</tr>
<tr>
<td>AIR-PWRINJ4=; Power Injector - 1140 / 1250 Series; Spare</td>
<td>1 Each</td>
</tr>
<tr>
<td>CON-SNT-1142NAK; SMARTNET 8X5XNBD 802.11a/g/n Fixed Unified AP; Int Ant</td>
<td>3 Each</td>
</tr>
<tr>
<td>Riverbed for WAN optimization</td>
<td></td>
</tr>
<tr>
<td>SHA-00550-H; Steelhead 550 with 2 onboard GbE bypass ports (600 conn/2Mbps)</td>
<td>1 Each</td>
</tr>
<tr>
<td>MNT-GLD-SHA-00550; Gold level annual support for Steelhead Appliance 550 Series</td>
<td>1 Each</td>
</tr>
<tr>
<td>MEM-002; 2 GB Memory</td>
<td>1 Each</td>
</tr>
<tr>
<td>RMK-001; Rack Mount Kit for Steelhead SH250/550</td>
<td>1 Each</td>
</tr>
<tr>
<td>RSP-PCK-02; RSP Multi-Package License</td>
<td>1 Each</td>
</tr>
<tr>
<td>MNT-RSP-PCK-0 2; RSP Multi-Package License Support</td>
<td>1 Each</td>
</tr>
</tbody>
</table>
UPS

SUA750; APC Smart-UPS 750VA USB & Serial 120V 1 Each

AP9617; NETWORK MANAGEMENT CARD EX 1 Each

Network printer HP Model 5550DN or greater capable of 11X17 printing and network accessible.
- Contract for immediate site service

Multi-Function Device (MFD), Konica BizHub C220 or greater capable of color printing, 11X17 printing, scan to email and fax capabilities.
- Contract for immediate site service

The contractor shall provide an Internet, T1 line or greater. The internet circuit shall be provided for the duration of the project to the CM with an Ethernet handoff. Provide a public routable IP address scheme with a subnet mask of /29 for routable addresses. The Contractor shall provide LAN Line telephone service and voicemail and will perform maintenance including move, add, and changes for the duration of the project. Each network component and UPS device will carry the stated maintenance types until thirty (30) days after Final Acceptance. Contractor shall provide all consumable supplies necessary for complete operation of the equipment specified under this section shall be furnished by Contractor until thirty (30) days after Final Acceptance. These supplies include, but are not limited to, ink and toner cartridges, plain paper, first-aid supplies, and fire extinguisher certification.

2-17. INSPECTION.

PART 3 - NOT USED

End of Section
PART 1 - GENERAL

1-1. THE REQUIREMENTS.

A. This specification shall apply only to the OCSD Plant 2 Work.

B. This Specifications section includes furnishing, maintaining, and removing temporary construction facilities and controls, including temporary utilities, construction aids, barriers and enclosures, security, access roads, temporary environmental controls, project signs, field office, water for construction and testing and removal after construction.

C. In the event of a conflict between the requirements of this Specifications section and other Specifications, the most stringent requirements shall govern.

1-2. RELATED WORK SPECIFIED ELSEWHERE.

A. The requirements of the following Specifications sections and divisions apply to the Work of this Specifications section. Other sections and divisions of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. 01140, Work Restrictions
2. 01520, OCSD Contractor’s Field Office
3. 01550, OCSD Vehicular Access Storage and Security
4. 02200B, OCSD Earthwork

1-3. CONTRACTOR SUBMITTALS.

A. Submittals shall be made in accordance with the General Requirements and 01300 Submittals.

B. The Contractor shall provide a copy of the off-site parking plan and a security plan to the Engineer as specified in the paragraph entitled “Traffic Control” of this Specifications section.

C. The Contractor shall submit temporary engine-generator set documentation as specified in the paragraph entitled “Temporary Engine-Generator Set(s)” of this Specifications section.
D. The Contractor shall submit east perimeter dirt road access restriction methods and plans for Engineer review and acceptance, primarily for protection in place of the existing 120-inch diameter interplant secondary effluent pipeline which has limited cover.

E. The Contractor shall submit a written estimate of power needs to the Engineer for acceptance as specified in the General Requirements.

1-4. CONTRACTOR STAGING, STOCKPILE AND WORK AREAS.

A. Contractor staging area at Plant 2 is shown on Drawing 100-G-043. This area shall be used if necessary for stockpiling. No other staging and stockpile areas will be provided on the OCSD sites. Requirements for the staging area include:

1. Contractor and Contractor’s employees and Subcontractor’s parking is allowed in the staging areas designated for this Contract. Parking of Contractor vehicles, equipment, or personal vehicles will not be allowed outside of these areas. There shall be no parking of Contractor employee and personal vehicles on the public streets and right-of-ways. Designated parking areas for work vehicles shall be the responsibility of the Contractor at the work site.

2. The Contractor shall only access Plant No. 2 through the access gates and along routes identified in the Contract Documents.

3. At Plant No. 2, Contractor shall develop a badge identification system with photo identification for all workers that are assigned to the Project for more than ten (10) Days or who are required to provide repeated deliveries on an ongoing basis. All truck delivery drivers shall be required to sign in at the OCSD’s security station at the Banning gate. No workers shall be allowed on-site without their identification and the Contractor shall remove any worker from the workforce who is in repeated non-compliance.

4. The Contractor shall safely guard all Work, materials, equipment, and property from loss, theft, damage and vandalism.

5. At Plant No. 2, Contractor shall provide security guards in conformance with the paragraph entitled “Security” of this Specifications section to provide the required security and prevent unauthorized entry to the plants’ staging area. Guard service shall be posted at the Plant No. 2 Banning Gate (Plant No. 2). The security guard service shall be accepted by OCSD. At no time shall anyone other than authorized persons be allowed to the work areas or through the gates.

6. If additional area is required, the Contractor shall make arrangements for additional off-site storage, office space and/or work areas outside OCSD Plants No. 2 treatment facilities at no additional cost to OCWD.
7. The Contractor shall have access to the construction and rehabilitation work areas shown in the Contract Drawings.

1-5. CONTRACTOR’S FIELD OFFICE.

A. Refer to Specifications Section 01520, Contractor’s Field Office.

B. The field office shall be located where shown on the Contract Drawings. The Contractor shall not use public and/or private property for field offices and/or for any purpose other than as designated in the Contract Documents without obtaining written authorization of the jurisdiction and/or owner and submitting a copy of the authorization to the Engineer.

1-6. TEMPORARY UTILITIES.

A. Staging area power and water for the field office shall be provided by OCSD in accordance with the General Requirement entitled “OCSD-Furnished Power and Water at Plants No. 1 and No. 2”.

B. Temporary Electrical Power:

1. OCSD will provide temporary electrical power as indicated in Contract Documents. Contractor shall provide all labor, equipment, and supplies required to establish and test power source. The power sources are subject to interruption during plant power outages. Temporary power is 480 V acm 100 Amp, 3-phase and is intended only for trailers and small tools.

2. Contractor shall provide temporary power for all flow bypass, dewatering requirements, bypass pumping requirements, and any other special equipment including a new distribution rack, wiring and all connections. All such facilities shall be in conformance with the latest electrical Codes. Limited shutdowns for tie ins will be permitted as coordinated with and approved by the Engineer.

3. Contractor may provide stand-by power generators instead of temporary power from the local utility company. Contractor shall meet all local, State, Regulatory agency standards for utilizations. Contractor shall acquire all necessary licenses, permits, and acceptances to operate stand-by power supplies at no additional cost to OCSD. The Contractor shall not exceed noise restrictions of the local, State, and Regulatory agency having jurisdiction. Contractor shall meet the most restrictive requirement at no additional cost to OCSD.

4. The Contractor shall construct all connections between tie-in points and points of use for the temporary power.
5. Contractor shall protect temporary power supply in roads or other areas accessible by vehicles.

6. Contractor shall provide a separate backup power supply for his own equipment to be used in the event OCSD experiences loss of power.

C. Temporary Electrical Lighting:

1. The Contractor shall provide temporary lighting per this section, General Requirements, and Section 01500.

2. In work areas, provide temporary lighting sufficient to maintain lighting levels during working hours not less than lighting levels required by OSHA and State agency which administers OSHA regulations where Project is located. Night work conducted only with OCSD approval shall be suitably lighted to insure proper performance, inspection, visibility and safe working conditions.

3. When available, permanent lighting facilities may be used in lieu of temporary facilities.

4. Prior to Substantial Completion of the Work, replace bulbs, lamps, or tubes used by Contractor for lighting.

D. Temporary Heating, Cooling, and Ventilating: Heat and ventilate work areas to protect the Work from damage by freezing, high temperatures, weather, and to provide safe environment for workers.

E. Telephone and Internet: Contractor shall provide internet service at the construction site office. Contractor shall provide either land line based, internet based, or cell phone based telephone service. Radio-telephone service is not acceptable as a substitute for telephone service.

F. Temporary Water:

1. Potable Water: Contractor to provide potable drinking water per General Requirement entitled “Drinking Water”.

2. Construction Water:
   a. Non-potable construction water will be provided by OCSD in accordance with the General Requirements.
   b. Non-potable water is available at nearby hydrants as shown on the Drawings. The Contractor shall furnish, install, and calibrate an OCSD acceptable backflow preventer before connecting to the water source. Non-potable water shall be provided at no cost to Contractor. Contractor shall note that non-potable water from hydrants is not fit for consumption and shall be used for construction purposes only
c. Non-potable secondary effluent and equivalent plant water is also available for the Contractor at key locations. The Contractor shall make his own temporary connection to the plant water system and conveyance to the point of use as approved by the Engineer and shall provide all necessary tools, labor and material for such connection and piping to point of use. Limited shutdowns required to affect the connection shall be scheduled and coordinated with the Engineer to minimize disruption to plant operations and work by other contractors on site. Temporary construction water piping shall not thwart passage by plant and construction vehicles not otherwise blocked by plant and construction operations.

d. The rate of flow from hydrants or connections to the plant water system shall not exceed 250 gpm.

3. Water for hydrostatic testing:

a. The Contractor shall use RW and/or secondary effluent for hydrostatic testing of piping, wetwell and tanks. Secondary effluent shall be used for pump and system testing. Sources of such water shall be the 120-inch TFSC pipeline.

G. Temporary Sanitary Facilities: The Contractor shall provide suitable and adequate self contained and maintained sanitary facilities that are in compliance with applicable Laws and Regulations and in accordance with General Requirements, Environmental Controls, and in compliance with Specifications Section 01520, Contractor’s Field Office. No gravity or pumped sewer service is available for the Contractor’s field office, staging or stockpiling areas.

H. Temporary Fire Protection: Provide sufficient number of fire extinguishers of type and capacity required to protect the Work and ancillary facilities.

I. First Aid: Post first aid facilities and information posters conforming to requirements of Occupational Safety and Health Administration (OSHA) and other applicable Laws and Regulations in readily accessible locations.

J. Utilities in Existing Facilities: See Specifications Section 01140, Work Restrictions.

K. The Contractor shall supply a sump pump and piping to provide temporary storm water pumping for the area north of the main construction, soil improvement and excavation area until the replacement storm drain system can be constructed and placed in service.

1. The pump and piping shall be in place and placed into service prior to excavation within 10 feet of the existing storm drain piping to be
demolished. The Contractor shall keep these temporary facilities in place and ready to operate at all times after the storm drain piping has been demolished, for the remaining duration of the Contract.

2. The pump and temporary piping shall be in operation during rain events.

3. The pump shall be self-priming and capable of pumping up to 50 gallons per minute of flow.

4. The piping shall be twelve inches in diameter and placed with restrained joints above grade. The piping shall be secured to prevent movement when in use and to prevent surge from separating joints or initiating pipe movement.

5. Storm and nuisance water shall be desilted and handled in accordance with the SWPPP.

6. The Contractor shall protect in place the piping and pump unit while deployed at all times.

1-7. CONSTRUCTION AIDS.

A. Provide railings, kick plates, enclosures, safety devices, and controls required by Laws and Regulations and as required for adequate protection of life and property.

B. Use construction hoists, elevators, scaffolds, stages, shoring, and similar temporary facilities of ample size and capacity to adequately support and move loads.

C. Design temporary supports with adequate safety factor to assure adequate load bearing capability.

1. When requested, submit design calculations by professional registered engineer prior to application of loads. Submitted design calculations are for information and record purposes only.

D. Accident Prevention:

1. Exercise precautions throughout construction for protection of persons and property in accordance with this Specifications section and the Contract Documents.

2. Guard machinery and equipment, and eliminate other hazards.

3. Make reports required by authorities having jurisdiction, and permit safety inspections of the Work.

4. Before commencing construction work, take necessary action to comply with provisions for safety and accident prevention.
E. Warning Devices and Barricades:

1. Place barriers at ends of excavations and along excavations to warn pedestrian and vehicular traffic of excavations in accordance with the General Requirement entitled “Public Convenience and Access”.

2. Provide barriers with flashing lights after dark.

3. Barricade excavations to prevent persons from entering excavated areas in streets, roadways, parking lots, treatment plants, or other public or private areas.

4. Adequately identify and guard hazardous areas and conditions, such as overhead power lines, by visual warning devices and, where necessary, physical barriers.

5. Warning devices shall conform to OSHA and State agency requirements, which administers OSHA regulations where the Project is located.

6. Fencing shall be provided around all contractor work areas, staging areas, and temporary work areas. Fencing shall be chain link, a minimum of 8 feet high, with green screening fabric covering all fencing. Fencing shall be provided where indicated on the Drawings, and in the event not indicated on the Drawings, where Contractor work areas, staging areas, and temporary work areas exist at no additional cost to OCWD.
F. Hazards in Public Right-of-Way:

1. Mark at reasonable intervals in accordance with the General Requirement entitled "Public Convenience and Access", trenches and other continuous excavations in public right-of-way, running parallel to general flow of traffic, with traffic cones, barricades, or other suitable visual markers during daylight hours.

2. During hours of darkness, provide markers with flashers, or other adequate lights.

3. At intersections, where traffic may reasonably be expected to approach head on, protect excavations by continuous barricades.

4. During hours of darkness, provide warning lights at fifty (50) foot intervals.

G. Hazards in Protected Areas: Mark or guard excavations in areas from which public is excluded, in manner appropriate for hazard.

H. Above Grade Protection: On multi-level structures, provide safety protection that meets requirements of OSHA and State agency which administers OSHA regulations where the Project is located.

I. Protect existing structures, trees, shrubs, and other items to be preserved on Project site from damage or destruction by vehicles, equipment, worker or other agents with substantial barricades or other devices commensurate with hazards.

1-8. SECURITY.

A. Prior to construction, the Contractor shall submit and obtain Engineer’s acceptance of a security plan that addresses normal security protocols and procedures, integration with the existing OCSD security program and personnel, reporting and responding to suspected and actual security breaches, and emergency protocols and procedures for both normal working hours and outside-of-normal working hours. The Contractor shall make adequate provisions for protection of the work area against fire, theft, and vandalism, and for protection of public against exposure to injury.

B. The Contractor shall be responsible for protection of the Project site, and all Work, materials, equipment, and existing facilities thereon, against vandals and other unauthorized persons.

C. No claim shall be made against OCSD or OCWD by reason of any act of an employee or trespasser, and the Contractor shall make good all
damage to OCSD's property resulting from Contractor's failure to provide security measures as specified.

D. The Contractor shall provide security measures to protect OCSD's existing facilities during normal operation, but shall also include such additional security fencing, barricades, lighting, watchman services, and other measures as required to protect the Project site.

E. The Contractor shall provide security services at the Plant No. 2 Banning gate in accordance with paragraph entitled “Contractors Access Gate and Security” in Specifications Section 01550, Vehicular Access Storage and Security.

1-9. ACCESS ROADS.

A. General:

1. The Contractor shall maintain access roads in accordance with this Specifications.
2. Maintain dust free roads, which are suitable for travel at 20 miles per hour.

B. On-site (Plant No. 2, Access Roads):

1. Maintain access roads to storage areas and other areas to which frequent access is required.
2. Maintain similar roads to existing facilities on-site of the Work to provide access for maintenance and operation.
3. Protect buried vulnerable utilities (any underground utility with less than 6 feet of cover) under temporary roads with steel plates, wood planking, or bridges.
4. Maintain on-site access roads free of dirt and mud. Under no circumstances shall vehicles leaving the site track dirt or mud off the site onto the public right-of-way.
5. Contractor shall repair any damaged fencing or utilities, including but not limited to sprinkler systems, in kind at no additional cost to OCSD, if damaged during the execution of the Work.
6. Contractor shall follow OSHA and SCE requirements for work near powerlines.
1-10. TEMPORARY ENVIRONMENTAL CONTROLS.

A. The Contractor shall comply with environmental regulations and requirements in accordance with General Requirement and Environmental Control.

1-11. NOISE CONTROL.

A. The Contractor shall perform the Work in accordance with General Requirement and Environmental Control.

B. Local Noise Ordinances: For all projects located inside or outside of the treatment plants, the Contractor shall comply with the ordinances of local agencies having jurisdiction.

C. The Contractor shall take reasonable measures to avoid unnecessary noise. Such measures shall be appropriate for the normal ambient sound levels in the area during working hours.

D. All construction machinery and vehicles shall be equipped with practical sound-muffling devices, and operated in a manner to cause the least noise consistent with efficient performance of the Work.

E. During construction activities at Plant No. 2, Contractor shall erect sound screens or sound attenuation barriers/blankets effective in reducing noise and shall conduct its operations to avoid unnecessary noise which exceeds local noise ordinances Especially the Santa Ana River Bike Trail.

F. Continuous monitoring of noise at all work sites shall be recorded to comply with the OCSD and County noise regulations. Monitors shall be provided at adjacent property lines within 200 feet of the work site. Monitors shall be in good working condition and with be calibrated for current use. Monitors shall be capable of recording at least seven (7) Days’ worth of data. Any shutdown time due to excessive construction noise generated by the GWRSFE construction project shall be borne by the Contractor. Contractor shall produce noise records upon request by Engineer. Contractor shall submit noise monitoring records monthly for Engineer review.

G. Additional Restrictions: In addition to the noise ordinances, the Contractor shall follow the restrictions identified in Specifications Section 02200, OCSD Earthwork.
1-12. TEMPORARY ENGINE-GENERATOR SET(S).

   A. Work areas having active temporary generator set(s) shall be configured such that they comply with Contract Documents noise restrictions and requirements.

   B. Diesel-fueled generator set(s) shall be provided with weatherproof and sound-attenuated enclosure, 68 dBA at full load measured at 7 meters.

   C. The specific requirements of the diesel-fueled generator sets intended for use on this Project shall be submitted for Engineer's acceptance.

   D. Furnish and connect temporary diesel-fueled generator set(s) to provide a temporary power source(s) as required.

      1. For each set, provide a fuel tank containing no less than the 150 percent of the set’s full day usage.

      2. Provide proper grounding for each fuel tank and each generator set.

   E. Provide automatic remote dialing to notify Contractor’s designated personnel and OCSD’s designated personnel of the diesel-fueled generator set alarm conditions specified herein.

      1. The OCSD phone number to be dialed shall be as designated by the Engineer.

1-13. TRAFFIC CONTROL.

   A. All Contractor’s and Subcontractor’s regular staff working on this Project shall be issued parking passes which are accepted by OCSD. All other construction traffic shall sign IN/OUT at the security station. All the Contractor’s field offices, storage facilities and parking shall be contained within the Contractor’s designated staging area. The Contractor shall make plans for off-site overflow parking.

   B. The Contractor shall coordinate all Work to avoid any interference with vehicle traffic through the treatment plant and on public right-of-ways. Contractor shall not block existing access roadways and/or access to service equipment and facilities. Contractor shall provide access for chemical deliveries, cake trucks, and routine operation by OCSD staff at all times.

   C. The Contractor shall provide safe and reasonable access for OCSD and emergency vehicles to all areas within the work site throughout construction. The Contractor shall provide temporary barricades as required to protect open trenches and construction equipment from vehicles passing by the Work area.
D. Barricades and flagging shall conform to the latest edition of the California Department of Transportation “California Manual on Uniform Traffic Control Devices – Temporary Traffic Control” using “Figure 6H -18 Lane Closure on Minor Street (TA-18)” as a guide for the lane closure.

E. The Contractor shall maintain and keep all temporary traffic control devices in good repair and working order until no longer required. The maintenance shall be at the Contractor’s expense. The Contractor shall also pay the cost of replacing such devices that are lost or damaged, to such an extent as to require replacement, regardless of the cause of such loss or damage.

F. The Contractor shall provide reflectorized cones, delineators, or barricades used in the diversion of traffic with flashers, arrow boards, or other accepted illumination if in place during hours of darkness. All signs shall be illuminated or reflectorized unless otherwise accepted by the appropriate jurisdictional agency.

G. All materials delivered to the Project shall be unloaded and placed in a manner which will not interfere with the flow of necessary traffic.

H. The Contractor shall cleanup all roadways impacted by this Project at the end of each work day.

I. Contractor shall, as necessary, wash truck tires leaving the site to reduce the amount of particulate matter transferred to paved streets as required by SCAQMD Rule 403.

J. All Contractor’s and Subcontractor’s employees shall park personal vehicles within the Project’s staging area unless otherwise accepted in writing by the Engineer.

K. The Contractor shall be allowed a maximum of two (2) work vehicles /trucks positioned next to each work area unless accepted otherwise in writing by the Engineer.

L. The following activities shall be prohibited outside of work areas and staging areas unless otherwise indicated in the Contract Documents or accepted in writing by the Engineer:
   1. Blocking and/or restricting access through plan emergency routes
   2. Blocking and/or restricting access to operated facilities
   3. Storage of equipment and materials
   4. Stockpiling of excavated materials, if any.
M. Existing access routes to operational facilities shall be maintained.

1-14. **REMOVAL.**

A. Remove all temporary facilities and structures per General Requirement entitled “Final Cleanup”.

B. Clean and repair damage caused by installation or use of temporary facilities.

C. Remove underground installations to minimum depth of 24 inches and grade to match surrounding conditions.

D. Restore existing facilities used during construction to specified or original condition.

E. Prior to Final Completion, Contractor shall remove paint markings from utility requests on public right-of-ways and roadways by water blasting without damaging existing surfaces. Water shall be collected and disposed of properly.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION**

3-1. **TEMPORARY ENGINE-GENERATOR SET OPERATION.**

A. Ensure reliable operation and required availability of the diesel-fueled generator set(s) by performing the following:

1. Inspect the set and its components at least once a day, including both working and non-working days. Continuously monitor fuel availability to each diesel-fueled generator set. Fill up the fuel tank to the maximum allowable tank capacity specified elsewhere in this Specifications section, at least once a day, including both working and non-working days.

   End of Section
PART 1 - GENERAL

1-1. REQUIREMENTS.

A. The field office requirements specified herein shall apply only to the OCSD Plant 2 Contractor's field office.

B. The Contractor shall provide all required power connections, telephone and internet, necessary for proper operation of the temporary facilities. The field offices shall have a maintenance and service contract to take care of cleaning, and service for the heater/air conditioner, printer/telephone/copier/fax machine, bottled water, sanitary facility, and portable toilet disposal service. The costs required to furnish, install, maintain, remove and decommission the temporary facilities at the end of the Project shall be included in the contract lump sum Bid Price.

C. The field office shall consist of a stand-alone structure and be located within the staging area set forth in the general drawings.

D. All environmental controls including noise control, fugitive dust, air pollutant emissions, housekeeping and rubbish control and sanitation for the field office shall be those indicated for the construction area.

1-2. RELATED WORK SPECIFIED ELSEWHERE.

A. The requirements of the following Specifications sections and divisions apply to the Work of this Specifications section. Other sections and divisions of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. 01025, Measurement and Payment

1-3. REFERENCE SPECIFICATIONS, CODES, AND STANDARDS.

A. All facilities shall conform to applicable building codes, ordinances and regulations. All associated permits required are the responsibility of the Contractor.

1-4. CONTRACTOR SUBMITTALS.

A. Submittals shall be made in accordance with the General Requirements.
B. Office trailers provided for the Project, to comply with the requirements of this Specification section shall not be over five (5) years old. Contractor to provide date when field offices were manufactured in submittal.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3-1. GENERAL.

   A. The field offices shall be located within the Contractor’s staging area shown on the Contract Documents.

3-2. OFFICE APPARATUS.

   A. The Contractor’s field office shall be watertight construction with the walls and ceilings lined on the inside with insulating fiberboard. The field office shall be large enough to comfortably accommodate the minimum requirements specified in paragraph entitled “Requirements” above. The Contractor shall be responsible for determining the type of office equipment and other amenities required for a comfortable, efficient, and safe work space for the Contractor’s personnel.

   B. The Contractor shall provide for janitorial service for all field offices, which shall include weekly floor and window cleaning and trash removal. The field offices shall have a maintenance and service contract to take care of cleaning, and service for the heater/air conditioner, printer/telephone/copier/fax machine, bottled water, sanitary facility, and portable toilet disposal service.

3-3. WORK SEQUENCE.

   A. The field offices shall be completed within sixty (60) Days after Notice to Proceed, in a location acceptable to the Engineer. The building (field office) shall remain on-site for the duration of the Contract until closeout of Contract, whereupon it shall be removed by the Contractor at no additional cost to OCWD. All costs, including those required to purchase or rent the temporary office, utilities, including telephone lines, permits for the field office, installation, moving costs, removal, and all other costs necessary to complete the Work specified under this Specification section, shall be paid for by the Contractor.

   B. The occupancy of the field offices shall not exceed the Contract duration.

End of Section
PART 1 - GENERAL

1-1. THE REQUIREMENT.

A. This Specifications section applies to work at OCSD’s Plant 2.

B. Protect Work, existing premises, and OCSD’s operations from theft, vandalism, and unauthorized entry.

C. The Contractor shall initiate a security system program to coordinate with OCSD’s existing security system and Project No. J-117B, P2-122, P2-110 contractors at mobilization.

D. Maintain program throughout construction period as specified herein.

1-2. RELATED WORK SPECIFIED ELSEWHERE.

A. The requirements of the following Specifications sections and divisions apply to the Work of this Specifications section. Other sections and divisions of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. 01300 Submittal

1-3. CONTRACTOR SUBMITTALS.

A. General: Submittals, including samples of materials, shall be in accordance with the Submittal section as indicated herein.

B. The Contractor shall submit a security plan and map (or series of maps) indicating, as a minimum, the following items:

1. Staging of construction as it relates to traffic flow
2. Entrance gate to be used
3. Location of trailers
4. Laydown area
5. Employee parking
6. Storage
7. Traffic control plans and emergency routes to be maintained
1-4. EMPLOYEE SHUTTLE ROUTING CLOSURE OF ACCESS ROADS WITHIN PLANT.

A. The Contractor shall minimize the inconvenience and minimize the time period that access roads will be closed.

B. If closure of any access road is required during construction, the Contractor shall apply in writing to the Engineer at least fourteen (14) Days in advance of the required closure and provide proposed detours for consideration.

1-5. CONTRACTOR'S WORK AND STORAGE AREA.

A. No equipment or material storage will be allowed within the public right-of-way.

B. Contractor’s construction and staging areas, and access routes are shown on Drawing 100-G-043.

C. At completion of the Work, the Contractor shall return these areas to their original condition, including grading and landscaping.

D. The Contractor shall make its own arrangements for any necessary off-site storage or shop areas necessary for the proper execution of the Work.

1-6. CONTRACTOR ACCESS GATE AND SECURITY.

A. The Contractor shall access the site only through the Banning Gate on Brookhurst Street and shall comply with all OCSD security procedures.

B. Access and use of the Banning Gate will be shared with OCSD, the P2-110 contractor, J-117B contractor, P2-122 contractor, and other OCSD contractors. The Contractor shall not allow the staging of delivery or construction vehicles in a manner that blocks or unduly restricts access via the Banning Gate to other users thereof.

C. Gate staffing and security up to the time of Project No. P2-110 completion (scheduled August 2019) and after to J-117B (scheduled completion July 2024): P2-110/J-117B contractor will be responsible for the security of Banning Gate during Project No. P2-110/J-117B contract for the working hours of their project contract. The Contractor shall coordinate the Banning gate security, access requirements, and security guard coverage outside of Project No. P2-110/J-117B working hours with the P2-110/J-117B contractor. Scheduled working hours for Project No. P2-110/J-117B at time of bid are Monday through Friday, 6:30 A.M. to 3:00 P.M. These hours and weekdays are subject to change and the CONTRACTOR shall coordinate with P2-110/J-117B contractor for any changes. The
Contractor shall provide security services at the Banning gate for all GWRSFE Work outside of scheduled working hours of Project No. P2-110, J-117B, P2-122 and other OCSD contractors may also be working during the same period using the Banning Gate for access and CONTRACTOR shall coordinate with them.

D. Gate staffing and security following completion of Project No. P2-110 : The J-117B contractor will provide security services at the Plant No. 2 Banning gate for all Project No. J-117B work upon completion of Project No. P2-110. Security guard services will be provided in accordance with the requirements herein. The Contractor shall include in the Bid the cost of providing guard services at the Plant No. 2 Banning Gate for Work outside of Project No. J-117B scheduled working hours and days.

E. Should any of the Contractor’s operations require temporary closing of the Banning Gate entrance, the gate staffing and security shall be relocated to the Bushard Gate for the duration of the outage and the same security provisions as specified above shall apply with costs therefor to be borne by the Contractor for the duration of the Banning Gate outage. The maximum duration of the Banning Gate outage shall be thirty (30) Days.

1-7. PARKING.

A. The Contractor’s employee/worker vehicles shall park in the area shown in Drawing 100-G-043.

1-8. PERSONNEL IDENTIFICATION.

A. The Contractor shall develop a badge identification system with picture identification for all workers that are assigned to this Project for more than ten (10) Days or who are required to provide deliveries on an ongoing basis. All truck delivery drivers shall be required to sign in at the Banning Gate security station to receive a temporary day badge for that day. No workers will be allowed on-site without their identification and the Contractor shall remove any worker from the workforce who is in repeated non-compliance. Badge identification system shall be compatible with system developed and utilized by the P2-110/J-117B contractors.

B. The Contractor shall arrange for utilizing the dual use, keypad and magnetic card access system and the automatic gate operator at the Banning Gate, and shall be responsible for its maintenance after completion of the J-117B until the completion of GWRSFE Plant 2 construction. The system shall include the following:

1. A keypad and magnetic card system in full operation during the term of the Contract. The Contractor shall provide any software required to make the system functional and locate the database control hardware
in its field office. The system will not be tied into OCSD’s gate security system.

2. The Contractor shall provide magnetic cards for the Contractor’s staff and Subcontractor’s staff, and shall secure the distribution of magnetic cards and maintain a database log of all cardholders. The Contractor shall maintain the cardholder log current at all times and shall forward a copy of the updated cardholder log to the Engineer whenever a change has occurred.

3. The Contractor shall limit the use of the magnetic access cards to the Contractor’s and Subcontractor’s on-site staff and essential personnel. The magnetic card access system shall log all after work hours entry and exit access for up to a six (6) month period. The entry / exit database from the previous six (6) month period shall be downloaded from the system to an electronic file and database maintained for the duration of the Work.

4. The Contractor shall provide entry/exit data records upon the Engineer’s request. The system shall have a “Failed Open” alarm in the event the access system fails and the gate remains open for thirty (30) minutes. The system shall automatically notify the Contractor’s field office and the Contractor provided security personnel in the event of a failed open alarm. The Contractor shall have a monitoring service to implement the “Failed Open” alarm feature.

5. The Contractor shall respond immediately to an alarm notice on a 24-hour basis, including weekends and holidays. The Contractor shall be responsible for gate repairs, traffic loop repairs and keypad and magnetic card system repairs. If repairs are not made within four (4) hours and the gate remains open, OCSD reserves the right to close and barricade the gate.

1-9. CONSTRUCTION EQUIPMENT ACCESS.

A. Heavy construction equipment including cranes over 20-ton capacity and track vehicles, as well as any vehicles exceeding H-20 loading criteria, shall not be permitted to cross existing tunnels without protective traffic plates in place. The Contractor shall be responsible for obtaining and paying for adequate traffic plates to protect existing structures from damage.

B. For access to unpaved road above the existing 120-inch diameter interplant pipeline (IPP) and the 84-inch diameter IPP at Plant No. 2, the Contractor shall place 1-1/4-inch steel traffic plates across the 120-inch IPP throughout the use of the Contractor’s access to protect the 120-inch IPP.
PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

End of Section
PART 1 - GENERAL

1-1. THE REQUIREMENT.

A. This specification shall apply only to the OCSD Plant 2 Work.

B. This Specifications section supplements the General Requirements. All requirements of General Requirement, Environmental Control, and all SCAQMD rules, in particular SCAQMD Rule 403-Fugitive Dust, shall be strictly enforced. The Contractor shall be responsible to review and be familiar with all applicable SCAQMD rules. Where there are differences, the most stringent of the requirements specified in General Requirement, Environmental Control, this section, and SCAQMD rules, shall apply.

1-2. RELATED WORK SPECIFIED ELSEWHERE.

A. The requirements of the following Specifications sections and divisions apply to the Work of this Specifications section. Other sections and divisions of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. Environmental Control
2. 01300 Submittal
3. 02050, Demolition
4. 02200B, OCSD Earthwork

1-3. TRAFFIC CONTROL AND EARTH HAULING.

A. Contractor’s delivery trucks will not be allowed to line up on Brookhurst Street before normal construction hours. Deliveries shall be scheduled to arrive at the site during normal construction hours, such that they can enter the Plant No. 2 site immediately upon arrival.
1-4. **CONTRACTOR SUBMITTALS.**

A. At least thirty (30) Days prior to excavation operations, the Contractor shall submit a truck haul route plan to OCWD, OCSD and to the City of Huntington Beach, Department of Public Works, for acceptance by both entities. The plan shall comply with all requirements of Huntington Beach Municipal Code, Chapter 17.05 Grading and Excavation Code in general, and Section 17.05.210, Import and export of earth material, in particular. The plan shall include the approximate number of truck trips and the proposed truck haul routes. The plan shall specify the hours in which transport activities will occur and methods to mitigate construction-related impacts to adjacent residents. The plan shall include location of a truck washdown area (with water source and drainage shown) to be operated by the Contractor to minimize the material on the trucks that may be deposited on city streets.

1-5. **DUST CONTROL.**

A. The Contractor shall keep moist all Plant No. 2 roads (paved and unpaved), excavated areas, and stockpiles at all times to prevent fugitive dust. The Contractor shall provide continuous street sweeping operations on Brookhurst Street, and neighborhood streets as applicable, during all Contractor operations that include hauling soiling material on/off-site. At the end of every day in which dirt was excavated or hauled on/off-site, the Contractor shall provide a thorough street sweeping on all paved Plant 2 used by the Contractor.

B. The Contractor shall provide rumble strips and tire cleaning operations for trucks leaving the Plant 2 site. The Contractor shall ensure that no dirt or mud is tracked onto Brookhurst Street.

C. Street Sweepers for applications specified in 1.4 A shall be waterless, vacuum type, approved under South Coast Air Quality Management District Rule 1186, July 11, 2008 (Elgin Pelican P. Elgin Eagle F, or equal). Street sweeping will be allowed between the hours of 8:00 A.M. and 4:30 P.M.

D. The Contractor shall maintain the minimum freeboard specified below on all trucks hauling soil, sand or other loose material.

   1. Minimum 2 feet freeboard, uncovered.
   2. Minimum 6 inches freeboard, covered.

E. Apply non-toxic soil binders to exposed soil stockpiles as necessary to comply with the General Requirements.
1-6. **NOISE AND VIBRATION CONTROL.**

A. Localized sheet piling is required as part of the Work, pile driving will be allowed only between the hours of 10:30 A.M. and 2:30 P.M. on regular work days.

B. Sound dampening devices shall be placed around or adjacent to pile driving activities to minimize noise impacts to the surrounding community.

C. Diesel-driven hammers will not be allowed. The Contractor shall use sound blankets on the west (Brookhurst Street) side of the pile driving hammer.

D. Maximum sound level during pile installation shall be 80 dBA at Plant No. 2 property lines. Requirements listed in 1.5A, 1.5B, and 1.5C will be enforced even if the sound level at the property line is less than the maximum listed in this paragraph.

E. Stationary construction equipment that generate noise or vibration (e.g., compressors, engine-generators, cement mixing, general truck idling) shall be placed on the construction site as far as possible from the nearest residential land uses.

1-7. **OVERSPRAY PREVENTION.**

A. All spray application of coatings or blast cleaning at the Project site which is performed outside of a totally enclosed booth shall be kept to a minimum. Alternative application methods (brushing, rolling, etc.) or off-hour work shall be considered and may be required to minimize potential overspray damage.

B. If spray painting and/or blast cleaning is required, the Contractor shall submit a work plan for review by the Engineer in advance, outlining specific areas where the Work will take place including a schedule and preventative measures being utilized to eliminate the possibility of overspray damage to facilities and vehicles.

C. Tenting or other means of containment shall be utilized for spray coating applications. A minimum of three (3) test panels, 2 feet by 3 feet with a contrasting background to the material being sprayed, shall be placed 10 feet outside of the local work area at elevations to be determined by the Engineer.

D. Tenting and/or wet blasting shall be considered when grit blasting steel or concrete surfaces. Under no circumstances will fugitive dusts or coating particulates be permitted to leave the immediate Work area.
E. Spraying/blasting operations shall be stopped if winds exceed 5 mph.

F. A minimum fourteen (14) Day notice is required to provide adequate notification prior to the scheduled start date.

G. For Work within Treatment Plant Sites, the Contractor shall provide and install signs at Plant entrances, work areas, and roadways to direct traffic as needed to alternate parking areas to prevent overspray damage to vehicles. Parking areas immediately downwind, or otherwise in high-risk areas, shall be delineated to prevent vehicles from parking in these areas.

H. Any damage incurred by OCSD or its employees due to paint, solvent or sandblasting materials from blasting or coating operations shall be promptly repaired by the Contractor to the satisfaction of OCWD, OCSD and its employees at no additional Contract cost.

1-8. ODOR CONTROL.

A. Contractor’s attention is directed to the potential that groundwater at the Project site is likely to produce offensive odors when exposed to the atmosphere, and to General Requirement, and Environmental Control. The Contractor shall be responsible to prevent discharge of nuisance odor from its operation.

B. As a minimum odor prevention measure, the Contractor shall limit the sources of air/gas venting from its dewatering system, shall provide air tight covers on desanding boxes and other storage vessels that are part of the dewatering water discharge system, and shall provide and maintain a passive odor adsorption (carbon or equal) unit on all vents from desanding boxes and other storage vessels. The Contractor shall replace the adsorption canisters as often as necessary to prevent odors.

PART 2 - PRODUCTS (NOT USED)
PART 3 - EXECUTION

3-1. VIBRATION AND NOISE MONITORING.

A. To monitor the effects of vibration from the pile driving to existing structures, seismograph equipment shall be installed in the buildings near the pile driving and closest to the west plant property boundary along Brookhurst Street. The seismograph equipment shall be installed and maintained by the Contractor. The purpose of the monitoring will be to identify vibrations from pile driving that could be harmful to the existing structures and a nuisance to nearby residential areas. Modifications to pile driving procedures required by results from vibration monitoring shall be the responsibility of the Contractor.

B. Continuous monitoring of noise shall be recorded to comply with the OCSD regulations. Any shutdown time due to excessive noise shall be borne by the Contractor.

3-2. ATTACHMENT.

A. OCSD Sewer Debris Dumping Procedure.

End of Section
PART 1 - GENERAL

1-1. GENERAL REQUIREMENTS.

A. This Section describes procedures for site access and pedestrian traffic during construction on-site and off-site in public streets and highways. The Contract Drawings show access requirements for the Work.

B. All work shall be performed in accordance with approved traffic control plans and specifications, Caltrans - Manual of Traffic Control Devices for Construction and Maintenance Work Zones, Standard Plans, Standard Specifications; and the WATCH Manual.

C. All work shall be coordinated to minimize the closing of streets or public right-of-way. The Contractor shall keep the City of Fountain Valley, the City of Huntington Beach, Police Department, Fire Department, and the California Department of Transportation informed of streets or lanes that are closed and when they are scheduled to be re-opened. A permit for any street or lane closure on City streets must be obtained from the appropriate agency by the Contractor. The Contractor shall comply with all conditions of said permits.

D. The Contractor shall furnish, install, construct, maintain, and remove detours, road closures, lights, temporary signals, signs, striping, markings, barricades, fences, K-rail, flares, flagmen, drainage facilities, paving, and such other items and services as are necessary to adequately safeguard the public from hazard and inconvenience. All such work shall comply with Laws and Regulations of authorities with jurisdiction over the public roads in which the construction takes place and over which detoured traffic is routed by the Contractor.

E. The Contractor shall maintain and keep temporary traffic control devices in good repair and working order until no longer required. The maintenance shall be at the Contractor's expense. The Contractor shall also pay the cost of replacing such devices that are lost or damaged, to such an extent as to require replacement, regardless of the cause of such loss or damage.

F. Prior to the start of construction operation, the Contractor shall notify the police and fire department, giving the expected starting date and completion date. Notifications on job progress to the emergency service agencies shall be in accordance with procedures and channels to be
established at the pre-construction meeting. In addition, the Contractor shall provide the police and fire departments with the name and telephone number of at least two responsible persons who may be contacted at any hours in the event of a condition requiring immediate correction.

G. The Contractor shall provide reflectorized cones, delineators, or barricades used in the diversion of traffic with flashers, arrow boards, or other approved illumination if in place during hours of darkness. All signs shall be illuminated or reflectorized unless otherwise approved by the appropriate jurisdictional agency.

H. The Contractor shall provide a minimum of 48-hours notice to the appropriate agency for any work that may affect signal loops, equipment, or devices. In the event underground utilities, traffic devices, pipes, or conduits are damaged and require emergency repair by the appropriate agency, all costs incurred by the appropriate agency in making such repairs, plus 25 percent for administration costs, shall be paid by the Contractor.

I. The Contractor shall post temporary "No Parking – Tow Away" signs 48 hours prior to work in areas where parking is normally permitted. Police Departments of the Cities within the project area shall be notified 48 hours prior to the posting of any temporary parking restrictions in the respective City.

J. The Contractor shall coordinate the relocation of bus routes and bus stops with the Orange County Transit Authority staff three weeks in advance of construction activity affecting bus stops.

K. The Contractor shall maintain a 24-hour emergency service to remove, install, relocate, and maintain warning devices and furnish to the authority having jurisdiction the names and telephone number of the person(s) responsible for this emergency service. The emergency response service shall be reachable using cellular phones to minimize response time to a construction related emergency. In the event these persons do not promptly respond or the authority having jurisdiction deems it necessary to utilize other forces to accomplish emergency service, the Contractor shall pay the cost of such emergency service.

L. The Contractor shall utilize the designated Laydown Areas as shown in the Contract Documents for the exclusive use of delivery, handling and storage of tools, materials and equipment only and no employee parking within the Laydown Area will be allowed.

M. The Contractor shall locate and develop a designated Off-Site Workforce Parking location for utilization of all daily workers at the Contractor’s expense. Only employees housed in the Contractor’s temporary offices shall be permitted to park on-site. Contractor’s Superintendents, Foremen
and Inspectors and Subcontractor’s Superintendents & Foremen shall be allowed access on-site provided they are driving authorized company vehicles.

N. All school district and private schools affected by construction activities shall be notified on construction schedules to lessen potential impacts to instructional and transportation services. Ample time shall be provided so affected schools can prepare and plan for possible disruptions caused by project construction.

O. For work within Garfield Avenue, safe pedestrian access shall be maintained at all times from the Garfield and Ward intersection to the Santa Ana River Trail. During non-work hours all open trench shall be covered with steel plates and secured.

1-2. SUBMITTALS.

A. A traffic control plan shall be prepared by the Contractor for the AWTF work and work within Garfield Avenue, and approved by the City of Fountain Valley and applicable agencies.

A traffic control plan shall be prepared by the Contractor for the work at OCSD’s Plant 2 site and work within Garfield Avenue, and approved by the City of Huntington Beach and applicable agencies.

B. The On-Site Traffic Control Plan shall be submitted to and approved by the Engineer in compliance with all applicable requirements of this specification and all applicable contract documents.

D. The Contractor shall include in the On-Site Traffic Control Plan, the proposed areas for staging and the route(s) for ingress and egress of demolition haul-off trucks, mass excavation and haul-off trucks, import materials trucks, concrete delivery trucks, pipe and equipment materials delivery trucks and vehicles.

E. The Contractor shall meet with the Owner’s and OCSD’s Plant Operations Manager and Engineer for coordination of the traffic plan development with existing operations. The plan shall show the route(s) of Existing Plant Operational deliveries and shall designate areas on the plan for emergency response staging for coordination with local fire & life safety agencies.

F. The Contractor shall coordinate its proposed traffic route(s) that travel on or through the property of the Owner’s and OCSD’s Plant Operation and other construction contractors working on the Owner’s and OCSD’s property.
1-3. **DETOURS.**

A. Whenever streets or alleys are closed as provided herein, it will be the sole responsibility of the Contractor to adequately mark and light the detours.

B. A minimum of forty-eight (48) hours prior to closing any streets to traffic, the Contractor shall notify the appropriate City and/or County Fire and Police Departments and the California Department of Transportation (if appropriate) of the time of closure, and of the streets closed and the approved detour routing.

1-4. **TRAFFIC MAINTAINED OVER CONSTRUCTION.**

A. Where traffic is maintained along the street or alley under construction, care shall be used to shape and maintain the roadbed so that a safe and convenient roadway is available to the traveling public. Temporary cold mix asphalt shall be used to cover backfilled trenches at the end of each day's work. Ramps from undisturbed streets onto disturbed areas shall be maintained for traffic on gradual grades and the maximum ramp grade shall be 6 horizontal to 1 vertical slope. The Contractor shall make full provision for dust control.

1-5. **BARRICADES AND WATCHMEN.**

A. At the end of each workday, it shall be the responsibility of the Contractor to check the job site to insure proper barricading. Barricades will not be removed from each job site until the hazard has been removed.

B. The Contractor shall erect and maintain barricades and sufficient safeguards around all excavation, embankments, and obstructions; shall provide suitable warning lights on or near the work and keep them lighted at night or other times when visibility is limited and shall employ such watchmen as may be necessary for the protection of the public. Barricading shall occur in conformance with California Department of Transportation Manual of Traffic Controls for Construction and Maintenance Work Zones and the WATCH Manual and shall be approved by the inspector prior to any work.

1-6. **PROTECTION OF STREET SIGNS, TRAFFIC SIGNS, AND SIGNALS.**

A. Street signs, traffic signs, signals, and other traffic control devices erected by the City, County, or State for information and to safeguard traffic must be protected by the Contractor. Where it is necessary to disturb or remove any of these items, the Contractor shall secure approval of the Engineer prior to any such work, this approval to be based on concurrence and requirements from the agency having jurisdiction.
B. All traffic control devices shall be restored to their original condition at the end of the Work to the satisfaction of the Owner, OCSD or applicable agency's traffic engineer.

C. Prior to the commencement of construction and ongoing during construction, property owners/residents/businesses within and adjacent to construction activity shall be notified of the specific construction activity and associated schedule. Additionally, signs shall be posted at strategic locations within the Project area, specifically within the City limits of Fountain Valley and Huntington Beach; easily visible during construction. The notifications and signs shall identify the address, “hotline” number, and name of designated person to contact for response to questions or complaints during the construction period. The notifications and signs shall also identify the hours of permissible construction work and estimated duration.

1-7. MAINTAINING TRAFFIC.

A. Construction warning signs and sign placement shall conform to the latest revision of the California Department of Transportation Manual for Traffic Controls and for Construction and Maintenance Work Zones.

B. As noted in Paragraph 1.2, a traffic control plan will be prepared and will be implemented as part of this Contract. This plan is expected to be used in permit applications to regulatory agencies. Any changes to the traffic control plans must be approved by the applicable permit agencies.

C. The Contractor shall furnish and maintain construction traffic control signing that shall include advance warning signs, as required by the Engineer, when construction work will interface with a moving traffic lane.

D. All materials delivered to the job shall be unloaded and placed in a manner which will not interfere with the flow of necessary traffic.

E. The Contractor shall cleanup all roadways at the end of each work day.

F. The Contractor shall maintain two lanes of traffic on all streets unless otherwise noted.

I. Contractor shall, as necessary, wash truck tires leaving the site to reduce the amount of particulate matter transferred to paved streets as required by SCAQMD Rule 403.

J. Contractor shall sweep on and off-site streets if silt is carried over to adjacent public thoroughfares, as determined by the City Engineers in the affected jurisdictions to reduce the amount of particulate matter on public streets.
1-8. **PEDESTRIAN TRAFFIC CONTROL.**

A. Unless otherwise shown on the plan, the Contractor shall maintain and delineate a minimum of one 4-foot-wide pedestrian walkway along each public street at all times during construction. Maintain existing pedestrian accesses at intersections at all times. When existing crosswalks are blocked by construction activity, install signs directing pedestrian traffic to the nearest alternative crosswalk.

B. Erect a fence or provide other means to preclude unauthorized entry to any open excavation during all nonworking hours on a 24-hour basis including weekends and holidays. Said fence shall be a minimum of 7 feet high around the entire excavation, consisting of a minimum 9-gage chain link type fence fabric and shall be sturdy enough to prohibit toppling by children or adults. There shall be no openings under the wire large enough for a child to crawl through. Lock any gates if no adult is in attendance. Place warning signs spaced on 50-foot centers on the outside of the fence with the statement "DEEP HOLE DANGER".

1-9. **ACCESS TO ADJACENT PROPERTIES.**

A. General: Maintain reasonable access from the public streets to all adjacent properties at all times during the construction. Prior to restricting normal access from public streets to adjacent properties, notify each resident, informing him or her of the nature of the access restriction, the approximate duration of the restriction, and the best alternate access.

B. During the progress of the work, the Contractor shall maintain clear access to fire hydrants, water and gas valves; gutters and waterways must be kept open or other suitable provisions made for the removal of stormwater. Access to residential and commercial property must be maintained at all times. The Contractor shall build and maintain temporary driveways, bridges, and crossings such as in the opinion of the Engineer are necessary to reasonably accommodate the public. In the event of the Contractor's failure to comply with the same, the Owner may cause such work to be done by others and deduct the cost of such work from any money due or to become due the Contractor under this Contract. Performance of such work by the Owner shall serve in no way to release the Contractor from his liability for the safety of the Public or the work.

C. Access to police and fire station facilities shall be maintained at all times. Only one driveway of a safety facility shall be closed at any one time.

1-10. **SITE SECURITY AND ACCESS CONTROLS.**

A. The Contractor shall provide security guard(s) at the entrance to the project sites during normal working hours.
B. The Contractor shall develop a badge identification system with picture identification for all workers that will be assigned to the project for more than ten working days or who will be required to provide repeated deliveries on an ongoing/return basis. All truck delivery drivers shall be required to sign in at the guard station to receive a temporary day badge for that day. No workers will be allowed onsite without their identification and Contractor shall remove any worker from the workforce that is in repeated non-compliance.

C. The use of plant roads beyond the project areas shown on the Contract Drawings is subject to approval by the Engineer.

The use of the OCSD Plant 1 North Perimeter Road (Administration Area) and Front Security Station and guard are prohibited.

The use of the OCSD Plant 2 Front Security Station and guard is prohibited.

D. The Contractor shall provide a manned Security Station at all points of ingress and egress from the project area. The Contractor shall coordinate the security procedure with the Owner’s and OCSD’s Security Department. The security procedure shall be approved by the Engineer. Copies of all security logs and records shall be submitted to the District each month.

Site security requirements are described in the Site Security section of these specifications.

E. All regular staff shall be issued parking passes which are approved by the Engineer. All other construction traffic should sign IN/OUT at the security station. All the Contractor’s field offices storage facilities and parking shall be contained within the Contractor’s designated staging area. The Contractor shall make plans for offsite overflow parking and provide a copy of the Offsite Parking Plan to the Engineer.

PART 2 - PRODUCTS  (NOT USED)

PART 3 - EXECUTION  (NOT USED)

End of Section
PART 1 – GENERAL

1-1. SCOPE. Furnish, install and maintain project identification signs. Contractor shall install the Project signs within 30 days of the Notice to Proceed.

Contractor shall remove the signs on completion of construction. No other signs are to be displayed. Project identification signs are to be installed at the approximate locations indicated on drawing 100-G-010. The final exact location shall be field determine by the Owner.

1-2. SUBMITTALS. Prior to fabrication of the signs, Contractor shall submit a “mock-up” sample of the proposed sign and graphics for review and approval by the Engineer.

1-3. PROJECT IDENTIFICATION SIGN. Contractor shall provide two (2) painted sign of not less than 32 square feet (3 square meters) area for installation on the GWRS and OCSD Plant 1 sites. Each of the two (2) signs shall include painted content as follows:

1) Groundwater Replenishment System Final Expansion
2) Orange County Water District
3) Names and Titles of Authorities
4) Project start and completion dates
5) Design Engineer: Black & Veatch Corporation
6) Construction Manager: Butler Engineering, Inc.
7) Prime Contractor: TBD
8) Major Subcontractors: TBD

The Project signs shall be in accordance with the configuration shown on Figure 01580A-1 which follows this section.

1-4. INFORMATIONAL SIGNS. Contractor shall provide informational signs where shown on the drawings. Informational signs shall be painted with painted lettering, or standard products:

1) Size of signs and lettering: as required by regulatory agencies, or as appropriate to usage.
2) Colors: as required by regulatory agencies, otherwise uniform colors throughout Project.

PART 2 - PRODUCTS

2-1. SIGN MATERIALS.

Structure and Framing: may be new or used, wood or metal, in sound condition structurally adequate to work and suitable for specified finish.

Sign Surfaces: Exterior softwood plywood with medium density overlay, standard large sizes to minimize joints.

Thickness: As required by standards to span framing member, to provide even, smooth surface without waves or buckles.

Rough Hardware: Galvanized

Paint: Exterior Quality:

  Use Bulletin colors for graphics.

  Colors for structure, framing, sign surfaces and graphics: As selected by Engineer.

  Adequate to resist weathering and fading for scheduled construction period.

PART 3 – EXECUTION

3-1. PROJECT IDENTIFICATION SIGN. Paint exposed surfaces of supports, framing and surface material; one coat of primer and one coat of exterior paint.

Paint graphics in styles, sizes, and colors selected by Owner and Engineer.

3-2. MAINTENANCE. Maintain signs and supports in a neat, clean condition; repair damages to structure, framing or sign.

3-3. REMOVAL. Remove signs, framing, supports and foundations at completion of project.

End of Section
Groundwater Replenishment System

Final Expansion

We are enhancing the plant to provide water for future generations

Contractor: To Be Determined (TBD)
Start: TBD
Expected Completion: TBD

Design Engineer: Black & Veatch
Construction Manager: Butier Engineering, Inc.

For more information, go to www.gwrsystem.com or call (714) 378-3200
Section 01610

GENERAL EQUIPMENT STIPULATIONS

1. SCOPE. When an equipment specification section in this Contract references this section, the equipment shall conform to the general stipulations set forth in this section, except as otherwise specified in other sections.

2. COORDINATION. Contractor shall coordinate all details of the equipment with other related parts of the Work, including verification that all structures, piping, wiring, and equipment components are compatible. Contractor shall be responsible for all structural and other alterations in the Work required to accommodate equipment differing in dimensions or other characteristics from that contemplated in the Contract Drawings or Specifications.

3. MANUFACTURER’S EXPERIENCE. Unless specifically named in the Specifications, a manufacturer shall have furnished equipment of the type and size specified which has been in successful operation for not less than the past 5 years.

4. WORKMANSHIP AND MATERIALS. Contractor shall guarantee all equipment against faulty or inadequate design, improper assembly or erection, defective workmanship or materials, and leakage, breakage, or other failure. Materials shall be suitable for service conditions.

All equipment shall be designed, fabricated, and assembled in accordance with recognized and acceptable engineering and shop practice. Individual parts shall be manufactured to standard sizes and thicknesses so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except as required by tests.

Except where otherwise specified, structural and miscellaneous fabricated steel used in equipment shall conform to AISC standards. All structural members shall be designed for shock or vibratory loads. Unless otherwise specified, all steel which will be submerged, all or in part, during normal operation of the equipment shall be at least 1/4 inch thick. When dissimilar metal components are used, consideration shall be given to prevention of galvanic corrosion.

5. STRUCTURAL DESIGN REQUIREMENTS. All equipment, including non-structural components and non-building structures as defined in ASCE 7, and their anchorage, shall be designed and detailed in accordance with the Meteorological and Seismic Design Criteria section. Submittals for equipment and other non-structural components and non-building structures shall include a seal by a professional engineer registered in the state of California, to confirm...
that the anchorage design meets the code requirements. Conformance to the building code of the pipe support systems designed by the Contractor shall be certified by a professional engineer registered in the state of California.

6. LUBRICATION. Equipment shall be adequately lubricated by systems which require attention no more frequently than weekly during continuous operation. Lubrication systems shall not require attention during startup or shutdown and shall not waste lubricants.

Lubricants of the types recommended by the equipment manufacturer shall be provided in sufficient quantities to fill all lubricant reservoirs and to replace all consumption during testing, startup, and operation prior to acceptance of equipment by Owner. Lubricants for equipment where the lubricants may come in contact with water before or during a potable water treatment process or with potable water, shall be food grade lubricants. This includes lubricants for equipment not normally in contact with water, but where accidental leakage of the lubricants may contaminate the water.

Lubrication facilities shall be convenient and accessible. Oil drains and fill openings shall be easily accessible from the normal operating area or platform. Drains shall allow for convenient collection of waste oil in containers from the normal operating area or platform without removing the unit from its normal installed position.

7. ELEVATION. The elevation of the site shall be as indicated in the Meteorological and Seismic Design Criteria section. All equipment furnished shall be designed to meet stipulated conditions and to operate satisfactorily at the specified elevation.

8. ELECTRIC MOTORS. Unless otherwise specified, motors furnished with equipment shall meet the requirements specified in the General Purpose Induction Motors section or specified in the specific equipment sections.

9. DRIVE UNITS. The nominal input horsepower rating of each gear or speed reducer shall be at least equal to the nameplate horsepower of the drive motor. Drive units shall be designed for 24-hour continuous service.

9.01. Gearmotors. The use of gearmotors sharing an integral housing or cutgears into the motor output shaft, or that require removal of lubricant from the gear reducer to change out the motor will not be acceptable.

9.02. Gear Reducers. Each gear reducer shall be a totally enclosed unit with oil or grease lubricated, rolling element, antifriction bearings throughout.

Unless superseded by individual specification requirements each helical, spiral bevel, combination bevel-helical, and worm gear reducers shall have a service
factor of at least 1.50 based on the nameplate horsepower of the drive motor. Cycloidal gear reducers shall have a service factor of at least 2.0 based on the nameplate horsepower of the drive motor. Shaft-mounted and flange-mounted gear reducers shall be rated AGMA Class III. Helical gear reducers shall have a gear strength rating to catalog rating of 1.5. Each gear reducer shall be designed and manufactured in compliance with applicable most current AGMA standards, except the L₁₀ bearing life shall be 200,000 hours.

The thermal horsepower rating of each unit shall equal or exceed the nameplate horsepower of the drive motor. During continuous operation, the maximum sump oil temperature shall not rise more than 100°F above the ambient air temperature in the vicinity of the unit and shall not exceed 200°F.

Each grease lubricated bearing shall be installed in a bearing housing designed to facilitate periodic regreasing of the bearing by means of a manually operated grease gun. Each bearing housing shall be designed to evenly distribute new grease, to properly dispose of old grease, and to prevent overgreasing of the bearing. The use of permanently sealed, grease lubricated bearings will not be acceptable in large sized reducers. In small reducers, similar to basin equipment, permanently sealed grease lubricated bearings rated L₁₀ 200,000 hour life may be provided at the manufacturer’s option. An internal or external oil pump and appurtenances shall be provided if required to properly lubricate oil lubricated bearings. A dipstick or a sight glass arranged to permit visual inspection of lubricant level shall be provided on each unit.

Gear reducers which require the removal of parts or the periodic disassembly of the unit for cleaning and manual regreasing of bearings will not be acceptable.

Certification shall be furnished by the gear reducer manufacturer indicating that the intended application of each unit has been reviewed in detail by the manufacturer and that the unit provided is fully compatible with the conditions of installation and service.

9.03. **Adjustable Speed Drives.** Each mechanical adjustable speed drive shall have a service factor of at least 1.75 at maximum speed based on the nameplate horsepower [kilowatts] of the drive motor. A spare belt shall be provided with each adjustable speed drive unit employing a belt for speed change. Unless specifically permitted by the detailed equipment specifications, bracket type mounting will not be acceptable for variable speed drives.

9.04. **V-Belt Drives.** Each V-belt drive shall include a sliding base or other suitable tension adjustment. V-belt drives shall have a service factor of at least 1.75 at maximum speed based on the nameplate horsepower of the drive motor.
10. **SAFETY GUARDS.** All belt or chain drives, fan blades, couplings, and other moving or rotating parts shall be covered on all sides by a safety guard. Safety guards shall be fabricated from 16 USS gage thick or thicker galvanized, aluminum-clad sheet steel, or stainless sheet steel or from 1/2 inch mesh galvanized expanded metal, or pultrusion molded UV resistant materials. Each safety guard shall be reinforced or shaped to provide suitable strength to prevent vibration and deflection and shall comply with OSHA. Each guard shall be designed for easy installation and removal. All necessary supports and accessories shall be provided for each guard. Supports and accessories, including bolts, shall be galvanized. All safety guards in outdoor locations shall be designed to prevent the entrance of rain and dripping water.

11. **ANCHOR BOLTS.** Equipment suppliers shall furnish suitable anchor bolts for each item of equipment. Anchor bolts, together with templates or setting drawings, shall be delivered sufficiently early to permit setting the anchor bolts when the structural concrete is placed. Anchor bolt materials shall comply with the Anchorage in Concrete and Masonry section, and sleeves shall be provided as indicated on the drawings. Unless otherwise specified, anchor bolts shall be at least 3/4 inch in diameter.

Unless otherwise indicated or specified, anchor bolts for items of equipment mounted on baseplates shall be long enough to permit 1-1/2 inches of grout beneath the baseplate and to provide adequate anchorage into structural concrete.

12. **EQUIPMENT BASES.** Unless otherwise indicated or specified, all equipment shall be installed on concrete bases at least 6 inches high. Cast iron or welded steel baseplates shall be provided for pumps, compressors, and other equipment. Each unit and its drive assembly shall be supported on a single baseplate of neat design. Baseplates shall have pads for anchoring all components, and adequate grout holes. Baseplates for pumps shall have a means for collecting leakage and a threaded drain connection. Baseplates shall be anchored to the concrete base with suitable anchor bolts and the space beneath filled with grout as specified in the Grouting section.

13. **SPECIAL TOOLS AND ACCESSORIES.** Equipment requiring periodic repair and adjustment shall be furnished complete with all special tools, instruments, and accessories required for proper maintenance. Equipment requiring special devices for lifting or handling shall be furnished complete with those devices.

14. **SHOP PAINTING.** All iron and steel surfaces of the equipment shall be protected with suitable protective coatings applied in the shop. Surfaces of the equipment that will be inaccessible after assembly shall be protected for the life of the equipment. Coatings shall be suitable for the environment where the equipment is installed. Exposed surfaces shall be finished, thoroughly cleaned,
and filled as necessary to provide a smooth, uniform base for painting. Electric motors, speed reducers, starters, and other self-contained or enclosed components shall be shop primed or finished with an epoxy or polyurethane enamel or universal type primer suitable for top coating in the field with a universal primer and aliphatic polyurethane system.

Surfaces to be coated after installation shall be prepared for painting as recommended by the paint manufacturer for the intended service, and then shop painted with one or more coats of a universal primer.

Machined, polished, and nonferrous surfaces which are not to be painted shall be coated with rust-preventive compound as recommended by the equipment manufacturer.

15. **PREPARATION FOR SHIPMENT.** Equipment shall be prepared for shipment as specified in the Shipping section.

16. **STORAGE.** Handling and storage of equipment shall be as specified in the Handling and Storage and Requirements section.

17. **INSTALLATION AND OPERATION.** Installation and operation shall be as specified in respective equipment sections and the Startup Requirements section.

18. **OBSERVATION OF PERFORMANCE TESTS.** Where the Specifications require the presence of Engineer, initial tests shall be observed or witnessed by Engineer. Owner shall be reimbursed by Contractor for all costs of subsequent visits by Engineer to witness or observe incomplete tests, retesting, or subsequent tests.

19. **BOLTS AND WASHERS.** Regardless of whether indicated in the Drawings or not, all anchor bolts shall have one washer and all bolt and nut assemblies shall have two washers.

20. **PROGRAMMING SOFTWARE.** Programming software shall be provided for any equipment which includes a programmable logic controller (PLC) or other digital controller that is user-programmable. The software shall be suitable for loading and running on a laptop personal computer operating with a Windows-based operating system. A copy of the manufacturer’s original operating logic program shall be provided for use in maintaining and troubleshooting the equipment. Where multiple pieces of equipment, from the same or different vendors, use the same programming software, only one copy of the software need be provided. Programming software shall be provided to Engineer, Owner, and OCSD.

End of Section
Section 01611

METEOROLOGICAL AND SEISMIC DESIGN CRITERIA

1. SCOPE. Buildings, non-structural components and non-building structures shall be designed in accordance with this section. In the event of conflict with requirements in other sections, the more stringent criteria shall be followed.

2. DESIGN CRITERIA. Buildings, non-structural components, non-building structures including anchorage of such items, shall be designed in accordance with the following criteria.

General Design Data - AWTF:

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<tr>
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<td>Design groundwater elevation (ft)</td>
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<td>Risk Category (wind loads)</td>
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<td>Building enclosure classification</td>
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Seismic Design Data for Building Structures

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<tr>
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</table>

Mapped MCE one second period
spectral response acceleration, $S_1$ 0.579g (Plant 1)  
0.62g (Plant 2)  
Design short period spectral response acceleration, $S_{DS}$ 1.038g (Plant 1)  
1.12g (Plant 2)  
Design one second period spectral response acceleration, $S_{D1}$ 0.579g (Plant 1)  
0.62g (Plant 2)  
Risk Category III  
Building Importance factor, $I$ 1.25  
Building Seismic Design Category D  
Non-Structural Components Importance factors, $I_P$ As indicated in the Non-Structural Component Schedule  
Non-Structural Components Seismic Design Category D  
Non-Building Structures Importance factors, $I$ As indicated in the Non-Building Structure Schedule or in the applicable reference documents, whichever is greater.

3. **WIND ANCHORAGE.** Equipment that is to be located outdoors shall have anchor bolts designed for the effects of wind forces, as determined in accordance with ASCE 7, Chapter 6. Design of anchorage into concrete shall be in accordance with ACI 318 Chapter 17, shall consider concrete to be cracked, and shall not include the strengthening effects of supplementary reinforcement or anchor reinforcement unless approved by Engineer. Design of anchorage into masonry shall be in accordance with ACI 530. Post-installed anchors into concrete or masonry may be used only when approved by Engineer, and shall be designed in accordance with the anchor manufacturer’s research report. Shop drawings shall include full anchor bolt details, and shall be sealed by a professional engineer licensed in the state of the project. Calculations shall be furnished when requested by Engineer.

4. **SEISMIC DESIGN.**

4-1. **General.** Structural systems shall provide continuous load paths, with adequate strength and stiffness to transfer all seismic forces from the point of application to the point of final resistance.
4-2. **Pre-Engineered Buildings.** Pre-engineered buildings shall have sufficient strength and ductility to resist the specified seismic effects defined for buildings and shall meet all of the design, proportioning, detailing, inspection, and quality assurance provisions of the specified building code.

"W" for buildings shall include the total dead load, the total operating weight of permanent equipment and the effective contents of vessels, and applicable portions of other loads, as required by the specified building code.

4-3. **Non-Structural Components.** Non-structural components are architectural, mechanical, and electrical items that are permanently attached to and supported by a structure but are not part of the structural system, as indicated in Chapter 13 of ASCE 7. The Non-Structural Components Schedule identifies the components that require seismic design. The requirements of this paragraph are applicable only to the items listed in the Non-Structural Components Schedule.

4-3.01. **General.** Design of non-structural components shall be in accordance with all applicable provisions of ASCE 7, Chapter 13. “Wp” shall include the total operating weight of the component or system, including, but not limited to, any insulation, fluids, and concentrated loads such as valves, condensate traps, and similar components.

4-3.02. **Anchorage Design.** Every component in the Non-Structural Components Schedule shall have its anchorage to the supporting structure designed in accordance with ASCE 7, Chapter 13. Design of anchorage into concrete shall be in accordance with ACI 318 Chapter 17, shall consider concrete to be cracked, and shall not include the strengthening effects of supplementary reinforcement or anchor reinforcement unless approved by Engineer. Design of anchorage into masonry shall be in accordance with ACI 530. Post-installed anchors into concrete or masonry may be used only when approved by Engineer, and shall be designed in accordance with the anchor manufacturer’s research report.

Components shall be attached so that seismic forces are transferred to the structural system. Curbs that support roof-mounted equipment shall be designed to transfer forces from the equipment into the main structural roof members. All structural attachments shall be bolted, welded, or otherwise positively fastened. Frictional resistance due to gravity shall not be considered in evaluating the required resistance to seismic forces.

4-3.03. **Component Design.** Components indicated in the Non-Structural Components Schedule to require design of the component itself, as opposed to an anchorage design alone, shall be designed in accordance with ASCE 7, Chapter 13.
Components shall have sufficient strength and ductility to resist the specified seismic effects, and shall meet all of the design, proportioning, detailing, inspection, and quality assurance provisions of the specified building code and other referenced codes. Components shall be designed to be operable during and following a design level seismic event without collapsing, breaking away from supports, creating an ignition hazard, or releasing any contents.

Seismic effects that shall be analyzed in the design of piping systems include the dynamic effects of the piping system, contents, and supports. The interaction between piping systems and the supporting structures, including other mechanical and electrical equipment, shall also be considered. Where pipe supports are to be designed by Contractor, as required by the Pipe Supports section, both the piping and support systems shall be designed to meet the applicable requirements of ASCE 7, Chapter 13.

4-3.04. **Submerged Components.** Components that are to be submerged in water shall be designed to withstand loads from the effects of water sloshing during the seismic event. The calculation of the sloshing effects shall be in accordance with the latest edition of ACI 350.3.

4-3.05. **Seismic Certification.** Design of components and their anchorage shall be certified by one of the following methods.

1. Analysis and design by a design professional registered in the state of the project.
2. Shake table testing based upon a nationally recognized testing standard procedure, such as ICC-ES AC 156, acceptable to the authority having jurisdiction.
3. Experience data, based upon nationally recognized procedures acceptable to the authority having jurisdiction.

Components indicated in the Non-Structural Components Schedule to require special seismic certification shall be certified only by methods 2 or 3 above, except that certification for containment of hazardous materials may be by any of the three methods.

4-3.06. **Construction Documents.** Construction documents (fabrication or shop drawings) of non-structural components shall be sealed by a design professional that is registered in the state of the project. Documents shall be sealed whether the basis for certification is analysis and design, shake table testing, or experience data. The sealing method shall clearly indicate that the anchorage system, and the component itself when applicable, have been designed for the code required seismic forces.
4-3.07. **Submittals.** The construction documents, structural design calculations, shake table certification, and experience data certification, as applicable, shall be submitted in accordance with the Submittal Procedures section.

4-4. **Non-Building Structures** Non-building structures are the items described as such in Chapter 15 of ASCE 7. The Non-Building Structures Schedule identifies the items that require seismic design. The requirements of this paragraph are applicable only to the items listed in the Non-Building Structures Schedule.

4-4.01. **General.** Design of non-building structures shall be in accordance with all applicable provisions of ASCE 7, Chapter 15. Design of anchorage into concrete shall be in accordance with ACI 318 Chapter 17, shall consider concrete to be cracked, and shall not include the strengthening effects of supplementary reinforcement or anchor reinforcement unless approved by Engineer. Post-installed anchors into concrete may be used only when approved by Engineer, and shall be designed in accordance with the anchor manufacturer's research report.

"W" shall include the total dead load and shall also include all normal operating contents of tanks, vessels, bins, and piping.

Non-building structures shall provide sufficient strength and ductility to resist the specified seismic effects, and shall meet all of the design, proportioning, detailing, inspection, and quality assurance provisions of the specified building code and other referenced codes.

The seismic design of non-building structures shall provide sufficient stiffness, strength and ductility to resist the effects of seismic ground motions during the design level earthquake.

Non-building structures shall be designed to be operable during and following a design level seismic event, without collapsing, breaking away from supports, creating an ignition hazard, or releasing any contents.

4-4.02. **Construction Documents.** Construction documents (fabrication or shop drawings) depicting all seismic force resisting elements of non-building structures shall be sealed by a design professional that is registered in the state of the project.

4-4.03. **Submittals.** The construction documents shall be submitted in accordance with the Submittal Procedures section.

End of Section
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<tr>
<th>Component</th>
<th>Applicable Specification Section</th>
<th>Importance Factor ($I_p$)</th>
<th>Component Design Required</th>
<th>Special Seismic Certification Required</th>
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Note: Some specification sections listed in the Non-Structural Components Schedule cover multiple items. Within those sections, some components may be exempt from seismic design based on their weight and/or their height above the floor. Reference ASCE 7, Paragraph 13.1.4 for specific conditions of the exemptions. Some ductwork and piping systems may also be exempt from seismic design based on criteria in their respective paragraphs in ASCE 7, Chapter 13.

### Non-Building Structures Schedule

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Section 01612

SHIPPING

1. **SCOPE.** This section covers packaging and shipping of materials and equipment.

2. **PREPARATION FOR SHIPMENT.** All equipment shall be suitably packaged to facilitate handling and to protect against damage during transit and storage. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling, and storage. All equipment shall be protected from exposure to the elements and shall be kept dry at all times.

Painted and coated surfaces shall be protected against impact, abrasion, discoloration, and other damage. Painted and coated surfaces which are damaged prior to acceptance of equipment shall be repainted to the satisfaction of Engineer.

Grease and lubricating oil shall be applied to all bearings and similar items. Contractor shall refer to Figure 1 – 01612 for export shipping packing instructions.

3. **SHIPPING.** Before shipping each item of equipment shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment. Figure 2 – 01612 shall be referenced for marking instructions.

End of Section
1. **SCOPE.** This section covers delivery, storage, and handling of materials and equipment.

2. **DELIVERY.** Contractor shall bear the responsibility for delivery of equipment, spare parts, special tools, and materials to the site and shall comply with the requirements specified herein and shall provide required information concerning the shipment and delivery of the materials specified in this Contract. These requirements also apply to any subsuppliers making direct shipments to the Site.

   Contractor shall, either directly or through contractual arrangements with others, accept responsibility for the safe handling and protection of the equipment and materials furnished under this Contract before and after receipt at the port of entry. Acceptance of the equipment shall be made after it is installed, tested, placed in operation and found to comply with all the specified requirements.

   All items shall be checked against packing lists immediately on delivery to the site for damage and for shortages. Damage and shortages shall be remedied with the minimum of delay.

   Delivery of portions of the equipment in several individual shipments shall be subject to review of Engineer before shipment. When permitted, all such partial shipments shall be plainly marked to identify, to permit easy accumulation, and to facilitate eventual installation.

3. **STORAGE.** Upon delivery, all equipment and materials shall immediately be stored and protected until installed in the Work.

   Stacked items shall be suitably protected from damage by spacers or load distributing supports that are safely arranged. No metalwork (miscellaneous steel shapes and reinforcing steel) shall be stored directly on the ground. Masonry products shall be handled and stored in a manner to hold breakage, chipping, cracking, and spalling to a minimum. Cement, lime, and similar products shall be stored off the ground on pallets and shall be covered and kept completely dry at all times. Pipe, fittings, and valves may be stored out of doors, but must be placed on wooden blocking. PVC pipe, geomembranes, plastic liner, and other plastic materials shall be stored off the ground on pallets and protected from direct sunlight.

   Pumps, motors, electrical equipment, and all equipment with antifriction or sleeve bearings shall be stored in weathertight structures maintained at a temperature above 60°F. Electrical equipment, controls, and insulation shall be protected...
against moisture and water damage. All space heaters furnished in equipment shall be connected and operated continuously.

Equipment having moving parts, such as gears, bearings, and seals, shall be stored fully lubricated with oil, grease, etc., unless otherwise instructed by the manufacturer. Manufacturer's storage instructions shall be carefully followed by Contractor.

When required by the equipment manufacturer, moving parts shall be rotated a minimum of twice a month to ensure proper lubrication and to avoid metal to metal "welding". Upon installation of the equipment, Contractor shall, at the discretion of Engineer, start the equipment at one-half load for an adequate period of time to ensure that the equipment does not deteriorate from lack of use.

When required by the equipment manufacturer, lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. New lubricants shall be put into the equipment by Contractor at the time of acceptance.

Equipment and materials shall not show any pitting, rust, decay, or other deleterious effects of storage when installed in the Work.

In addition to the protection specified for prolonged storage, the packaging of spare units and spare parts shall be for export packing and shall be suitable for long-term storage in a damp location. Each spare item shall be packed separately and shall be completely identified on the outside of the container.

4. HANDLING. Stored items shall be laid out to facilitate their retrieval for use in the Work. Care shall be taken when removing the equipment for use to ensure the precise piece of equipment is removed and that it is handled in a manner that does not damage the equipment.

During handling, carbon steel constructed material including chains, straps, and forks on lifting equipment shall not directly contact any equipment or material constructed of stainless steel. It shall be the Contractor’s responsibility to correct any carbon steel contamination of stainless steel.

End of Section
Section 01620

EQUIPMENT SCHEDULE

1. **SCOPE.** This section consists of an equipment schedule for items for which a basic level of manufacturer's field services or operation and maintenance manuals are required, but not covered in other sections. When other sections indicate that manufacturer's field services and operation and maintenance manuals are required, the requirements shall be as specified in the other sections.

Specific requirements for manufacturer's field services are covered in the Quality Control section and the equipment specifications.

Specific requirements for operation and maintenance manuals are covered in the Submittals Procedures section and the equipment specifications.

2. **SCHEDULE.** Manufacturer's field services, including equipment installation checks and training, and operation and maintenance manuals shall be provided for the items of equipment indicated in the following schedule:

<table>
<thead>
<tr>
<th>Spec Section</th>
<th>Type of Equipment</th>
<th>Factory Test Required</th>
<th>Witness Required</th>
<th>Mfr's. Field Services, Minimum (trips/days)</th>
<th>Mfr's Training, Minimum (trips/days)</th>
<th>O&amp;M Manual</th>
</tr>
</thead>
<tbody>
<tr>
<td>11115</td>
<td>Horizontal End Suction Centrifugal Pumps</td>
<td>Yes</td>
<td>No</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
</tr>
<tr>
<td>11115MF</td>
<td>Horizontal End Suction Centrifugal Pumps (MF)</td>
<td>Yes</td>
<td>No</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
</tr>
<tr>
<td>11140</td>
<td>Vertical Diffusion Vane Pumps (AWTF, MF, OCSD)</td>
<td>Yes</td>
<td>Yes</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
</tr>
<tr>
<td>11185</td>
<td>Submersible Sump and Sewage Pumps</td>
<td>Yes</td>
<td>No</td>
<td>See Spec</td>
<td>1/1</td>
<td>Yes</td>
</tr>
<tr>
<td>11213MF</td>
<td>Vertical Turbine Pumps (MF)</td>
<td>Yes</td>
<td>Yes</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<tr>
<td>11213</td>
<td>RO Feed Pumps</td>
<td>Yes</td>
<td>Yes</td>
<td>2/2 each</td>
<td>1/1</td>
<td>Yes</td>
</tr>
<tr>
<td>11217MF</td>
<td>Vacuum Pumps (MF)</td>
<td>Yes</td>
<td>Yes</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<td>11224</td>
<td>Static Mixer</td>
<td>Yes</td>
<td>Yes</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<tr>
<td>11249MF</td>
<td>FRP Tanks (MF CIP)</td>
<td>Yes</td>
<td>Yes</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<td>11293</td>
<td>Sluice and Slide Gates</td>
<td>No</td>
<td>No</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<tr>
<td>11305</td>
<td>Membrane System</td>
<td>Yes</td>
<td>Yes</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
</tr>
<tr>
<td>Spec Section</td>
<td>Type of Equipment</td>
<td>Factory Test Required</td>
<td>Witness Required</td>
<td>Mfr's. Field Services, Minimum (trips/days)</td>
<td>Mfr's Training, Minimum (trips/days)</td>
<td>O&amp;M Manual</td>
</tr>
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<tr>
<td>11345</td>
<td>Chemical Feed Pumps and Sample Pumps Peristaltic Pumps</td>
<td>Yes</td>
<td>No</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<tr>
<td>11370MF</td>
<td>Compressed Air</td>
<td>Yes</td>
<td>No</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<tr>
<td>11377MF</td>
<td>Multistage Blowers</td>
<td>Yes</td>
<td>No</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<tr>
<td>11392</td>
<td>Automatic Sampler</td>
<td></td>
<td></td>
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<td>11400</td>
<td>Reverse Osmosis Treatment System</td>
<td>Yes</td>
<td>Yes</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<td>11401</td>
<td>Forced Draft Decarbonator</td>
<td>Yes</td>
<td>No</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<tr>
<td>11403</td>
<td>Cartridge Filters</td>
<td>Yes</td>
<td>No</td>
<td>1/1</td>
<td>1/1</td>
<td>Yes</td>
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<td>11406</td>
<td>Interstage Booster Pumps</td>
<td>Yes</td>
<td>Yes</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<tr>
<td>11720</td>
<td>Polymer Feed Systems</td>
<td>Yes</td>
<td>No</td>
<td>Not Required</td>
<td>Not Required</td>
<td>Yes</td>
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<tr>
<td>11727</td>
<td>Liquid Chemical Feed System (Sulfuric Acid)</td>
<td>No</td>
<td>No</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<tr>
<td>11727MF</td>
<td>Liquid Chemical Feed System (Sodium Hypochlorite)</td>
<td>No</td>
<td>No</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<tr>
<td>13190</td>
<td>Fiberglass Reinforced Plastic Chemical Storage Tanks (Polymer and Sodium Hypochlorite)</td>
<td>Yes</td>
<td>Yes</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<td>13192</td>
<td>Steel Chemical Storage Tanks</td>
<td>Yes</td>
<td>Yes</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<td>13207</td>
<td>Wrapped Prestressed Concrete Tanks</td>
<td>No</td>
<td>No</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<td>13500</td>
<td>Process Control System</td>
<td>Yes</td>
<td>Yes</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<td>13530</td>
<td>Distributed Controller System</td>
<td>Yes</td>
<td>Yes</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<tr>
<td>13561</td>
<td>Panel Mounted Instruments</td>
<td>Yes</td>
<td>No</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<tr>
<td>13562</td>
<td>Flow Instruments</td>
<td>Yes</td>
<td>No</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<tr>
<td>13563</td>
<td>Pressure and Level Instruments</td>
<td>Yes</td>
<td>No</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<td>13564</td>
<td>Analytical Instruments</td>
<td>Yes</td>
<td>No</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<tr>
<td>13565</td>
<td>Miscellaneous Instruments</td>
<td>Yes</td>
<td>No</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<tr>
<td>13570</td>
<td>Panels, Consoles and Appurtenances</td>
<td>Yes</td>
<td>Yes</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
</tr>
<tr>
<td>Spec Section</td>
<td>Type of Equipment</td>
<td>Factory Test Required</td>
<td>Witness Required</td>
<td>Mfr's. Field Services, Minimum (trips/days)</td>
<td>Mfr's Training, Minimum (trips/days)</td>
<td>O&amp;M Manual</td>
</tr>
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<tr>
<td>13700</td>
<td>UV Disinfection System</td>
<td>No</td>
<td>No</td>
<td>Refer to UV System Procurement Documents for requirements on UV Supplier (Trojan) furnished equipment</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>13930</td>
<td>Fire Sprinkler System</td>
<td>Yes</td>
<td>No</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
</tr>
<tr>
<td>Various</td>
<td>Valves and Gates</td>
<td>Yes</td>
<td>No</td>
<td>1/1 (per type)</td>
<td>Not Required</td>
<td>Yes</td>
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<tr>
<td>14240</td>
<td>Hydraulic Elevator</td>
<td>No</td>
<td>No</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<tr>
<td>14621</td>
<td>Monorail Chain Hoists</td>
<td>Yes</td>
<td>No</td>
<td>1/1</td>
<td>Not Required</td>
<td>Yes</td>
</tr>
<tr>
<td>14630</td>
<td>Bridge Cranes</td>
<td>Yes</td>
<td>Yes</td>
<td>1/1</td>
<td>Not Required</td>
<td>Yes</td>
</tr>
<tr>
<td>15094</td>
<td>Backflow Preventers</td>
<td>Yes</td>
<td>No</td>
<td>Not Required</td>
<td>Not Required</td>
<td>Yes</td>
</tr>
<tr>
<td>15106</td>
<td>Valves and Gate Actuators</td>
<td>Yes</td>
<td>No</td>
<td>1/1 (per type)</td>
<td>Not Required</td>
<td>Yes</td>
</tr>
<tr>
<td>15500</td>
<td>Heating, Ventilating, and Air Conditioning</td>
<td>Yes</td>
<td>No</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
</tr>
<tr>
<td>15650</td>
<td>Refrigeration Systems</td>
<td>Yes</td>
<td>No</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
</tr>
<tr>
<td>16101</td>
<td>Prefabricated Electrical Equipment Buildings</td>
<td>Yes</td>
<td>Yes</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
</tr>
<tr>
<td>16150</td>
<td>Variable Frequency Drives</td>
<td>Yes</td>
<td>No</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
</tr>
<tr>
<td>16155</td>
<td>Medium Voltage Variable Frequency Drives and Isolation Transformers</td>
<td>Yes</td>
<td>Yes</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
</tr>
<tr>
<td>16220</td>
<td>General Purpose Induction Motors</td>
<td>Yes</td>
<td>No</td>
<td>Not Required</td>
<td>Not Required</td>
<td>Yes</td>
</tr>
<tr>
<td>16221</td>
<td>Medium Voltage Induction Motors</td>
<td>Yes</td>
<td>Yes</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
</tr>
<tr>
<td>16442</td>
<td>OCSD Control Panels</td>
<td>Yes</td>
<td>No</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
</tr>
<tr>
<td>16480</td>
<td>600 Volt Motor Control Centers</td>
<td>Yes</td>
<td>Yes</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
</tr>
<tr>
<td>16610</td>
<td>Uninterruptible Power Supply</td>
<td>Yes</td>
<td>No</td>
<td>Not Required</td>
<td>Not Required</td>
<td>Yes</td>
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<tr>
<td>16721</td>
<td>Fire Detection and Alarm System</td>
<td>Yes</td>
<td>No</td>
<td>Not Required</td>
<td>Not Required</td>
<td>Yes</td>
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<tr>
<td>16725</td>
<td>Electronic Security System</td>
<td>Yes</td>
<td>No</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
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<tr>
<td>17156</td>
<td>OCSD Magnetic Flowmeters</td>
<td>Yes</td>
<td>No</td>
<td>See Spec</td>
<td>See Spec</td>
<td>Yes</td>
</tr>
</tbody>
</table>

End of Section
1-1. SCOPE. This section consists of a schedule of 4 inch and larger pipelines indicating the type of pipe to be used. Pipe materials, installation, testing, and disinfection, when specified, are covered in other sections.

Water piping 4 inches and larger shown on the plumbing drawings shall be ductile iron pipe with flanged fittings for above ground pipe.

Some of the MF Membrane System piping is to be furnished by the MF Supplier. The Contractor is to refer to the Project drawings and coordinate implementation with the MF membrane supplier to produce a complete and operating installation.

1-2. ALTERNATIVE PIPE TYPES. Where more than one type of pipe is indicated in the schedule, the type of pipe material to be installed may be selected by Contractor. The details on the drawings were developed using one type of pipe material for each pipeline. If a different material is selected by Contractor, all details of connections, jointing, wall fittings, support, anchorage, and harnesses shall be modified as necessary to produce an equivalent design acceptable to Engineer.

1-3. WALL FITTINGS. A wall pipe or sleeve will be required for all pipe passing through concrete or masonry block walls unless otherwise noted. Wall fittings and sleeves shall be as indicated on the drawings and as specified in the applicable piping section.

2-1. SCHEDULE INDEX. Pipe material abbreviations and their applicable specification section number are as indicated:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Pipe Material</th>
<th>Section No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BR</td>
<td>Brass</td>
<td>15060</td>
</tr>
<tr>
<td>CI</td>
<td>Cast iron soil pipe</td>
<td>15069</td>
</tr>
<tr>
<td>CPVC</td>
<td>CPVC pipe</td>
<td>15067</td>
</tr>
<tr>
<td>CS</td>
<td>Miscellaneous steel pipe</td>
<td>15065</td>
</tr>
<tr>
<td>CSG</td>
<td>Galvanized steel pipe</td>
<td>15065</td>
</tr>
<tr>
<td>CU</td>
<td>Copper tubing</td>
<td>15070</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Pipe Material</td>
<td>Section No.</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------------------------------------------</td>
<td>--------------------</td>
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<tr>
<td>DCP</td>
<td>Double-contained pipe (CPVC in CPVC)</td>
<td>02630, 15067</td>
</tr>
<tr>
<td>DIP</td>
<td>Ductile iron pipe</td>
<td>15061</td>
</tr>
<tr>
<td>FRP</td>
<td>FRP pipe</td>
<td>15067</td>
</tr>
<tr>
<td>GRS/CSG</td>
<td>Galvanized steel pipe</td>
<td>15065</td>
</tr>
<tr>
<td>HDPE</td>
<td>HDPE pressure pipe</td>
<td>02634</td>
</tr>
<tr>
<td>PE</td>
<td>Polyethylene pipe</td>
<td>15067</td>
</tr>
<tr>
<td>PP</td>
<td>Polypropylene pipe</td>
<td>15067</td>
</tr>
<tr>
<td>PVC</td>
<td>PVC pipe</td>
<td>15067</td>
</tr>
<tr>
<td>RBH</td>
<td>Rubber Braided Hose</td>
<td>15067</td>
</tr>
<tr>
<td>SP (CML&amp;T)</td>
<td>Steel pipe (Cement Mortar Lined and Tape Coated)</td>
<td>15062</td>
</tr>
<tr>
<td>SP (CML&amp;C</td>
<td>Steel pipe (Cement Mortar Lined and Epoxy Coated)</td>
<td>15062</td>
</tr>
<tr>
<td>CMLCSP)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STL/L</td>
<td>Steel pipe (Epoxy Lined and Coated; All Areas except Area 144)</td>
<td>15062</td>
</tr>
<tr>
<td>STL/L</td>
<td>Steel pipe (Polyurethane Lined and Coated; Area 144 only)</td>
<td>15062</td>
</tr>
<tr>
<td>SS</td>
<td>Stainless steel pipe</td>
<td>15064</td>
</tr>
<tr>
<td>WRFH</td>
<td>Wire reinforced flexible hose</td>
<td>15060</td>
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</tbody>
</table>

3-1. **SCHEDULE.** Pipe materials shall conform to those specified in Schedule 01630-S01. All pipelines indicated on the drawings and all pipelines required for proper operation of the equipment furnished shall be provided whether listed in the schedule or not.

End of Section
<table>
<thead>
<tr>
<th>Size (in)</th>
<th>Process Code</th>
<th>Description</th>
<th>Type of Installation</th>
<th>Material</th>
<th>Spec Section</th>
<th>Minimum Wall Thickness or Pressure Class (in. / psi)</th>
<th>Test Pressure Specification Section</th>
<th>Test Pressure (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18, 14, 12, 10</td>
<td>MFE</td>
<td>Microfiltration Effluent</td>
<td>Interior</td>
<td>316SS</td>
<td>15062MF</td>
<td>Sch 40</td>
<td>02704</td>
<td>100</td>
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<tr>
<td>36, 60</td>
<td>MFE</td>
<td>Microfiltration Effluent</td>
<td>Interior</td>
<td>STL/L</td>
<td>15062</td>
<td>¼ in.</td>
<td>02704</td>
<td>50</td>
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<tr>
<td>6, 12, 14</td>
<td>PA</td>
<td>Process Air</td>
<td>Interior</td>
<td>316SS</td>
<td>15062MF</td>
<td>Sch 40</td>
<td>02704</td>
<td>100</td>
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<tr>
<td>54, 60</td>
<td>MFF</td>
<td>Microfiltration Feed</td>
<td>Buried</td>
<td>STL/L STL/L</td>
<td>15062</td>
<td>3/8 in.</td>
<td>02704</td>
<td>50</td>
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<td>24</td>
<td>MFF</td>
<td>Microfiltration Feed</td>
<td>Interior</td>
<td>STL/L 316SS</td>
<td>15062 15064</td>
<td>¼ in. Sch 40</td>
<td>02704</td>
<td>50</td>
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<td>16</td>
<td>BWW</td>
<td>Backwash Waste</td>
<td>Interior</td>
<td>CMLCSP</td>
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<td>02704</td>
<td>50</td>
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<tr>
<td>24</td>
<td>BWW</td>
<td>Backwash Waste</td>
<td>Interior</td>
<td>STL/L</td>
<td>15062</td>
<td>¼ in.</td>
<td>02704</td>
<td>50</td>
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<tr>
<td>54</td>
<td>BWW</td>
<td>Backwash Waste</td>
<td>Buried</td>
<td>STL/L STL/L</td>
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<td>¼ in.</td>
<td>02704</td>
<td>50</td>
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<tr>
<td>Size (in)</td>
<td>Process Code</td>
<td>Description</td>
<td>Type of Installation</td>
<td>Material</td>
<td>Spec Section</td>
<td>Minimum Wall Thickness or Pressure Class (in./psi)</td>
<td>Test Pressure Specification Section</td>
<td>Test Pressure (psi)</td>
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*Refer to Section 11400 for specific RO piping requirements

End of Schedule
PART 1 – GENERAL

1.1. **SCOPE.** This Section of the specifications forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

1.2. **DESCRIPTION.** The valves listed in Appendix A (01640A) of this section are a summary list of process valves and gates for supply by the Contractor and others.

All valves indicated on the drawings or specified in other sections shall be provided whether listed in the schedule or not. The schedule does not relieve the Contractor of the responsibility for providing all valves and gates required by the drawings and the specifications.

Isolation ball valves for instrumentation, chemical feed, or water lines less than 4 inches are not listed herein. For details on those valves, refer to the P&IDs and respective Sections.

PART 2 – PRODUCTS

Not applicable

PART 3 – EXECUTION

Not applicable

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Orange County Water District
Groundwater Replenishment System
Final Expansion

SECTION 01640A
VALVE AND GATE SCHEDULE

February 2019
Issued for Bid
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H03

Location/ Area

510
510
510
510
510

510
510

510
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510
510
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510

510
510
510
510

510

System/
Service

BFV
BFV

BFV
BFV
BFV
BFV
VBV
VBV
VBV
VBV
ARV
VBV
ARV
VBV
ARV
VBV
BFV

BFV
BFV
BFV
BFV
SCV

PD

ROP
ROP
ROP
PCR

BFV

SCV
BFV
BFV
BFV

ROC FV
ROC SCV
ROC BFV
FLW BFV
FLW SCV
FLW BFV

ROF
ROF

CF/C
CR/C
CF/C
CR/C
ROF
ROF
ROF
ROF
ROP
ROP
ROP
ROP
ROC
ROC
CF/C

ROF
ROP
ROF
ROP
ROF

3105

2235
2240
2245
2905

2325
2335
2340
2810
2820
2830

2158
2162

2410
2420
2425
2430
2304
2302
2306
2310
2200
2200
2202
2202
2312
2312
2415

2416
2209
2165
2260
2169

ROF SCV 2135
ROF BFV 2140
ROF AVRV 2130
FF
BFV 2710
FF
BFV 2720

COMP ID

TAG Number

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510-H03-SCV-2335
510-H03-BFV-2340
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510-H03-SCV-2820
510-H03-BFV-2830

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510-H03-VBV-2306
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510-H03-VBV-2200
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510-H03-BFV-2209
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510-H03-SCV-2135
510-H03-BFV-2140
510-H03-AVRV-2130
510-H03-BFV-2710
510-H03-BFV-2720

Orange County Water District
Groundwater Replenishment System
Final Expansion

510
510
510
510
510
510
510
510
510
510
510
510
510
510
510

Unit/ Block No.

510
510
510
510
510

Sequence No.

510-I-730

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510-I-730

510-I-725
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510-I-725

510-I-721
510-I-721

510-I-720
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510-I-720

510-I-715
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510-I-715

PID

Butterfly

Check
Butterfly
Butterfly
Butterfly

Globe
Check
Butterfly
Butterfly
Check
Butterfly

Butterfly
Butterfly

Butterfly
Butterfly
Butterfly
Butterfly
Vacuum Breaker
Vacuum Breaker
Vacuum Breaker
Vacuum Breaker
Air Relief
Vacuum Breaker
Air Relief
Vacuum Breaker
Air Relief
Vacuum Breaker
Butterfly

Butterfly
Butterfly
Butterfly
Butterfly
Check

Check
Butterfly
Air/Vac
Butterfly
Butterfly

Type

01640A
14

VBF-3

VC-5
VBF-3
VBF-3
VBF-3

GV-1
VC-5
VBF-3
VBF-5
VC-5
VBF-3

VBF-5(Class 300)
VBF-5(Class 300)

VBF-5
VBF-5
VBF-5
VBF-5
VBV-3
VBV-3
VBV-3
VBV-3
15105-2.3A
VBV-3
15105-2.3A
VBV-3
15105-2.3A
VBV-3
VBF-5

VBF-5
VBF-3
VBF-5
VBF-3
VC-20

VC-20
VBF-5
15105-2.3C
VBF-5
VBF-5

Designation

6

14
14
14
4

8
8
8
8
8
8

12
12

10
10
12
8
1
1
1
1
1
1
1
1
1
1
12

18
12
12
8
12

18
18
1/2
8
8

Size
(in.)

SECTION 01640A
VALVE AND GATE SCHEDULE

AE

N/A
AE
AM
HW

AE
N/A
CW
AE
N/A
CW

AE
AE

WN
WN
WN
WN
NA
NA
NA
NA
NA
NA
NA
NA
NA
NA
WN

WN
AM
AE
AM
N/A

N/A
AM
NA
CW
AE

Actuator
Type

O-C

N/A
O-C
O-C
O-C

M
N/A
O-C
O-C
N/A
O-C

O-C
O-C

O-C
O-C
O-C
O-C
NA
NA
NA
NA
NA
NA
NA
NA
NA
NA
O-C

O-C
M
O-C
M
N/A

N/A
O-C
NA
O-C
O-C

Service

15

15
15
15
15

270
15
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NA
NA
NA
NA
NA
NA
NA
NA
NA
15

15
15
15
15
15

15
15
NA
15
15

Max Press
Diff (psi)

FO

N/A
FLP
NA
NA

FLP
N/A
NA
FLP
N/A
NA

FLP
FLP

NA
NA
NA
NA
NA
NA
NA
NA
NA
NA
NA
NA
NA
NA
NA

NA
NA
FLP
NA
N/A

N/A
NA
NA
NA
FLP

Spring Return Electric
Rotary Actuator

Class 300

Notes

VALVE AND GATE SCHEDULE
February 2019
Issued for Bid

Fail
Position


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TESTING, STARTUP, AND TRAINING REQUIREMENTS

1-1. SCOPE. This section covers testing, startup, and training requirements for all items of equipment and systems individual mechanical equipment. Startup and testing of new facilities shall include Factory Testing, Pre-startup Activities and Checks, Preoperational Testing, Individual System Startup, Individual System Acceptance Testing, Overall Startup and Acceptance Testing, Performance Testing, and Training activities. The Owner will be responsible for the activities defined under Performance Testing. Additional requirements may be specified in specific equipment specifications. The requirements of this section shall be satisfactorily completed upon completion of any field tests specified herein or in the specific equipment sections. This section shall be used in conjunction with all technical specification sections.

1-2. GENERAL. Startup shall include all checkouts of installed equipment and systems as required to verify proper installation and operation, and shall include all Factory Testing, Pre-startup Activities and Checks, Preoperational Testing, Individual System Startup, Individual System Acceptance Testing, Overall Startup and Acceptance Testing, Performance Testing, and Training activities; the requirements of which are defined in this section. Documentation of these activities and test results is considered part of Startup.

The Contractor shall provide personnel, both supervisory and from applicable trades, that are experienced in startup testing. Among these personnel, the Contractor shall provide a designated Startup Manager whose assigned duties are those specifically related to planning, supervising, and executing startup activities. The Startup Manager shall have the necessary experience to fully understand all startup requirements, to organize and coordinate the Contractor’s resources providing the startup services, and to prepare all startup documentation, as specified. Given the complexity of the Work, the Contractor is required to use a third party professional startup services firm to perform the functions of the Startup Manager and startup team.

The Contractor shall furnish all materials, instruments, incidental, and expendable equipment required. Temporary facilities required to carry out the specified testing, including temporary pipe, pumps, and other appurtenances, shall be furnished and installed, and removed at the Contractor’s expenses. Water power and chemicals required for Pre-startup Activities and Checks and Preoperational testing shall be provided by the Owner, unless specifically stated herein. Water, power, and chemicals required for Individual System Startup, Individual System Acceptance Testing, Overall Startup and Acceptance Testing, and Performance Testing, shall be provided by the Owner from the source.
supplying the system, unless specifically stated herein and/or in the Temporary Facilities section. Wastewater, including treated or test water that cannot be delivered to the system for any reason, shall be disposed of at the expense of the Contractor, in a manner acceptable to the Engineer, and in accordance with all local laws, regulations, and permits.

Startup and testing shall be conducted during the workweek of Monday through Friday, unless otherwise approved by the Owner. Where continuous long-term testing is required, testing may continue over the weekends and holidays with prior approval from the Owner.

1-3. STARTUP MANAGER, STARTUP TEAM. Given the complexity of the Work, the Contractor shall provide the services of a Startup Manager to plan, document, manage, and certify all work included in, or directly related to, startup and testing. The Startup Manager shall have a minimum of ten (10) years’ experience, in operations and startup of facilities, equipment, electrical, and plant controls of similar type, size, capacity, and of a complexity similar to those included in the Work.

The Contractor shall submit information to demonstrate that their Startup Manager is qualified. The qualifications for the Startup Manager shall be submitted at the Preconstruction Conference and will be reviewed by Owner and Engineer. Once accepted, the Contractor shall not change the Startup Manager throughout the full period of performance of the Work without the express written permission of the Owner or Engineer. The Startup Manager shall be part of the Contractor’s team from the beginning of the Project.

The services to be managed and/or executed by the Startup Manager shall include the following tasks:

a. Formation of an onsite Startup Team of supervisory staff qualified as a team in all elements of the startup process required as part of the Work. Startup Manager shall utilize representatives of the Contractor’s mechanical, electrical and instrumentation Subcontractor’s and others as appropriate for startup activities and testing.

b. Prepare startup and testing documentation, direct the startup activities and the Startup Team.

c. Complete planning, development, and preparation of Startup/Testing Plans, testing procedures, test reports, and related submittals/documentation for startup activities required by the Contract Documents.
d. Provide coordination and scheduling of startup and testing activities, including the development of detailed startup and testing schedules integrated with the Contractor’s CPM Schedule. Update the test schedule and incorporate testing activities in the progress schedule.

e. Coordinating manufacturers’ services and their certification of proper installation and/or function of operation of equipment as required by the Contract Documents.

f. Provide coordination, direction, and management of day-to-day startup activities.

g. Conduct weekly coordination meetings during startup and testing activities.

h. Schedule and conduct a one (1) day submittal review workshop with the Owner and Engineer to receive and resolve submittal review comments to the Contractor’s detailed startup and testing plan submittal.

i. Coordination of all disinfection requirements

j. Ensure that the Startup Team is equipped and ready to provide for emergency repairs and adjustments and corrections to the equipment and systems installed and modified as a part of the Contract.

k. Notify Owner and all respective equipment manufacturers at least 21 days prior to the date when each equipment system is scheduled for Pre-startup Activities and Checks.

l. Provide for required maintenance and servicing of equipment, including electrical gear and instrumentation, during startup and testing.

m. Organize International Electrical Testing Association (NETA) acceptance testing during the Pre-commissioning phase in accordance with the Electrical Equipment Installation section. Tests on newly-installed power systems and apparatus will be conducted before energizing, to ensure that the installation and equipment comply with specifications and intended use as well as with regulatory and safety requirements.

n. Facilitate and submit operator and maintenance training.

1-4. MANUFACTURER’S FIELD SERVICES ENGINEERS. The Manufacturers shall provide technically qualified field-service engineer, a manufacturer’s representative who is factory trained and certified, for the installation, startup and testing of equipment furnished as defined in the procurement documents and the specifications.

The technically qualified field service engineer shall be a person employed full-time by the manufacturer and who has conducted startup activities similar to those required herein on at least two other projects of a similar complexity. The field service personnel’s qualifications shall be submitted, in resume format, 21
days prior to commencement of services for approval by Owner. Owner shall have the right to reject the field service engineer for immediate replacement once the field service engineer is on-site, if submitted qualifications were not representative of the field service engineer’s actual experience or abilities, at the sole discretion of the Owner. The Contractor shall be responsible for planning, supervising, and executing the installation of the work, and shall plan for using the field-service engineers' time.

Additional services and travel expenses necessary to correct defective materials or equipment furnished by the manufacturer shall be provided at no additional cost to the Owner.

Field-service engineers shall observe, instruct, guide, and direct Contractor’s erection and installation procedures, and perform installation checks as required herein or as requested by the Engineer.

The Microfiltration (MF) System Field Service Engineer shall perform the following:

a. Submit a “Detailed Plan of Commissioning Activities” that shall be used as a guideline by the Contractor for startup and testing of the MF System.

b. Accept in writing the condition of all concrete basin construction and linings including cleanliness and removal of debris and proper pipework, pump and instrument installation prior to module installation.

c. Provide in writing Instruction to Contractor to start membrane installation.

d. Accept in writing the condition of all membrane modules installed and verify that flushing of preservative has been completed and membrane integrity tests completed on all units.

e. Perform an inspection of the completed installation and provide final acceptance of the MF equipment installation, in writing through a “Notice of Completed Installation”, prior to commencement of startup and testing.

f. Retain the services of specific equipment manufacturers as necessary to assist with startup and testing.

g. Facilitate Performance Testing (Acceptance Testing of Membrane Equipment).

h. Provide Operations Assistance, Operation and Maintenance Manuals; and training of operations and maintenance Personnel.

i. Complete all other start-up, testing, and operation experience as defined in the Section 11305MF Membrane System, 13030 Membrane Filtration System Installation, and the MF Procurement Document.
The Reverse Osmosis System Supplier (ROSS) Field Service Engineer shall:

a. Accept in writing the condition of ROSS installation including cleanliness and removal of debris and proper installation of pipework and instruments associated with the scope of the ROSS prior to membrane installation in vessels.

b. Accept in writing the condition of all membrane modules installed in vessels.

c. Perform an inspection of the completed installation and provide final acceptance of the equipment installed under the scope of the ROSS, in writing through a “Notice of Completed Installation”.

d. Assist startup and testing activities as appropriate through coordination with the Contractor.

e. Provide Operation and Maintenance Manuals and Training of operations and maintenance personnel as required by the technical specifications.

The Ultraviolet Light Field Service Engineer shall:

a. Accept in writing the condition of piping installation and UV train installation including cleanliness and removal of debris, completeness of pipeline pressure testing, correct installation of UV reactors, lamp sleeves and lamps, proper termination of electrical and control wiring, and all related instrument installation prior to any wet startup and commissioning.

b. All other requirements and manufacturer instructions as specified in Section 13700 and the UV Procurement Documents.

c. Provide Operation and Maintenance Manuals and Training of operations and maintenance personnel as required by the technical specifications.

2-1. SUBMITTALS. Contractor shall submit the following information for specific equipment where specified in individual sections and in this section, in accordance with the submittals section.

a. Names and resumes of proposed field technicians and Startup Manager

b. Manufacturer’s certification of proper installation of all equipment.

c. Startup/Testing plans with schedule for each equipment item and system. Schedules shall list each piece of equipment or component to be tested, as specified in this Section or by the various sections of the Technical Specifications. Schedules shall include sequence and duration for all categories of startup and testing.

d. Testing procedures specified in Process Control System section, prepared by the Process Control System Integrator (PCSI), for Process Control System (PCS) acceptance testing.
e. Operation and Maintenance Manuals for each equipment item and system to be tested.

f. Organization chart for conducting startup and testing activities and experience information (list of projects and owner contact information) for Startup Manager.

g. Instrumentation list with calibration methods and calibration dates.

h. Clearance, Red Tag and equipment release procedures including authorization assignments. Lock-Out and Tag-out procedures, at a minimum, be in accordance to with OSHA, 29 CFR, Part 1926 Construction Industry, Section 1910.1473.

i. Acceptance criteria required to release equipment and systems for startup.

j. Field calibration reports.

k. Submit preliminary copies of test data in field report form within two days after completion of each test.

l. Submit daily logs.

m. Submit five bound copies of field test reports of checkout and testing of all equipment.

n. Training material, instruction schedule, outline of lesson plans, lesson plans, and training aids

o. Submit sign-off and acceptance forms for each piece of equipment

3-1. **STARTUP AND TESTING REQUIREMENTS.** It is not the intent of the Engineer to instruct the Contractor in the startup and testing of the Work; however, the Engineer will be available prior to and during startup to provide technical support and to verify that all Work is performed in accordance with the Contract Documents.

The Contractor and manufacturer shall be responsible for scheduling and coordinating all startup and testing activities with the Owner’s staff and Engineer. The suggested sequence of activities for each system shall be as follows. A subsequent startup and testing step shall not be commenced until the previous steps are completed.

**Description**

**Step 1:** Civil Construction, structure hydrotest, and pressure tests

**Step 2:** Factory Testing and installation of equipment

**Step 3:** Prestartup Activities and Checks
Step 4: Preoperational Testing

Step 5: Initial Training: general training, maintenance training, PCS training, and OCSD training.

Step 6: Individual System Startup

Step 7: Individual System Acceptance Testing

Step 8: Overall Startup and Acceptance Testing

Step 9: Performance Testing

Step 10: Follow-up Training

It is noted that the UV System equipment has been procured in advance and assigned to the Contractor. Contractor shall refer to the Procurement Documents of the system for coordination with the System Supplier regarding startup, testing, and training activities.

The Contractor shall refer to the Membrane System Procurement Document for proposed startup, testing, and training activities.

3-1.01. Factory Testing. When specified in the specific equipment sections, the equipment will be test run at the location of manufacture, and the test results shall be delivered to Engineer. Such equipment shall not be shipped until Engineer has reviewed the test results and advised the Contractor, in writing, that the equipment is acceptable for shipment. Such acceptance, however, will not be considered as final acceptance, which will only be made on the basis of the test results of the equipment after installation.

For packaged systems, the Factory Testing also includes all PLC and operator interface software.

3-1.02. Prestartup Activities and Checks. Prior to testing of all equipment, the Contractor shall clean and check at a minimum the following:

a. Inspect and clean equipment, devices, and connected piping so they are free of foreign material.

b. Lubricate equipment in accordance with manufacturer’s instructions.

c. Turn rotating equipment by hand and check motor-driven equipment for correct rotation.

d. Open and close valves by hand and operate other devices to check for binding, interference, or improper functioning.
e. Check power supply to electric-powered equipment for correct voltage.
f. Check for proper equipment alignment.
g. Obtain manufacturer’s certification of proper installation.
h. Receive certification from the manufacturer’s field service engineers that the equipment installation complies with manufacturer’s installation instructions and the intent of the Drawings and Specifications.

Ready-To-Test Determination: All equipment shall be determined ready to test by the Engineer based on the following:

a. Notification in writing by the Startup Manager that each equipment and system is readiness for testing.
b. Verification by the Engineer that all lubricants, tools, maintenance equipment, spare parts and approved equipment operation and maintenance manuals have been furnished as specified.
c. Verification by Owner that all spare parts, safety equipment, tools and maintenance equipment, lubricants and approved operation and maintenance information have been received.
d. Submittal and approval of Startup/Testing plans.
e. Cleanliness of equipment, devices, and connected work.
f. Adequate completion of work adjacent to or interfacing with equipment to be tested.
g. Availability and acceptability of manufacturer’s representative’s to assist testing of respective equipment, and satisfactory fulfillment of other specified manufacturers’ responsibilities.
h. Acceptability of civil construction, hydrotests, and pressure tests.

Perform prestartup tests and make adjustments as needed. Pre-startup tests shall include, but not be limited to, the following:

a. Perform calibration tests of all position, pressure, level, flow, temperature, and monitoring instruments.
b. Conduct operating tests for all valves and operators. Inspect, adjust and operate the valves and auxiliary equipment.
c. Verify electrical operation of auxiliaries including: Solenoids, Limit switches, Remote indicating devices, position, pressure, and level transmitters.
d. Inspect and verify proper anchorage and grounding.
e. Perform tests of on-off controls, limit switches, and indicating lamps.
f. Perform tests of alarms, signals, and fail-safe or system shutdown controls.

g. Perform point-to-point circuit continuity tests.

h. Perform trip checks of all electrical equipment to verify the proper functions of all trip and control circuits.

i. Perform all pre-startup tests specified in sections of the Technical Specifications.

j. Perform tests required by manufacturer's catalogs or specifications.

k. Perform additional tests required by manufacturer's modifications to meet specified requirements, or tests required due to failures of Contractor’s furnished equipment, which shall be completed at the Contractor's expense with no additional cost to Owner.

Perform pre-startup testing for the following equipment systems and subsystems in accordance with NETA including tests indicated as optional for the following equipment:

a. Pumps and motors.

b. All valves and operators.

c. Mechanical and process equipment

A label shall be attached to all devices to indicate that testing has been performed, indicating the date that tests were completed and initialed by the person conducting the tests.

3-1.03. Preoperational Testing. Preoperational Testing shall be carried out for all items of process equipment, piping systems, electrical systems, instrumentation and control systems, and auxiliary systems. Preoperational Testing of equipment under power shall not be carried out until prestartup activities and checks, of the electrical equipment, has been completed. Preoperational testing shall include initial equipment operation in the presence of the manufacturer’s representative, where specified in the Contract Documents, and the requirements herein. Preoperational testing shall also include mechanical testing of the MF System, RO System and Ultraviolet Light System by the Contractor as specified in the MF membrane and UV procurement documents and respective technical specifications sections.

Preoperational Testing shall verify individual equipment component functional operation, and shall not involve complete system operation or specified performance requirement verification. No preoperational test water shall be discharged to the Santa Ana River or storm drains. No preoperational test water shall be discharged to the OCSD outfall pipeline without prior approval by the
Owner and Engineer, nor shall it be discharged to the OCSD outfall during peak wet weather storm events. Water discharged to the OCSD outfall must meet all applicable discharge requirements. See Regulatory Requirements and Permits Section for discharge requirements.

Ancillary facilities necessary to recycle or discharge preoperational test water from any of the facilities being tested shall be operational to facilitate the movement and discharge of test water. The methods for recirculation or disposal of preoperational test water shall be detailed in the Contractor’s Plan.

Preoperational Testing shall include the Contractor’s test operation of each piece of process and mechanical equipment. All moving parts of equipment and machinery shall be carefully tested for operation, and adjusted so all parts move freely and function to secure satisfactory operation. All equipment shall be tested continuously under actual or simulated operating conditions for a sufficient amount of time to demonstrate functionality. All parts shall operate satisfactorily in all respects, under continuous full load and in accordance with the specified requirements. If any part of a unit shows evidence of unsatisfactory or improper operation during the test period, correction or repairs shall be made and the full test operation, as specified, shall be completed after all parts operate satisfactorily.

Preoperational Testing of all process and pumping equipment and drive motors, including auxiliaries shall be made in accordance with the appropriate and approved test codes, such as by the American Society of Mechanical Engineers, Hydraulic Institute Standards, and IEEE.

Preoperational Testing shall include at least 4 full open-close cycles of operation for all actuated valves. Testing shall be in accordance with the maximum number of operations per hour as recommended by the actuator manufacturer.

Preoperational testing for the PCS shall be as specified in The Process Control System Section.

Prior to Preoperational Testing, the equipment shall be properly filled, by the Contractor, with oil, grease, lubricants, and other necessary liquids and the Contractor shall furnish all personnel, fuels, oil, grease, chemicals, and auxiliaries necessary for conducting Preoperational Testing of the equipment and systems. Chemicals, water, and energy for testing and regular operation of the expanded Plant will be provided by the Owner. Contractor shall notify the Engineer forty-five (45) days prior to any startup activities to allow the Owner time to order chemicals and have them delivered to the site for startup procedures. Contractor shall furnish all additional chemicals required for other uses (i.e., disinfection activities following construction) and not specifically for regular testing.
operation of the expanded plant. Refer to the Temporary Facilities section for additional requirements.

All equipment installed under this Contract, including that furnished by others, shall be placed into successful operation according to the written instructions of the equipment manufacturer and the instructions of the manufacturer's field representative.

Preoperational Testing shall not be considered complete until all testing provides successful results, and all documentation of tests and all manufacturer's certifications required by the Contract Documents are submitted and accepted by the Engineer.

It is suggested that at a minimum, qualified personnel from the electrical and instrumentation subcontractor’s crew responsible for the installation of the electrical and instrumentation portion of the Work shall be included as test personnel for the Preoperational tests electrical or instrumentation work.

3-1.04. Individual System Startup. Contractor shall conduct Individual System Startup to test operation of each complete process system, (i.e. MF System, RO System, SE Equalization Tanks, P2 SE Pump Station, UV System, etc), which shall include the mechanical, electrical, and instrumentation and control equipment, as a complete and functional process system. The Individual System Startup shall be in accordance with the requirements in this section and the technical specifications and procurement documents.

The startup shall continue for not to exceed forty-eight (48) hours without interruption. All moving parts of equipment and machinery shall be carefully tested for operation, and adjusted so all parts move freely and function to ensure satisfactory operation. All equipment shall be tested continuously under actual or simulated operating conditions. All parts shall operate satisfactorily in all respects, under continuous full operation. If any part of a unit shows evidence of unsatisfactory or improper operation during the testing period, correction or repairs shall be made and the full test operation, as specified, shall be completed after all parts operate satisfactorily.

Individual System Startup testing for the PCS shall be as specified in The Process Control System Section.

The Owner will provide operations personnel for observation of equipment during over-night testing. The only action the Owner’s Operator will perform is to Stop the System using Emergency Shutdown or Normal Shutdown provisions, if deemed necessary. Contractor shall provide a contact name and phone number for afterhours issues that occur while Owner is overseeing plant operation.
Ancillary facilities necessary to recycle or discharge preoperational test water from, any of the facilities being tested, must be operational to facilitate the movement and discharge of test water. During testing, the Contractor shall be required to recycle and/or discharge all test water as indicated under the Preoperational Testing.

At a minimum, tests conducted by the Contractor shall demonstrate routine, non-routine, and emergency operation such as: full operation in manual and automatic modes, full startup operation in normal and emergency modes, and full shutdown in normal and emergency modes.

Additional considerations for each system follow:

A. Microfiltration Backwash Waste, Microfiltration Backwash Supply, and Product Water Pump Station Startup

1. Conduct preliminary electrical energization tests. Initiate energization of station service transformer including phasing tests.

2. Pump-motor mechanical run (off-line). Provide instrumentation to measure vibration. Displacement measurements and acceptable field vibration limits shall be in accordance with Hydraulic Institute Standards for vertical pumps.

3. Operate each pump individually in the “local” control mode up to the limit of flow available. Pump operation for variable speed pumps shall be over the full range of speeds specified for operation.

4. Measure motor voltage, amperage, pump suction head, and pump discharge head at up to ten (10) points along the pump head-flow curve for each speed.

5. Pump-motor startup test (on-line). Initiate automatic start, placing each unit on-line. Operate unit at full load until stator temperature stabilizes. Bearing temperatures shall be determined by a contact-type thermometer. A running time of at least 30 minutes at full speed shall be maintained for this test. Record the following measurements on a strip chart during these tests:

   a. Speed
   
   b. Vibration (Provide instrumentation to measure vibration. Displacement measurements and acceptable field vibration limits shall be in accordance with Hydraulic Institute Standards for vertical pumps). Contractor shall enlist a third party firm to perform onsite vibration testing after pumps are installed.

   c. Motor temperature (RTD’s per motor).
d. Noise (“A” rated weighted noise level at 3 ft. See Vertical Diffusion Vane Pumps Section for performance requirements). Contractor shall enlist a third party firm to perform onsite noise testing after pumps are installed.

B. Microfiltration Startup

Secondary Effluent, or effluent from the existing MF trains, shall be used as MF feed for the Individual System Startup Testing. All components of the MF system shall be operated to ensure that the entire system can operate together under all control modes. One MF cell shall be brought on-line at a time.

Membrane integrity testing shall be completed before a cell is brought on-line for Individual System Startup Testing.

During this testing phase, the following shall be confirmed:

i. Verify filtration sequence
ii. Verify backwash sequence
iii. Verify membrane test sequence
iv. Verify other MF System process sequences
v. Chemically clean the membrane units

C. Reverse Osmosis Startup

MF Filtrate, or RO permeate from existing units, shall be used as RO Feed. All components of the RO system shall be operated to ensure that the entire system can operate together under all control modes. One RO unit shall be brought on-line at a time.

The contractor shall temporarily connect the RO Permeate to the RO Concentrate for orifice testing and testing performed after membrane installation. Only after the results of the conductivity profiling have been approved by the Owner, the contracto may reconnect the RO Permeate and allow permeate to be produced.

A 48-hour long orifice test shall be performed on the RO units, prior to membrane installation. An orifice shall be placed inside the vessels to create hydraulic resistance equal to having the membranes installed. This testing shall be used to confirm hydraulic conditions of the system and pressure rating of vessels without risking damage to the membranes. Orifice testing shall be performed with the existing plant off-line.
Contractor shall notify Owner in advance of scheduling this test, in accordance with notification requirements in these specifications, for coordination of shutdown times.

During this testing phase, the following shall be confirmed:

i. Hydraulic conditions of the system
ii. Control sequences with Interstage Booster Pumps
iii. Control sequences without Interstage Booster Pumps
iv. Vibrational testing of the RO high pressure feed pumps (in accordance with technical specifications)

D. **Ultraviolet Light Startup**

UV start-up shall be as defined in the UV Disinfection System Installation section, UV Procurement Documents, and in accordance with manufacturer’s instructions. Operation of the UV System without all control system interlocks shall be coordinated to prevent the flow rate through a UV train from exceeding the manufacturer’s design limits.

E. **Chemical Feed System Startup**

Any testing related to chemical feed areas shall be performed in the presence of and under the supervision of operations staff from the Owner and OCSD. Additional requirements are defined in Liquid Chemical Feed Systems section.

F. **Tanks Startup**

Verify proper operation of all electrical, mechanical, instrumentation and communication systems at the tanks' sites.

G. **Plant 2 Secondary Effluent Pump Station Startup**

The Plant 2 Secondary Effluent Pump Station (P2SEPS) pumping system shall be operated using the piping loop install for the project which includes the flow path from the pump station through the tank through the meteing vault and back to the pump station wetwell for testing each individual pump. The overall system testing shall be performed to include pumping up to the Screenings Facility where flow will overflow the Screening Facility weir for discharge to the Plant 2 ocean outfall system. Startup tests of the pumping system shall be conducted to verify proper operation of the electrical system from the line interconnection through to the pump motors, and the pumping equipment and auxiliary systems. Startup tests using the temporary test loop shall include, but not be limited to the following:
1. Section 11140B: Pump Operation – operate each pump individually in the "local" control mode as specified. Verify proper operation and control of pumps, motors and accessories, and of discharge piping, valves and appurtenances.

2. Section 16150, Par. 3-2: VFD operation – perform "field acceptance test" on each VFD as specified, expect the drives shall be tested under actual operating conditions.


Verify proper operation and field settings of equipment, auxiliary systems and building systems, such as those specified in:

1. Section 15500, Heating, Ventilation, and Air Conditioning

3-1.05. Individual System Acceptance Testing (Acceptance Test). Contractor shall conduct Individual System Acceptance Testing of each complete process system (i.e. MF System, RO System, Tanks, Pump Stations, etc.) as a complete and functional process system. The individual systems shall undergo a series of Acceptance Tests designed to verify that the individual system meets the specified performance requirements in the Contract Documents. The start dates of the testing periods shall be on a date that is mutually agreed between Owner and Contractor. Manufacturer shall receive a minimum 30 day notice prior to the start of each of the Acceptance Tests. The Contractor shall furnish the services of authorized manufacturer’s representatives, as necessary, to correct faulty system operation. Representatives of the Manufacturer may provide advice during the Acceptance Tests, but they shall not operate the equipment. The representatives of the Manufacturer shall be at the site during Acceptance Tests as specified in the technical specifications. The representative shall be available on call the remainder of the time.

The Acceptance Test shall continue for up to five (5) days without interruption. The Acceptance Test will be used to demonstrate that the system operates satisfactorily as a complete, functional system meeting the specified performance requirements. Each system shall be tested continuously under actual or simulated operating conditions. If any part of a system shows evidence of unsatisfactory or improper operation during the testing period, correction or repairs shall be made and the full testing operation shall start again until successful operation is observed, unless the test is interrupted for any of the following reasons:

- Loss of secondary effluent water delivered to the OCWD facilities beyond the control of the Contractor.
• Loss of power to the OCWD facilities such as a local power failure.

• Inability of the Barrier Injection Well System or Recharge Basins to accept the water produced by the OCWD facilities if water is approved to be discharged to the Barrier and/or Recharge Basins.

• Inability to discharge any water produced in an acceptable manner.

If the test is interrupted for any of the reasons above, the Contractor is still responsible for completion of the Acceptance Test from the time of failure to the completion of the test once whatever caused the shutdown has been resolved at no additional cost to the Owner. The testing shall include testing of all alarms, such as high and low range set points to confirm settings and operation and system shall be operated in all control modes.

Individual System Acceptance testing for the PCS shall be as specified in The Process Control System Section.

During this testing period a licensed plant operator provided by the Owner will provide continuous observation of all commissioning activities at all times. During the Individual System Acceptance Test, the individual system does not meet the product water quality criteria for that stage of treatment, then it returns either to the head of the OCSD facilities or to the OCSD outfall. If the water does meet the product water quality criteria for that stage, it continues to the next process for further treatment or, in the case of post-treatment acceptance testing, to the product water/barrier water pump station.

The operator will operate under the Contractor’s direction whenever water is produced for delivery, however the operator may at any point in the commissioning process halt commissioning for any reason.

During this testing period water shall be diverted to ultimate use as long as specified performance requirements are being met or shall otherwise be recycled to the head of the OCSD facilities. The Contractor shall plan to provide pumping equipment and piping to divert flow.

3-1.06. Overall Startup and Acceptance Testing. Following confirmation that all systems are ready to operate through successful completion of Individual System Acceptance Tests, the Contractor shall conduct an Overall Startup and Acceptance Test. The test shall consist of the requirements listed herein, unless exceptions or additions are indicated in the specific equipment sections.

Overall Startup and Acceptance Testing shall be at least a thirty (30)-day operational run of the entire facility demonstrating that all portions of the facility operate as intended. The test is intended to demonstrate that the facilities are complete, functional and can be continuously operated for their full intended function. During the testing period, the plant shall be operated under all control
modes, including manual, remote-manual, and automatic. PLC-PCS Owner’s staff shall operate the facility under the direction of the Startup Manager and Manufacturer’s representatives if applicable.

All systems must properly run continuously 24 hours per day for the test period at flow rates acceptable to Owner. The full AWTF capacity flow of 130 MGD on an average daily basis or the maximum available capacity as defined by the Owner shall be tested. Duty and standby equipment shall be alternated so that all equipment is selected for duty operation for a period of at least (two) 2 days during the test. Unless indicated otherwise, if any item fails, malfunctions or a defect is found during the test, the item shall be repaired and the test restarted at time zero with no credit given for the operating time before the failure, malfunction, or defect was found. Failures, malfunctions, or defects meeting both of the following conditions may, at the Engineer’s discretion, not be considered grounds for restarting the test at time zero:

1. Malfunctions that do not cause an interruption to the operation of the facility because standby equipment can be placed into service.

2. Malfunctions that are corrected within four (4) hours of the time the malfunction is detected. Correction of a malfunction, failure or defect will be considered complete only when the affected equipment is placed back into service and is operating as intended. It is the Contractor’s responsibility to note the time of failure and to immediately notify Engineer.

The Contractor shall supply all oil, grease, lubricants and other auxiliaries required for Overall Startup and Acceptance Testing. The Owner will supply chemicals, water, and power for operation of the expanded facilities during Acceptance Testing. Contractor shall notify the Engineer forty-five (45) days prior to any testing activities to allow the Owner time to order chemicals and have them delivered to the site for testing procedures. Contractor shall furnish all additional chemicals required for other uses (i.e., disinfection activities following construction) and not specifically for regular operation of the expanded plant. See Temporary Facilities Section for additional requirements.

All failure, malfunctions, defects in materials or workmanship, or other flaws, which appear during this test period, shall be immediately corrected by the Contractor.

All PCS coordination issues and trending requirements shall be finalized so they are tested during this period. Additional requirements for the Overall Startup and Acceptance testing for the PCS shall be as specified in The Process Control System Section.
During this testing period water processed through the OCWD facilities shall be suitable for discharge from the Product Water/Barrier Water Pump Station.

3-1.07. Performance Testing. Performance Testing is for coordination with the requirements equipment systems; including the MF Membranes and pre-procured UV System. Specific requirements for this testing from the procurement documents are highlighted below. The Owner will provide chemicals, water, and power required during performance testing of the new facilities. Contractor shall notify the Engineer forty five (45) days prior to any testing activities to allow the Owner time to order process chemicals and have them delivered to the site for testing procedure. Contractor shall furnish all additional chemicals required for other uses (i.e., disinfection activities following construction) and not specifically for regular operation of the expanded plant. The Owner will operate the facility.

a. MF System Performance Testing. The MF System shall undergo Performance Testing to satisfy the Acceptance Testing requirements of the MF Membrane Procurement Documents. Performance Testing of the MF System shall include the following.

- Testing shall extend for a period of 90 consecutive days and shall be completed within a total of 120 days after commencement.
- Each membrane cell shall be tested concurrently but shall be evaluated separately for performance.
- Owner shall operate the facility, but the Manufacturer’s Representative shall make a minimum of 3 on-site visits and be available at all times by phone during normal working hours and non-working hours in case of an emergency.
- The Manufacturer’s Representative shall submit a written report including the data and results of the testing at the termination of the period. Report shall confirm that all Membrane System Warranty for performance, as specified in the Procurement Documents, are met.
- During the test, feed water flow shall be divided so one or more membrane cells operate at the design flow, with the other cells equally balanced to treat the remaining raw water available for the 90-day period.
- During the test, the System shall perform in accordance with the guaranteed product water quality to allow the District to discharge treated water.

b. UV System Performance Testing. The UV System testing shall be as specified in the UV Disinfection System Installation Section and UV Procurement Documents.
4-1.  **STARTUP/ TESTING PLANS AND SCHEDULES.** The Contractor shall develop a series of plans and schedules for the startup and testing for all facilities included in the Work, and shall submit the plans for review by the Owner and Engineer in accordance with the Submittals section. When multiple identical units are involved, a single plan shall be approved, as used as a template for the preparation of subsequent plans.

Where applicable, testing procedures included in the plans shall be developed in accordance with the requirements in each applicable section of the Contract Documents.

Plans shall include all documentation required to plan and monitor the performance of all startup and testing activities. It is expected that documentation will include selected portions of the Contract Documents, submittals, and manufacturer’s information.

The startup and testing plans shall include detailed startup schedules which are consistent with the Contractor’s current CPM Construction Schedule and applicable requirements of the Contract Documents. The Startup Schedule shall become a subnetwork of the overall Project CPM schedule.

The Contractor shall submit Factory Testing, Prestartup Activities and Checks, Preoperational Testing, Individual System Startup, Individual System Acceptance Testing, and Performance Testing Plans to the Engineer no later than 90 calendar days prior to commencing any testing covered by the plans.

The Contractor shall review and present plan in a workshop format. The Engineer, the Owner, and Orange County Sanitation District will review the preliminary test plan and return the plan with comments. The Contractor shall incorporate all comments and shall submit the final plan.

The Plan shall document the as-built and tested condition of the equipment. Plan shall include, but not be limited to the following:

1. Testing Narrative:
   a. Description of objectives to be completed during commissioning and Start-up.
   b. Schedule of Equipment Testing organized by Equipment Tag
   c. Temporary Connection Discussion
   d. Lock-Out Tag Out procedures
   e. Safety Considerations
   f. Miscellaneous Considerations:
      1) Oil, Grease and Lubrication Requirements
2) Chemical
3) Waste Disposal Considerations
4) Disinfection Requirements

g. Acceptance Criteria:

2. Roles and responsibilities of the:
a. Contractor Start-up Manager
b. Equipment Suppliers and Manufacturer Representatives
c. PCSI Personnel
d. Owner and Owners Representatives
e. Construction Manager
f. Design Engineer
g. Other personnel

3. Scoped and approved P&IDs
4. Control Panels Diagrams
5. I/O and Digital Communication Testing Schedules
6. Equipment Specification
7. PCS and Functional Loop descriptions and Testing Schedules
8. Testing and Calibration procedures for equipment organized by Tag
9. Testing and Calibration forms for equipment organized by Tag
10. Relevant as-built equipment supplier data including
   a. Drawings
   b. Installation and Operational Manuals

11. Installation Information
   a. Hydrotest test record form
   b. Electrical and Control sheets in accordance with Division 16
   c. Installation sign-off forms for each type of equipment installed by the Contractor on this contract
   d. Manufacturers Certification of Proper Installation (MCPI)

4-1.02. Preoperational Testing Plan. The Preoperational Testing Plan shall be a comprehensive description of the personnel, equipment, procedures, analyses, and reporting program for all Preoperational Testing required for the Work. The Preoperational Testing Plan shall be subdivided into testing plans for each system. Each system test plan shall include the following:
- The test number.
- Identification information for each component or piece of equipment to be tested as part of the system. All applicable tag numbers shall be included.
- The schedule and duration for the test.
- Prerequisites for the test.
- A narrative description of the purpose and goals of the test.
- Pass/Fail criteria for the test.
- A checklist for tracking testing progress which includes prerequisites for the test and each step of the testing procedure. The check list shall include specified performance criteria that are to be met.
- A listing and copy of pertinent reference documents for each test (Contract Documents, submittal information, other manufacturer’s information, and industry standards or specifications applicable to the testing).
- A description of test apparatus used to conduct the test. Where useful, drawings may be included.
- Listing of manufacturer’s representative(s) to be on site during the test.
- Certificates of proper installation, as applicable to the test.
- Step-by-step detailed procedures of how the test will be conducted. The level of detail shall be sufficient for a witness with a rudimentary technical aptitude to be able to follow the execution of the steps during the test and be confident that the test is being performed as planned. All steps required to proceed through the test in an orderly manner are considered significant and each of these steps shall be included in the procedure.
- Copies of the actual data logs and/or data recording forms that will be used during the test.
- Calculation methodologies to be used to evaluate the data and/or test criteria for the test.
- Sample computations or analyses for the test with results in the same format as the final report. This item is intended to demonstrate how data collected will be used to generate final results. A sample shall be included for each type of computation required for the test and analysis of results.
- Blank sign-off form for the test acknowledging the Contractor’s, the Engineer’s, the Owner’s, and the equipment manufacturer’s acceptance of the test where applicable.
- An example of the System Problem Report is as follows.
# SYSTEM PROBLEM REPORT

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Groundwater Replenishment System Final Expansion</th>
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</thead>
<tbody>
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<td>Test Name:</td>
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</tr>
<tr>
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<tr>
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<td>Description:</td>
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<tr>
<td>Can problem be reproduced at will?</td>
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<td>Time: Date: By:</td>
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<td>Description:</td>
<td></td>
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<tr>
<td>CORRECTION:</td>
<td>Time: Date: By:</td>
</tr>
<tr>
<td>Description:</td>
<td></td>
</tr>
<tr>
<td>FINAL SIGN OFF</td>
<td>Time: Date: By:</td>
</tr>
</tbody>
</table>

Orange County Water District 01650
Groundwater Replenishment System -22-
Final Expansion

February 2019
Issued for Bid
4-1.03. **Individual System Startup Plan.** The Individual System Startup Plan shall be prepared for each system. The Individual System Startup Plan shall include the following:

- A description of the purpose and goals of the test.
- A prerequisite checklist, to be acknowledged by the Engineer prior to initiating the test, to demonstrate that all testing and other Work required to be completed prior to the test.
- A listing of all personnel to be used to operate the system and conduct any related monitoring of performance.
- A listing of all test and/or monitoring equipment to be used as part of the startup.
- A listing of standby personnel, equipment, and materials that will be available if needed during the startup period.
- A description of all preparatory work required to facilitate the startup and the continuous operation of the complete system.
- A procedure for startup of the facility.
- Step-by-step procedures for operation during the startup period including a schedule of equipment operation times and duty/standby alternations.
- A description of all data and other information to be reported in support of the completed test, including any blank data logs that may be used.
- Complete mechanical drawings, control panel drawings, and P&IDs for the system.
- Complete equipment lists with equipment cut sheets and I/OM information for all equipment in the system.
- Complete control narratives for the system.
- Testing check lists for the following items: Motor Operated Open/Closed Valve with and without control stations, Motor Operated Modulating Valves, VFDs, Motors, Vibration Testing, and Instruments and Analyzers.
- Blank sign-off form for the test acknowledging the Contractor’s, the Engineer’s, the Owner’s, and the equipment manufacturer’s acceptance of the test.

4-1.04. **Individual System Acceptance Testing and Acceptance Testing Plan.** The Individual System Acceptance Testing and Acceptance Testing Plan shall be prepared for each system and for all systems combined. The Individual System Acceptance Testing and Acceptance Testing Plan shall identify the requirements for all systems testing, including subsystems. The Individual
System Acceptance Testing and Acceptance Testing Plan—shall include the following:

- A description of the purpose and goals of the test.
- A prerequisite checklist, to be acknowledged by the Engineer prior to initiating the test, that demonstrates that all testing and other Work required to be completed prior to the Individual System Acceptance Testing and Overall Startup and Acceptance Testing is indeed complete.
- A listing of all Owner's personnel to be used to operate the system and conduct any related monitoring of performance and a listing of Contractor's personnel designated to oversee the Owner's operators as required herein.
- A listing of standby personnel, equipment, and materials that will be available if needed during the test period.
- Step-by-step procedures for operation of the facility showing how local and remote control of equipment will be demonstrated.
- A description of all data and other information to be reported in support of the completed test. Include any blank data logs that may be used.
- Blank sign-off form for the test acknowledging the Contractor's, Engineer's, Owner's, and the equipment manufacturer's acceptance of the test.

4-1.05. **Startup Schedule.** A Startup Schedule shall be prepared, submitted, and kept current. It shall include all testing and related Work. A preliminary version of this schedule shall be included in the Overall Test Plan. The formal Startup Schedule described in this section shall be integrated into the overall Project CPM schedule and shall be prepared as specified for CPM schedules. The Startup Schedule shall be updated weekly to keep it current.

The schedule shall include each system test and all other testing specified in this section and other relevant sections of the Contract Documents.

4-1.06. **Startup Reports and Records.** Formal reporting and documentation of failures, malfunctions or defects, and repairs made during the startup and/or testing, is required. A “System Problem Report” form is included in this section, and shall be used by the Contractor to document problems that arise during these tests, and their resolution.

Records of all testing shall be compiled by the Contractor and submitted to the Engineer. Prior to being submitted to the Engineer, the Startup Manager shall certify that the test results show that the tested systems comply with the Contract requirements. Records shall include all documentation assembled for the test, all certifications, forms and check lists completed during the test, and sign-off forms.
Records for startup and tests shall be compiled as separate documents for each system tested, and shall be submitted within 48 hours of completion of the startup and/or testing for each system. Separate records shall be submitted for the Preoperational Testing and Acceptance Tests. These records shall include “System Problem Report” forms completed during those tests (see above).

Included herein as an exhibit is an example form that the Contractor may use to coordinate, review, and verify the startup and testing requirements for each piece of equipment on the Project.

5-1. TRAINING OF PERSONNEL.

5-1.01. General. Training is generally separated into two categories: Initial Training and Followup Training. The Startup Manager shall coordinate all training activities and shall ensure that Manufacturers provide factory-trained operations and maintenance specialist to instruct the Owner's maintenance and operations personnel in the operation, disassembly, and assembly of major equipment items, start-up, shutdown, safety concerns, troubleshooting, installation, alignment, and recommended corrective and preventive maintenance procedures for all equipment.

5-1.02. Initial Training. Initial Training shall be accomplished at a time approved by the Engineer, after Preoperational Testing but prior to Individual System Startup. Contractor shall provide a combination of classroom and field training. All training shall be conducted at the Project site. Contractor shall be responsible for planning, supervising, and conducting the training, in coordination with the Engineer and Manufacturer's Representatives. The Initial Training shall be planned such that it follows a logical sequence that generally includes the following components:

   a. Process – Overview by Engineer, training by Manufacturer's Representatives.
   b. Mechanical systems - Training by Manufacturer's Representative.
   c. Electrical Systems - Training by Manufacturer's Representative.
   d. Instrumentation and Controls - Overview by Engineer, training by Manufacturer's Representative.
   e. OCSD training for applicable process.

The Owner considers training performed by the manufacturer's representative a critical element of this Project. The Contractor shall provide a qualified videographer to record all training sessions including Follow Up Training. Recorded sessions shall be provided to the Owner on a Digital Video Disc (DVD) in the digital format requested by the Owner.
Contractor shall provide the number of days of training for equipment as indicated in the equipment schedule.

A personnel training day as indicated in the equipment schedule shall mean one full eight (8)-hour period of instruction at the Owner's facility. Travel and set-up time for manufacturer's training representatives shall be in addition to the personnel training days indicated. Personnel training days shall be in addition to manufacturer's field services required as indicated in the equipment and submittals sections.

5-1.03. Instruction Schedule. Contractor shall provide to Engineer a tentative training schedule and contact person 60 days prior to commencement of any training. Manufacturer shall submit for approval a proposed lesson plan for the instruction 30 days prior to commencement of scheduled training. Manufacturer shall submit for approval credentials of its designated instructor. Credentials shall include a brief resume and specific details of the instructor's experience with training on maintenance and operation of the equipment provided.

5-1.04. Instruction Lesson Plan. Manufacturer's proposed lesson plan shall include the elements presented in the outline specified herein. Specific components and procedures shall be identified in the proposed lesson plan. Manufacturer's proposed lesson plan shall detail specific instruction topics. Training aids to be utilized in the instruction shall be referenced and attached where applicable to the proposed lesson plan. "Hands-on" demonstrations planned for the instruction shall be described in the lesson plan. The manufacturer shall indicate the estimated duration of each segment of the training lesson plan.

5-1.04.01. Outline of Instruction Lesson Plan:

1. Equipment operation:
   a. Describe equipment's operating (process) function.
   b. Describe equipment's fundamental operating principals and dynamics.
   c. Identify equipment's mechanical, electrical, and electronic components and features.
   d. Identify all support equipment associated with the operation of subject equipment (i.e., air intake filters, valve actuators, motors).

2. Detailed component description:
   a. Identify and describe in detail each component's function.
   b. Where applicable, group related components into subsystems. Describe subsystem functions and their interaction with other subsystems.
c. Identify and describe in detail equipment safeties and control interlocks.

3. Equipment preventive maintenance:
   a. Describe preventive maintenance inspection procedures required to:
      (1) Perform an inspection of the equipment in operation.
      (2) Spot potential trouble symptoms (anticipate breakdowns).
      (3) Forecast maintenance requirements (predictive maintenance).
   b. Define the recommended preventive maintenance intervals for each component.
   c. Provide lubricant and replacement part recommendations and limitations.
   d. Describe appropriate cleaning practices and recommended intervals.

4. Equipment troubleshooting:
   a. Define recommended systematic troubleshooting procedures.
   b. Provide component-specific troubleshooting checklists.
   c. Describe applicable equipment testing and diagnostic procedures to facilitate troubleshooting.

5. Equipment corrective maintenance:
   a. Describe recommended equipment preparation requirements.
   b. Identify and describe the use of any special tools required for maintenance of the equipment.
   c. Describe component removal/installation and disassembly/assembly procedures.
   d. Perform at least two "hands-on" demonstrations of common corrective maintenance repairs.
   e. Describe recommended measuring instruments and procedures and provide instruction on interpreting alignment measurements, as appropriate.
   f. Define recommended torqueing, mounting, calibration, and/or alignment procedures and settings, as appropriate.
   g. Describe recommended procedures to check/test equipment following a corrective repair.
5-1.05. Training Aids. The manufacturer’s instructor shall incorporate training aids as appropriate to assist in the instruction. At a minimum, the training aids shall include text and figure handouts. The manufacturer shall provide Owner one (1) complete set of all slides, transparencies, diagrams, and other written material used for training purposes. Other appropriate training aids are:

a. Audio-visual aids (e.g. films, slides, digital video, posters, blueprints, diagrams, catalog sheets).

b. Equipment cutaways and samples (e.g. spare parts, damaged equipment).

c. Tools (e.g. repair tools, customized tools, measuring, and calibrating instruments).

The manufacturer’s instructor shall utilize descriptive class handouts during the instruction. Photocopied class handouts shall be good quality reproductions. Class handouts should accompany the instruction with frequent reference made to them. Customized handouts developed especially for the instruction are encouraged. Handouts planned for the instruction shall be attached with the manufacturer’s proposed lesson plan.

5-1.06. Hands-On Demonstrations. The manufacturer's instructor shall present at least two (2) "hands-on" demonstrations of common corrective maintenance repairs so that key operations and maintenance personnel have the opportunity to witness the demonstration. The manufacturer shall provide the tools and equipment to conduct the demonstrations. Requests for supplemental assistance and facilities should be submitted with the manufacturer's proposed lesson plan.

The proposed "hands-on" demonstrations should be described in the manufacturer's proposed lesson plan. In any hands-on training situation where Owner's operations or maintenance personnel participate in disassembly or assembly of equipment components, the manufacturer shall be responsible for such disassembly or assembly and shall provide written certification of proper equipment operation to the Engineer.

5-1.07. Manufacturer's Services. Training for each equipment item in these specifications shall be in accordance with this section unless otherwise specified. All training will be performed during the operating staff’s normal business hours or at other times requested or approved by the Owner. In addition to the above criteria, each equipment specification may request minimum times and material for training. These shall include, but not be limited to, installation assistance; startup, checkout, and testing; pre-startup training; and post-startup training. The time specified for these activities shall be in addition to time required for fulfilling the instruction requirements as specified above.
5-1.08. **Follow up Training.** Contractor shall include 8 hours of follow up training time for each of the following:

- Sodium Hypochlorite System
- Vertical Diffusion Vane Pumps
- RO Feed Pumps
- Instrumentation and Control System

The Manufacturer’s Representatives shall conduct this training to address any follow up issues or concerns at the conclusion of startup and testing. The Startup Manager shall schedule the training and coordinate with Manufacturer’s Representatives for availability.

End of Section
Section 01650A

TESTING, STARTUP AND TRAINING FORM

The forms listed below and included in this section are referenced from other sections of the Contract documents:

<table>
<thead>
<tr>
<th>Form No.</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>01650-1</td>
<td>Equipment Test Report Form</td>
</tr>
<tr>
<td>01650-2</td>
<td>Operation and Maintenance Transmittal Form</td>
</tr>
<tr>
<td>01650-3</td>
<td>Equipment Summary Form</td>
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<tr>
<td>01650-4</td>
<td>Equipment Record Form</td>
</tr>
<tr>
<td>01650-5</td>
<td>Manufacturer’s Installation Certification Form</td>
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<tr>
<td>01650-6</td>
<td>Manufacturer’s Instruction Certification Form</td>
</tr>
<tr>
<td>01650-7</td>
<td>Unit Responsibility Certification Form</td>
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<tr>
<td>01650-8</td>
<td>Motor Data Form</td>
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<tr>
<td>01650-9</td>
<td>Wire and Cable Resistance Test Data Form</td>
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<tr>
<td>01650-10</td>
<td>Installed Motor Test Data Form</td>
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<tr>
<td>01650-11</td>
<td>Dry Transformer Test Data Form</td>
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<tr>
<td>01650-12</td>
<td>Motor Control Center Test Form</td>
</tr>
<tr>
<td>01650-13</td>
<td>Medium Voltage Motor Starter Test Form</td>
</tr>
<tr>
<td>01650-14</td>
<td>Medium Voltage Switchgear Test Form</td>
</tr>
<tr>
<td>01650-15</td>
<td>Protective Relay Test Form</td>
</tr>
<tr>
<td>01650-16</td>
<td>Low Voltage Switchgear Test Form</td>
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<td>01650-17</td>
<td>Medium Voltage Load Interrupter Switch Test Form</td>
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<td>01650-18</td>
<td>Liquid-Filled Transformer Test Form</td>
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<td>01650-19</td>
<td>Automatic Transfer Switch Test Form</td>
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<tr>
<td>01650-20</td>
<td>Loop Wiring and Insulation Resistance Test Data Form</td>
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<td>01650-21</td>
<td>Panel Indicator Calibration Test Data Form</td>
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<td>01650-22</td>
<td>Field Switch Calibration Test Data Form</td>
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<td>Transmitter Calibration Test Data Form</td>
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<td>01650-24</td>
<td>Miscellaneous Instrument Calibration Test Data Form</td>
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<td>01650-25</td>
<td>Individual Loop Test Data Form</td>
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<tr>
<td>01650-26</td>
<td>Loop Commissioning Test Data Form</td>
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</table>
NOTE: This example equipment test report is provided for the benefit of the Contractor and is not specific to any piece of equipment to be installed as a part of this project. The example is furnished as a means of illustrating the level of detail required for the preparation of equipment test report forms for this project.

ORANGE COUNTY WATER DISTRICT
GROUNDWATER REPLENISHMENT SYSTEM
FINAL EXPANSION

ABC Construction Company, Inc., General Contractor
Orange County Water District, Engineer

EQUIPMENT TEST REPORT

Equipment Name: RO Transfer Pump AO3
Equipment Tag Number: 255-A03-PMP-0400
Specification Ref: 11140
Area Reference Code: 255
Area Description: RO Transfer Pump Station

PREOPERATIONAL CHECKLIST

Mechanical

Lubrication
Alignment
Anchor bolts
Seal water system operational
Equipment rotates freely
Safety guards
Valves operational
Hopper purge systems operational
Sedimentation tank/hopper clean
O&M manual information complete
Manufacturer's installation certificate complete

Contractor Verified Date

Engineer Verified Date
<table>
<thead>
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<th>Electrical</th>
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<tr>
<td>(circuit ring-out and functionality tests)</td>
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<td>Circuits:</td>
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<tr>
<td>Power to MCC</td>
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<tr>
<td>Control to HOA</td>
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<td>Indicators at MCC</td>
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<td>Indicators at local control panel</td>
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<td>Control station</td>
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<td>Control panel</td>
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<tr>
<td>Equipment bumped for rotation</td>
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<td>Piping Systems</td>
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<td>Temporary piping screens in place</td>
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<td>Instrumentation and Controls</td>
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<td>Flowmeter calibration</td>
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<td>Flow recorder calibrated against</td>
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<td>transmitter</td>
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<td>VFD speed indicator calibrated against</td>
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<td>independent reference</td>
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<td>Discharge overpressure shutdown switch</td>
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<tr>
<td>Simulate discharge overpressure</td>
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<td>Shutdown</td>
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### FUNCTIONAL TESTS

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### Remarks:

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### Electrical

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### OPERATIONAL TEST

48-hour continuous test. Pump cycles as specified, indicators functional, controls functional, pump maintains capacity, overpressure protection remains functional, hour meter functional

### RECOMMENDED FOR BENEFICIAL OCCUPANCY

__________________________________________________________

Engineer ____________________________ Date _____________

### ACCEPTED FOR BENEFICIAL OCCUPANCY

__________________________________________________________

District’s Representative ___________________________ Date _____________
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<td>13. Preventive maintenance plan and schedule</td>
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Remarks: __________________________________________________________________________

Contractor's Signature
## EQUIPMENT SUMMARY FORM:

1. **EQUIPMENT ITEM**

2. **MANUFACTURER**

3. **EQUIPMENT IDENTIFICATION NUMBER(S)**
   (maps equipment number)

4. **LOCATION OF EQUIPMENT**

5. **WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS)**

6. **NAMEPLATE DATA -**
   - Horsepower
   - Amperage
   - Voltage
   - Service Factor (S.F.)
   - Speed
   - ENC Type
   - Capacity
   - Other

7. **MANUFACTURER'S LOCAL REPRESENTATIVE**
   - Name
   - Address
   - Telephone Number

8. **MAINTENANCE REQUIREMENTS**

9. **LUBRICANT LIST**

10. **SPARE PARTS (recommendations)**

11. **COMMENTS**
### MECHANICAL INFORMATION

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<tr>
<th>Description</th>
<th>Asset Type</th>
<th>Loop Tag No.</th>
<th>Manufacturer</th>
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<th>Shaft Seal</th>
<th>Discharge Size</th>
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### Breaker

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### Starter

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MANUFACTURER’S INSTALLATION CERTIFICATION FORM:

Contract No: ______________________________ Speciﬁcation section: ______________________________

Equipment name: ____________________________________________________________________________

Contractor: ________________________________________________________________________________

Manufacturer of equipment item: __________________________________________________________________

The undersigned manufacturer of the equipment item described above hereby certifies that he has checked the installation of the equipment and that the equipment, as speciﬁed in the project manual, has been provided in accordance with the manufacturer’s recommendations, and that the trial operation of the equipment item has been satisfactory.

Comments: ____________________________________________________________________________________

______________________________________________________________________________________________

______________________________________________________________________________________________

______________________________________________________________________________________________

Date __________________________ Manufacturer

______________________________________________________________________________________________

Signature of Authorized Representative

Date __________________________ Contractor

______________________________________________________________________________________________

Signature of Authorized Representative
MANUFACTURER'S INSTRUCTION CERTIFICATION FORM:

Contract No: __________________________ Specification section: __________________________

Equipment name: ________________________________________________________________

Contractor: ____________________________________________________________________

Manufacturer of equipment item: __________________________________________________

The undersigned manufacturer certifies that a service engineer has instructed the water
treatment plant operating personnel in the proper maintenance and operation of the equipment
designated herein.

Operations Check List (check appropriate spaces)

Start-up procedure reviewed
Shutdown procedure reviewed
Normal operation procedure reviewed

Others: __________________________________________


Maintenance Check List (check appropriate spaces)

Described normal oil changes (frequency)
Described special tools required
Described normal items to be reviewed for wear
Described preventive maintenance instructions
Described greasing frequency

Others: __________________________________________


Date ____________________________ Manufacturer

________________________________ Signature of Authorized Representative

Date ____________________________ Signature of District's Representative

Date ____________________________ Signature of Contractor's Representative

Orange County Water District 01650A testing, startup and training form
Groundwater Replenishment System -12- February 2019
Final Expansion Issued for Bid
<table>
<thead>
<tr>
<th>(Job Title)</th>
</tr>
</thead>
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**CERTIFICATE OF UNIT RESPONSIBILITY**

for Specification Section ____________

__(Section title)__

In accordance with the contract documents, the undersigned manufacturer accepts unit responsibility for all components of equipment furnished under specification Section ____________. We hereby certify that these components are compatible and comprise a functional unit suitable for the specified performance and design requirements.

Notary Public

________________________

Name of Corporation

________________________

Commission expiration date

Address

________________________

By: __________________________

Duly Authorized Official

________________________

Legal Title of Official

________________________

Date: ________________________
01650-8        MOTOR DATA FORM:

Equipment Name________________________        Equipment No(s). __________

Site Location ___________________________

Nameplate Markings

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<th>Mfr Model</th>
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FLA _______ LRA _______ Freq _______ Amb temp rating _______ degrees C

Time rating ____________________________ Design letter ______________________

(NEMA MG1-10.35) (NEMA MG-1.16)

KVA code letter ___________ Insulation class ___________

The following information is required for explosion proof motors only:

A. Approved by UL for installation in Class _____, Div _______

B. UL frame temperature code ______; Group _______ Atmosphere
   (NEC Tables 500-2 and 500-2(b))

The following information is required for all motors 1/2 horsepower and larger:

A. Guaranteed minimum efficiency _______________________________

B. Nameplate or nominal efficiency _______________________________

Data Not Necessarily Marked on Nameplate

Type of enclosure __________________________ Enclosure material _______________

Temp rise __________________________ degrees C (NEMA MG1-12.41,42)

Space heater included? _______ Yes _______ No; if Yes, _______ watts _______ volts

Type of motor winding over temperature protection, if specified: ______________________

Use the space below to provide additional information on other motor modifications, if specified:

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________
<table>
<thead>
<tr>
<th>Location of Test</th>
<th>Insulation resistance, megohms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td></td>
</tr>
</tbody>
</table>

CERTIFIED ______________________________ Date_________________________

Contractor's Representative

WITNESSED ______________________________ Date_________________________

District’s Representative
01650-10  INSTALLED MOTOR TEST FORM:

Motor Equipment Number ______________________ Date of test ________________
Equipment Driven ____________________________
MCC Location ________________________________ Ambient temp _______ °F

Resistance:
  Insulation resistance phase-to-ground megohms:
    Phase A ____,   Phase B ____.,  Phase C ____

Current at Full Load:
  Phase ________________  Current, amps ________________
  Phase ________________  Current, amps ________________
  Phase ________________  Current, amps ________________

Thermal Overload Device: Manufacturer/catalog # ________________  Amperes _____

Circuit breaker (MCP) setting: ________________________________

Motor Nameplate Markings:
  Mfr __________________ Mfr type  __________  Frame ______
  HP ______
    Volts ______  Phase ______  RPM ______ **Service factor ______
    Amps ______  Freq _________  Ambient temp rating __________ °C
    Time rating ________________  **Design letter (NEMA 1-10.35)
      (NEMA MG-1.16)
    Code letter ________________  Insulation class ________________

**Required for 3-phase squirrel cage induction motors only.

CERTIFIED ______________________________________  Date____________________
  Contractor's Representative

WITNESSED ______________________________________  Date____________________
  District's Representative
01650-11  DRY TRANSFORMER TEST DATA FORM:

Equipment No. ______________________________ Temperature __________________
Location ________________________________
Winding: Primary __________________________ Secondary __________________

A. INSULATION-RESISTANCE TEST:

The test shall be made with a megohmmeter at the test voltage for a period of 1 minute.

<table>
<thead>
<tr>
<th>Voltage rating</th>
<th>Test voltage</th>
<th>Phase</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-600</td>
<td>1000</td>
<td>A-GRD</td>
<td>A-B</td>
</tr>
<tr>
<td>601-5000</td>
<td>2500</td>
<td>B-GRD</td>
<td>B-C</td>
</tr>
<tr>
<td>5000+</td>
<td>5000</td>
<td>C-GRD</td>
<td>C-A</td>
</tr>
</tbody>
</table>

Test results (megohms)

Resistance readings less than the manufacturer’s recommended value or less than 10 megohms shall be brought to the attention of the Engineer.

B. DIELECTRIC-ABSORPTION TEST:

The test shall be made with a megohmmeter at the test voltage for a period of 10 minutes.

1. TEST RESULTS: (megohms)
<table>
<thead>
<tr>
<th>Phase</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-GRD</td>
<td>A-B</td>
</tr>
<tr>
<td>B-GRD</td>
<td>B-C</td>
</tr>
<tr>
<td>C-GRD</td>
<td>C-A</td>
</tr>
</tbody>
</table>

2. POLARIZATION INDEX:

\[ \frac{10 \text{ minute reading}}{1 \text{ minute reading}} = \text{polarization index} \]

Polarization index values less than 2 shall be brought to the attention of the Engineer.

CERTIFIED ______________________________ Date __________________
Contractor’s Representative

WITNESSED ______________________________ Date __________________
District’s Representative
01650-12 MOTOR CONTROL CENTER TEST FORM:

Equipment No. ___________________________ Ambient room temperature _______________________
Location ________________________________________________________________________________

A. MECHANICAL CHECK:

All bolted connections either bus to bus or cable to bus shall be torqued to the manufacturer’s recommendations.

B. ELECTRICAL TESTS:

1. Measure insulation resistance of each bus section phase to phase and phase to ground for one minute using a megohmmeter at 1000 volts.

   Test results (megohms)

<table>
<thead>
<tr>
<th>Phase</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-GRD</td>
<td>A-B</td>
</tr>
<tr>
<td>B-GRD</td>
<td>B-C</td>
</tr>
<tr>
<td>C-GRD</td>
<td>C-A</td>
</tr>
</tbody>
</table>

2. Set the circuit breaker in the starter unit to comply with the requirements of NEC, Article 430-52 and Table 430-152.

3. Motor overload heater elements shall be sized and installed based on the actual nameplate full load amperes of the motor connected to the starter.

CERTIFIED ___________________________ Date________________________
Contractor’s Representative

WITNESSED ___________________________ Date________________________
District’s Representative
The protective devices shall be set in accordance with the specification before the tests are performed.

1. Measure contact resistance (micro-ohms)
   Phase: A   B   C
   Contacts shall be replaced if resistance exceeds 50 micro-ohms.

2. Perform an insulation resistance test (1000 volts DC for 1 minute).
   Phase   A   B   C
   Pole to ground  _ _ _ megohms
   Across open pole _ _ _ megohms
   Pole to pole     AB______ BC______ CA______ megohms

3. Perform minimum pickup voltage tests on trip and close coils.

4. Motor RTDs shall be tested by using a hot oil bath. The temperature at which the sensor trips shall be recorded for each RTD.

5. The Contactor shall be tripped by operation of each protective device.
The protective devices shall be set in accordance with the specification before the tests are performed.

1. Measure contact resistance (micro-ohms)
   
   Phase: A __ B __ C _____

   Contacts shall be replaced if resistance exceeds 50 micro-ohms.

2. Perform an insulation resistance test (1000 volts DC for 1 minute).

<table>
<thead>
<tr>
<th>Phase</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
</table>
   | Pole to ground | _ | _ | _ | megohms
   | Across open pole| _ | _ | _ | megohms
   | Pole to pole   | AB | BC | CA | megohms

3. Perform minimum pickup voltage tests on trip and close coils.

4. Verify the instrument transformer ratios. Check the transformer's polarity electrically.

5. The Contractor shall be tripped by operation of each protective device.
01650-15       PROTECTIVE RELAY TEST FORM:

Location ________________________________________________________________

Switchgear Breaker No. __________________________________________________

Protective Relay Description _____________________________________________

The protective relays shall be tested in the following manner:

1. Each protective relay circuit shall have its insulation resistance tested to ground.

2. Perform the following tests on the specified relay setting:
   a. Pickup parameters on each operating element.
   b. Timing test shall be performed at three points on the time dial curve.
   c. Pickup target and seal-in units.

The results shall be recorded and signed. A copy shall be given to the Engineer in accordance with Paragraph 16010-1.05 B.
01650-16   LOW VOLTAGE SWITCHGEAR TEST FORM:

Equipment No. ____________________________________________________________________________

Location _________________________________________________________________________________

Room Temperature __________________________________________________________________________

The protective devices shall be set in accordance with the specification before the tests are performed.

1. Measure contact resistance (micro-ohms)

   Phase: A____ B____ C____

   Contacts shall be replaced if resistance exceeds 50 micro-ohms.

2. Perform an insulation resistance test (1000 volts DC for 1 minute).

   Phase
   Pole to ground __    __    __ megohms
   Across open pole   _     _     _ megohms
   Pole to pole      AB    BC    CA     _ megohms

3. Minimum pickup current shall be determined by primary current injection.

4. Long time delay shall be determined by primary injection at three hundred percent (300%) pickup current.

5. Short time pickup and time delay shall be determined by primary injection of current.

6. Instantaneous pickup current shall be determined by primary injection.

7. Trip unit reset characteristics shall be verified.

8. Auxiliary protective devices, such as ground fault or under voltage relays, shall be activated to ensure operation of shunt trip devices.
01650-17  MEDIUM VOLTAGE LOAD INTERRUPTER SWITCH TEST FORM:

Equipment Number ________________________________________________________________

Location __________________________________________________________________________

Date __________________________________________________________________________

1. Measure switch blade resistance (micro-ohms).
   Phase: A____ B____ C_____

Contacts shall be replaced if resistance exceeds 50 micro-ohms.

2. Perform an insulation resistance test (1000 volts DC for 1 minute).

<table>
<thead>
<tr>
<th>Phase</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pole to ground</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Across open pole</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pole to pole</td>
<td>AB</td>
<td>BC</td>
<td>CA</td>
</tr>
</tbody>
</table>

megohms

The results shall be recorded and signed. A copy shall be given to the Engineer in accordance with Paragraph 16010-2.06 B.

CERTIFIED _____________________________ Date____________________

Contractor’s Representative

WITNESSED ____________________________ Date____________________

District’s Representative
01650-18  LIQUID-FILLED TRANSFORMER TEST FORM:

Equipment Number  

Location  

Date/Weather Conditions  

A. Perform the "Insulation-Resistance Test" and "Dielectric Absorption Test" using Form 01650-11, Dry Transformer Test Data Form.

B. Perform an applied voltage (low frequency dielectric) test in accordance with ANSI C57.12.90, paragraph 10.5, Applied Voltage Test. Applied voltage levels shall be 75 percent of recommended factory test levels or recommended test levels of ANSI C57.12.00, Table 5.

C. Insulating oil shall be sampled and shall be laboratory tested for the following:
   1.  Dielectric strength.
   2.  Acid neutralization.
   3.  Interfacial tension.
   5.  Power factor.

D. Perform a turns ratio test between the windings for all tap positions.

E. The temperature and pressure switches shall be tested using a hot oil bath and air pump.

The results shall be recorded and signed by the Contractor and Engineer. Any readings which are abnormal to ANSI industry standards shall be reported to the Engineer.
01650-19 AUTOMATIC TRANSFER SWITCH TEST FORM:

Equipment Number ____________________________________________

Location _____________________________________________________

Date _________________________________________________________

1. Perform an insulation resistance test (1000 volts DC for 1 minute):

   Phase
   A     B     C
   Pole to ground ___ ___ ___ megohms
   Pole to pole  AB_ BC_ CA_ megohms

2. Perform the following operations and initial:

   a. Manual transfer ________________

   b. Loss of normal power; ____ sec delay

   c. Return to normal power; ____ sec delay

The results shall be recorded and signed. A copy shall be given to the Engineer in accordance with Paragraph 16010-2.06 B.

CERTIFIED ________________________________ Date_______________________

            Contractor’s Representative

WITNESSED ________________________________ Date_______________________

            District’s Representative
Loop No:

List all wiring associated with a loop in table below. Make applicable measurements as indicated after disconnecting wiring.

<table>
<thead>
<tr>
<th>Wire No.</th>
<th>Panel Tie</th>
<th>Field TB</th>
<th>Continuity Resistancea</th>
<th>Insulation Resistanceb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cond. / Cond. / Shield / Shield Conductor / Cond. / Gnd. / Cond. / Gnd. / Shield</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>--</td>
<td>(A/SH)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>(A/B)</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>(A/C)</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>(A/D)</td>
<td>--</td>
<td></td>
<td></td>
</tr>
<tr>
<td>etc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. **Continuity Test.** Connect ohmmeter leads between wires A and B and jumper opposite ends together. Record resistance in table. Repeat procedure between A and C, A and D, etc. Any deviation of +2 ohms between any reading and the average of a particular run indicates a poor conductor, and corrective action shall be taken before continuing with the loop test.

b. **Insulation Test.** Connect one end of a 500 volt megger to the panel ground bus and the other sequentially to each completely disconnected wire and shield. Test the insulation resistance and record each reading.

CERTIFIED_________________________________________ Date________________________

Contractor’s Representative

WITNESSED_________________________________________ Date________________________

District’s Representative
01650-21  PANEL INDICATOR CALIBRATION TEST DATA FORM:

Tag No. and Description: 

Make and Model No.: Serial No.: 

Input: 

Scale: Range: 

PV Scale Calibration

<table>
<thead>
<tr>
<th>% of Range</th>
<th>Input</th>
<th>Expected Reading</th>
<th>Actual Reading</th>
<th>% Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

% Deviation Allowed: 

CERTIFIED ____________________________ Date ____________________________

Contractor’s Representative

WITNESSED ____________________________ Date ____________________________

District’s Representative

Orange County Water District
Groundwater Replenishment System
Final Expansion
**FIELD SWITCH CALIBRATION TEST DATA FORM:**

Tag No. and Description: ____________________________

Make and Model No.: ____________________________ Serial No.: ____________________________

Input: ____________________________

Range: ____________________________

Set Point (s): ____________________________

Simulate process variable (flow, pressure, temperature, etc.) and set desired set point(s). Run through entire range of switch and calculate deadband.

<table>
<thead>
<tr>
<th>Set Point</th>
<th>Incr. Input Trip Point</th>
<th>Decr. Input Trip Point</th>
<th>Calc. Deadband</th>
<th>Required Deadband</th>
</tr>
</thead>
</table>

CERTIFIED ____________________________ Date ____________________________

Contractor’s Representative

WITNESSED ____________________________ Date ____________________________

District’s Representative
TRANSMITTER CALIBRATION TEST DATA FORM:

Tag No. and Description: ____________________________________________________________

Make and Model No.: ___________________________ Serial No.: _______________________

Input: __________________________________________________________

Output: __________________________________________________________

Range: ___________________________ Scale: _________________________

Simulate process variable (flow, pressure, temperature, etc.) and measure output with appropriate meter.

<table>
<thead>
<tr>
<th>% of Range</th>
<th>Input</th>
<th>Expected Output</th>
<th>Actual Output</th>
<th>% Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

% Deviation Allowed: ____________________________________________

CERTIFIED ___________________________ Date________________________

Contractor’s Representative

WITNESSED ___________________________ Date________________________

District’s Representative
(For instruments not covered by any of the preceding test forms, the Contractor shall create a form containing all necessary information and calibration procedures).
01650-25  INDIVIDUAL LOOP TEST DATA FORM:

Loop No.: ________________________________

Description: (Give complete description of loop's function using tag numbers where appropriate.)

P&ID No.: (Attach copy of P&ID.)

   a. Wiring tested:
      (Attach test form 01650-20)
   b. Instrumentation tubing/piping tested:
   c. Instruments calibrated:
      (Attach test forms 01650-20 through 24)
   d. List step-by-step procedures for testing loop parameters. Test loop with instruments, including transmitters and control valves, connected and functioning. If it is not possible to produce a real process variable, then a simulated signal may be used with the Construction Manager's approval.

CERTIFIED ________________________________ Date__________________
   Contractor's Representative

WITNESSED ________________________________ Date__________________
   District's Representative
01650-26 LOOP COMMISSIONING TEST DATA FORM:

Loop No.: ________________________________

a. Loop tested:
   (Attach test form 01650-25)

b. Controlled or connected equipment tests confirmed:

c. Give complete description of loop’s interface with process.

d. With associated equipment and process in operation, provide annotated chart trace of loop response to changes in set points for verification of performance. This chart should demonstrate 1/4-amplitude damping as output adjusts to set point change. Show set points, starting and finishing times on chart, as well as any other pertinent data.

   Connect 2-pen recorder to process variable (PV) and to controller output. Use inch/second chart speed.

   Pen 1 - PV - Connections:

   Pen 2 - Output - Connections:

CERTIFIED ________________________________ Date____________________
   Contractor’s Representative

WITNESSED ________________________________ Date____________________
   District’s Representative
1-1. GENERAL-EQUIPMENT START-UP. After all acceptance tests have been completed by the Contractor, but prior to final acceptance, the Contractor shall recheck all equipment for proper alignment and adjustment, check oil levels, re-lubricate all bearing and wearing points, and, in general, assure that all equipment is in proper condition for regular continuous operation.

Section includes: Contract closeout requirements including:

1. Final cleaning.
2. Preparation and submittal of closeout documents.
3. Final completion certification.

1-2. FINAL CLEANING.

1-2.01. Final Clean Up. Before final inspection of the Work, the Contractor shall promptly remove from the vicinity of the completed work, all rubbish, trash, unused materials, concrete forms, construction equipment, tools, and temporary structures and facilities used during construction. All surrounding site areas, including the temporary construction trailer, equipment and material storage areas shall be restored to their original state, including grading as required. All parts of the Work shall be left in a neat and presentable condition.

Contractor shall provide for a professional cleaning service to clean, dust, sanitize as necessary, and provide a mop or vacuum clean condition for the complete project and in particular in all offices, control rooms, restrooms, laboratory, shop processes areas, and any other enclosed area subject to daily or periodic personnel use and shall complete this cleaning service no later than the commencement of the acceptance testing.

Contractor shall provide for weekly professional cleaning services after initial cleaning and sanitizing for the complete project and in particular in all offices, control rooms, restrooms, laboratory, shop, process areas and any other enclosed area subject to daily or periodic personnel use and maintain the weekly cleaning service from commencement of Acceptance Testing until issuance of Project Completion.

1-2.02. Final Building Clean Up. On all building projects and wherever else applicable, besides general broom cleaning, the following special cleaning shall be performed at completion of the Work:
A. Perform final cleaning prior to inspections for Final Acceptance.

B. Employ skilled workers who are experienced in cleaning operations.

C. Use cleaning materials which are recommended by manufacturers of surfaces to be cleaned.

D. Prevent scratching, discoloring, and otherwise damaging surfaces being cleaned.

E. Clean roofs, gutters, downspouts, and drainage systems.

F. Broom clean exterior paved surfaces and rake clean other surfaces of sitework.

G. Remove dust, cobwebs, and traces of insects and dirt.

H. Clean grease, mastic, adhesives, dust, dirt, stains, fingerprints, paint, blemishes, sealants, plaster, concrete, and other foreign materials from sight-exposed surfaces, and fixtures and equipment.

I. Remove non-permanent protection and labels.

J. Polish waxed woodwork and finish hardware.

K. Wash tile.

L. Wax and buff hard floors, as applicable.

M. Wash and polish glass, inside and outside.

N. Wash and shine mirrors.

O. Polish glossy surfaces to clear shine.

P. Vacuum carpeted and soft surfaces.

Q. Clean permanent filters and replace disposable filters when heating, ventilation, and air conditioning units were operated during construction.

R. Clean ducts, blowers and coils when units were operated without filters during construction.

S. Clean light fixtures and replace burned-out or dim lamps.
1-3. WASTE DISPOSAL.

A. Arrange for and dispose of surplus materials, waste products, and debris off-site.

Prior to making disposal on private property, obtain written permission from Owner of such property.

B. Do not fill ditches, washes, or drainage ways which may create drainage problems.

C. Do not create unsightly or unsanitary nuisances during disposal operations.

D. Maintain disposal site in safe condition and good appearance.

E. Complete leveling and cleanup prior to final acceptance of the Work.

1-4. TOUCH-UP AND REPAIR.

A. Touch-up or repair finished surfaces on structures, equipment, fixtures, and installations that have been damaged prior to inspection for Final Acceptance.

B. Refinish or replace entire surfaces which cannot be touched-up or repaired satisfactorily.

1-5. CLOSEOUT DOCUMENTS.

A. Submit following Closeout Submittals upon Completion and at least seven (7) days prior to submitting Application for Final Payment:

1. Evidence of Compliance with Requirements of Governing Authorities.
2. Project Record Documents.
3. Operation and Maintenance Manuals.
4. Warranties and Bonds.
5. Electronic version of all approved project submittals in pdf form.
7. Evidence of Payment and Release of Liens and Stop Payment Notices as outlined in Conditions of the Contract.
9. Survey Record Documents as specified in the Field Engineering section.
10. Certificate of Final Completion.

1-6. PROJECT RECORD DOCUMENTS.

A. Maintain at Project site, available to Owner, Construction Manager, and Engineer, one (1) copy of the Contract Documents, shop drawings and other submittals, in good order.

1. Mark and record field changes and detailed information contained in submittals and change orders.

2. Record actual depths, horizontal and vertical location of underground pipes, duct banks and other buried utilities. Reference dimensions to permanent surface features.

3. Identify specific details of pipe connections, location of existing buried features located during excavation, and the final locations of piping, equipment, electrical conduits, manholes, and pull boxes.

4. Identify location of spare conduits including beginning, ending and routing through pull boxes, and manholes. Record spare conductors, including number and size, within spare conduits, and filled conduits.

5. Provide schedules, lists, layout drawings, and wiring diagrams inclusive of any applicable Contractor derived CAD drawings pertinent to equipment installation.

6. Make annotations with erasable colored pencil conforming to the following color code:

| Additions: | Red          |
| Deletions: | Green        |
| Comments   | Blue         |
| Dimensions:| Graphite     |

B. Maintain documents separate from those used for construction.

1. Label documents "RECORD DOCUMENTS".

C. Keep documents current.

1. Record required information at the time the material and equipment is installed and before permanently concealing.

D. Deliver record documents with transmittal letter containing date, Project title, Contractor's name and address, list of documents, and signature of Contractor.
E. Record documents shall be available for the Engineer to review to ascertain that changes have been recorded. Engineer shall review Contractor’s record documents on a monthly basis to determine that documents have been updated.

F. Failure of the Contractor to keep current with the updating of the Record Documents shall be grounds for withholding monies from partial payment estimates.

Requests for partial payments will not be approved if the record drawings are not kept current, and not until the completed record drawings, showing all variations between the Work as actually constructed and as originally shown on the Contract Drawings or other Contract Documents, have been inspected by the Owner.

Final payment will not be approved until the Contractor-prepared record drawings have been delivered to the Owner. Said up-to-date record drawings may be in the form of a set of prints with carefully plotted information overlaid in pencil.

Upon substantial completion of the Work and prior to final acceptance, the Contractor shall complete and deliver a complete set of record drawings to the Owner conforming to the construction records of the Contractor. This set of drawings shall consist of corrected plans showing the reported location of the Work. The information submitted by the Contractor and incorporated into the Record Drawings will be assumed to be reliable, and the Owner will not be responsible for the accuracy of such information, nor for any errors or omissions which may appear on the Record Drawings as a result.

The Contractor within 30 days after Notice of Substantial Completion date, shall submit the following items in the form of a Final Project Report to the Engineer:

1. A final updated master schedule indicating actual completion date, schedule of values and cash flow curves.
2. Written warranties, guarantees and information for each mechanical, electrical, process equipment, architectural and other materials, products or equipment specified in the contract documents.
3. Operations and Maintenance Manuals, both in hard copy and electronic form.
4. Certificate of Completion for each component of the Project.
5. New permanent cylinders and key blanks for all locks.
6. Maintenance stock items: spare parts; special tools and record of missing items.
7. Final completed and verified record drawings in both hard copy format and electronic PDF format. Contractor shall refer to the Submittals section for the record drawing electronic PDF format requirements.

8. Final photographs and all progress photographs in both electronic and hard copy formats. Hard copies shall be included in photo-album binders.

9. Warranties, Guarantees or Bonds that cover the warranty period of each contract such as for roofing, landscape maintenance, etc., as required.

10. Certificates of inspection and acceptance by local governing agencies having jurisdiction.

11. Affidavit of Release of Liens – Releases from all parties who are entitled to claims against the subject project property, or improvement pursuant to the provisions of law.


14. Affidavit of Payment of All Taxes.

15. Affidavit of Payment.


17. Contractor’s Certification of Completion.

18. Final completed punchlist.

19. Electronic version of all approved project submittals in pdf format.

1-6.01. GUARANTEE. The Contractor shall provide a one-year guarantee per the General Provisions “GUARANTEES” Section. Contractor shall submit a complete binder containing copies of all specified warranties and bonds per the Product Warranties and Bonds section.

Prior to the expiration of the Guarantee period, the Owner reserves the right to hold a meeting and require the attendance of the Contractor. The purpose of the meeting is to review warranties, bonds, and maintenance requirements, and determine required repair or replacement of defective items.

End of Section
Section 01788

PRODUCT WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 SECTION INCLUDES.
   A. Compile specified warranties and bonds.
   B. Compile specified service and maintenance contracts.
   C. Co-execute submittals when so specified.
   D. Review submittals to verify compliance with Contract Documents.
   E. Submit to Engineer for review and transmittal to Owner.
   F. Schedule of submittals.

1.02 SUBMITTAL REQUIREMENTS.
   A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers and subcontractors.
   B. Number of Original Signed Copies Required: Two each.
   C. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item:
      1. Product or work item.
      2. Firm, with name of principal, address and telephone number.
      4. Date of beginning of warranty, bond or service maintenance contract.
      5. Duration of warranty, bond or service maintenance contract.
      6. Provide information for Owner's personnel:
         a. Proper procedure in case of failure.
         b. Instances which might affect the validity of warranty or bond.
      7. Contractor, name of responsible principal, address and telephone number.
1.03 FORM OF SUBMITTALS.

A. Prepare in duplicate packets.

B. Format:
   1. Size 8-1/2 by 11 inch.
   2. Punch sheets for standard ring binder.
   3. Fold larger sheets to fit into binders.
   4. Cover:
      a. Identify each packet with typed or printed title "WARRANTIES AND BONDS".
      b. List the following:
         1) Title of Project.
         2) Name of Contractor.

C. Binders: Commercial quality, three-ring, 2 inch with durable and cleanable plastic covers, white.

1.04 TIME OF SUBMITTALS.

A. Make submittals within 10 days after Date of Substantial Completion, prior to final request for payment.

B. For items of Work, where acceptance is delayed materially beyond Date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.

C. For items of Work, where equipment is available to be placed into service for Owner’s beneficial occupancy prior to Substantial Completion, Owner may, in writing accept beneficial occupancy prior to use of equipment. Within 10 days after this acceptance of beneficial use, Contractor shall supply Owner with an interim submittal of the warranties, bonds, and service and maintenance contracts as specified herein. This interim information shall again be included in the final submittal required after Substantial Completion regardless of the warranty start and end dates.

1.05 SCHEDULE OF SUBMITTALS.

A. Submit warranties, bonds and service and maintenance contracts as specified in individual sections.
PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers the demolition of existing structures, piping, equipment, and the salvage of existing materials and equipment as indicated on the Drawings and as specified herein. Miscellaneous demolition at other locations on the Project is also covered by this section. Miscellaneous locations include, but are not limited to the following:

   a. MF Facility
   b. RO Building
   c. Lime Building Polymer System
   d. Entrance Gate Area
   e. Plant 2 Stormwater Pump Station

1-2. GENERAL. Contractor shall be responsible for all work under this section.

All existing process pipelines, potable water, gas, sewer, and other utility services to be demolished shall be located by the Contractor and capped upstream of any demolition work. Electrical cable to be demolished shall be removed and terminated as shown on the Drawings. Demolition and salvage work shall create minimum interference with Owner's and OCSD's operations and minimum inconvenience to Owner. Care shall be taken to ensure that contamination does not occur on the site.

It is the responsibility of the Contractor to remove and dispose of all material, equipment, electrical devices, etc., taken from the existing construction during the demolition unless directed otherwise by the Engineer. All disposal shall be done in accordance with federal, state, and local laws governing waste disposal.

Storage of demolition debris shall not be stockpiled in any area of the site other than the location where demolition occurs.

Any excavation done as part of the demolition shall be limited to no more than 2 feet beyond the structure exterior that is to be demolished. Contractor shall be responsible for the design, permits, and work plan for any excavation and demolition that requires temporary shoring. All excavation work shall comply with all federal, state and local laws and regulations. Refer to California's Trenching and Shoring Manual for acceptable practices and methods. All excavation adjacent to existing structures shall be adequately designed and installed to protect the existing structure from damage caused from settlements, soil movement, or any loads associated with the demolition work. Contractor shall
submit any temporary shoring plans to Engineer for review prior to the start of excavations.

The perimeter of excavations shall be protected with sand bags or other acceptable method to prevent runoff surface water from entering the excavated area. A sump shall be provided at one corner of the excavation and the bottom surface sloped towards the sump.

Blasting will not be permitted.

Refer to Earthwork Section for restoration of area after demolition.

1-3. **COORDINATION.** Contractor shall plan, schedule, and coordinate its operations in a manner which will facilitate minimum disruption to the existing structures, operation of OCWD’s Advanced Water Purification Facility (AWPF) and OCSD’s Plant No. 1 and 2, and surrounding environment (i.e. residences, etc.). The Contractor shall also coordinate demolition so that the work is performed in a safe, logical sequence to expedite the overall completion of the demolition.

1-4. **LEAD AND ASBESTOS REQUIREMENTS AND OTHER HAZARDOUS MATERIALS.** Contractor shall be responsible for effective identification, abatement, packaging, storage, and disposal of materials to be impacted by the demolition and/or construction requirements including compliance with all federal, state, and local standards. Contractors performing any abatement work shall be qualified and properly licensed and insured for asbestos and lead abatement, and staff such work only with workers properly trained, certified, and under medical surveillance as required to perform such work.

1-4.01. **Asbestos Removal.** No asbestos removal is anticipated on the project. Contractor shall take necessary precautions to handle asbestos-containing materials.

Contractor shall notify SCAQMD and fill out and submit a copy of the asbestos demolition notification form prior to any demolition work as described in the Regulatory Requirements and Permits section.

1-4.02. **Lead Removal.** Per Cal-OSHA, Section 1532.1 in Title 8 of the CCR Contractor shall be responsible for basic steps in recognizing lead in construction. Contractor shall conform to Section 36100, Title 17 of the CCR, which covers lead abatement as part of the demolition work.

A Safety and Health Fact Sheet regarding lead is available from Cal-OSHA as described in the Regulatory Requirements and Permits section.

Regarding abatement of lead-containing building materials and paint, Contractor shall remove lead-containing paint from metal surfaces that would be potentially...
impacted by cutting, grinding, or other hot-work, prior to those activities. Scope of lead-paint removal will be determined by the Contractor but shall be of sufficient quantity to prevent the burning or oxidation of lead-containing paint or coatings.

PART 2 - PRODUCTS

2-1. MATERIALS. Not used.

PART 3 - EXECUTION

3-1. DEMOLITION. The Contractor shall assume full responsibility for any and all damages to existing buildings, facilities, and utilities not to be demolished. Contractor shall take any necessary photographs of existing construction to verify existing conditions and shall file a report with the Engineer listing any existing damaged construction before the work is started.

The Contractor shall protect and maintain duct banks, conduits, drains, sewers, pipes and wires that are to remain on the property.

3-1.01. Demolition. The following structures, piping, and equipment shall be demolished, and the debris shall be removed from the jobsite unless specifically required to be salvaged.

MF Facility: Refer to demolition drawings for paving and structure demolition requirements, and mechanical drawings for equipment demolition.

RO Building: Refer to demolition, structural, architectural, and mechanical drawings for demolition requirements.

Lime Building Polymer System: Refer to demolition and mechanical drawings for demolition requirements and Section 01140 Work Restrictions. This demolition will occur during the first of two phases.

Entrance Gate Area: Refer to demolition, structural, and architectural drawings for demolition requirements.

Plant 2 Pipelines and Utilities: Refer to area 144 yard drawings for demolition requirements. A 48-inch RCP, 6-inch digester gas pipe, 4-inch natural gas pipe, and communication conduits are abandoned and shall be removed and disposed of as required for installation of the new work. Although the alignments of each vary, in general, these abandoned pipeline and utilities are located parallel and just west of the existing 120-inch interplant pipeline from the north plant boundary to the Ocean Outfall Booster Pump Station. The Contractor shall assume and
include in the Bid Amount removal and disposal of these pipelines and utilities along the entire work area.

3-1.03. Electrical Equipment Demolition. The following electrical equipment shall be removed and shall become the property of Contractor. All such items shall be promptly removed from the jobsite.

RO Building Electrical: Refer to demolition and electrical drawings for electrical equipment demolition instructions.

3-1.04. Sitework Demolition. Sitework demolition shall include the following as shown on the Demolition Drawings:

- Removal of reinforced concrete drives, pavement, sidewalks, curbs, and slabs on grade within the limits indicated on the Drawings.
- Removal of asphaltic concrete pavement within the limits indicated on the Drawings.
- Removal of existing power and telephone poles.
- Removal of existing yard piping within the limits indicated on the Drawings. All 6 inch and larger yard piping indicated to be abandoned shall be plugged with concrete.

3-2. SALVAGE.

3-2.01. Items to Be Salvaged by Owner. Owner will perform some salvage work. Contractor shall coordinate its operations with Owner to facilitate the work and to avoid damage to items to be salvaged by Owner. Items that will be salvaged by Owner shall be as follows:

3-2.02. Items to Be Salvaged by Contractor. Removed and salvaged equipment or facilities shall include removal and salvage of all accessories, piping, wiring, supports, associated electrical starters and devices, baseplates and frames, and all other appurtenances, unless otherwise directed.

Existing materials and equipment removed, and not reused as a part of the work, shall become Contractor’s property unless otherwise specified, and shall be removed from the jobsite.

The following items shall remain Owner's property and shall be delivered to Owner by Contractor in good condition at the delivery points indicated:

<table>
<thead>
<tr>
<th>Item</th>
<th>Location</th>
<th>Delivery Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERD VFDs</td>
<td>RO Electrical Room</td>
<td>Annex Building</td>
</tr>
</tbody>
</table>
Contractor shall carefully remove, in a manner to prevent damage, all materials and equipment specified herein or indicated to be salvaged and to remain the property of Owner. Contractor shall store and protect salvaged items specified or indicated to be reused in the work. Any items damaged in removal, storage, or handling through carelessness or improper procedures shall be replaced by Contractor in kind or with new items.

Contractor may, at his option, furnish and install new items instead of those specified or indicated to be salvaged and reused, in which case such removed items will become Contractor’s property.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers dewatering and shall consist of the design, furnishing, installation, operation, maintenance, monitoring, reporting, and removal of a dewatering system(s) to achieve proper completion of all work performed on OCWD property. The Contractor shall secure all necessary permits to complete the requirements of this Section of the Specifications. The Contractor shall perform the dewatering in accordance with the Stormwater Pollution Prevention Plan (SWPPP) as described in the Regulatory Requirements and Permits and the Temporary Facilities sections.

Groundwater was encountered at depths that ranged from about 11 to 12 feet below ground surface. However, based on previous geotechnical reports, the groundwater level has been measured as high as 5 feet below ground surface. At a minimum, the Contractor shall assume the groundwater level to be at 5 feet below ground surface for the design of the dewatering system. See Geotechnical Reports.

The Contractor shall include in the dewatering system design for the additional flow entering the MF Facility excavation from the gravel base beneath the existing MF structure and from the gravel base beneath the 60-inch MFF pipeline. The Contractor shall assume an additional 100 gpm from beneath the MF structure and 100 gpm from the pipeline gravel base.

1-2. GENERAL REQUIREMENTS. The Contractor shall furnish, install, operate, and remove any and all additional machinery, appliances, and equipment necessary to keep excavations free from water during construction, and shall dewater and dispose of the water so as not to cause injury to public or private property, or to cause nuisance or a menace to the public. The Contractor must plan the dewatering and excavation sequence carefully so that stable and dry excavations are maintained throughout the construction sequence.

1-3. SUBMITTALS. Prior to commencement of excavation, the Contractor shall submit a detailed plan and operation schedule for dewatering of excavations. The plan shall be coordinated with and be in accordance with the SWPPP, as described in the Regulatory Requirements and Permits and the Temporary Facilities sections. The Contractor may be required to demonstrate the system proposed will satisfy the requirements specified herein and to verify that adequate equipment, personnel, and materials are provided to dewater the excavations at all locations and times. The Contractor’s dewatering plan is subject to review by the Engineer.
The plan shall include anticipated dewatering flow rates and a means for monitoring actual flow rates during construction. The plan shall also describe the disposal of water from construction dewatering into nearby drainages or the storm drain system. Contractor shall be responsible for obtaining permits required to discharge water into nearby sanitary sewer facilities. Contractor shall provide a plan for abandoning the groundwater monitoring wells at the completion of construction work, unless otherwise directed by the Engineer. A plan for treating, stabilizing, and disposing of chemically affected groundwater shall also be provided.

1-4. QUALITY CONTROL. It shall be the sole responsibility of the Contractor to control the rate and effect of the dewatering in such a manner as to avoid all objectionable settlement and subsidence.

All dewatering operations shall be the responsibility of the Contractor and shall be adequate to assure the integrity of the finished project.

Contractor shall establish reference points where critical structures or facilities exist immediately adjacent to areas of proposed dewatering. Reference points shall be observed at frequent intervals to detect any settlement which may develop. The responsibility for conducting the dewatering operation in a manner which will protect adjacent structures and facilities rests solely with the Contractor. The cost of repairing any damage to adjacent structures and restoration of facilities shall be the responsibility of the Contractor.

The Contractor shall monitor and record all dewatering pump rates and volumes. Dewatering equipment shall be equipped with meters and totalizers or similar equipment acceptable to the Engineer, to adequately measure the instantaneous and total flow from the equipment. Initial dewatering volumes and averaged rates shall be recorded at least once every 6 hours until the pumping has reached a uniform flow. Subsequent pumping volumes and averaged rates shall be recorded at least twice a day, once at the beginning of the work shift and once at the end of the work shift. A certified record of all pumping rates and volumes shall be provided to the Engineer on a weekly basis.

1-5. EQUIPMENT. Dewatering, where required, may include the use of well points, sump pumps, temporary pipelines for water disposal, rock or gravel placement, ditches, drainage trenches, and other means. Standby pumping equipment shall be maintained on the job site.

PART 2 - PRODUCTS. NOT USED.
PART 3 - EXECUTION

3-1. DEWATERING. Dewatering for structures and pipelines shall commence when groundwater is first encountered, and shall be continuous until such times as water can be allowed to rise in accordance with the provisions of this Section or other requirements.

Contractor’s dewatering operations shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

If foundation soils are disturbed or loosened by the upward seepage of water or an uncontrolled flow of water, the affected areas shall be excavated and replaced with fill material specified by the Engineer at no additional cost to the Owner.

Surface water should be directed away from open excavations, and water should not be allowed to accumulate in the bottoms of excavations.

Excavations that will be left open for an extended period (i.e., more than a couple of days) likely will require more elaborate dewatering measures.

The Contractor shall maintain the water level three feet below the bottom of the excavation in all work areas where groundwater occurs during construction, backfilling and until acceptance of the Work.

Flotation shall be prevented by the Contractor by maintaining a positive and continuous removal of water. The Contractor shall be fully responsible and liable for all damages which may result from failure to adequately keep excavations dewatered.

3-2. SITE DRAINAGE. At all times, site grading shall promote drainage. Surface runoff shall be diverted from excavations. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and be pumped or drained by gravity from the excavation to maintain a bottom free from standing water.

3-3. WELL AND WELL POINTS. If well points or wells are used, they shall be adequately spaced to provide the necessary dewatering. They shall be packed with sand and/or other porous medium to prevent pumping of fine sands or silts from the subsurface. A continual check by the Contractor shall be maintained to ensure that the subsurface soil is not being removed by the dewatering operation.
3-3.01. **Well Abandonment.** Contractor shall remove the pumps from the casing and shall excavate and cut pipe casing 12 inches below grade. Concrete shall be tremie pumped from a depth within 20 feet from the bottom of the well until the concrete fully displaces the water in the well and overflows at the top of the casing in the excavated area to form a “mushroom” cap. The concrete shall be left to set. Concrete shall be class D7 as defined in the Cast in Place Concrete section.

3-4. **DISPOSAL OF WATER.** Contractor shall dispose of water in a suitable manner without damage to adjacent property. The Contractor shall be responsible for obtaining any permits that may be necessary to dispose of the water. No water shall be drained into work built or under construction without prior consent of the Engineer. Water shall be filtered using an approved method to remove sand and fine-sized soil particles before disposal into any drainage system. The dewatering system shall not allow migration and pumping of soil fines with the discharge water.

For the AWTF dewatering operation, treated groundwater shall be discharged to OCWD MF Backwash Waste well located in the basement on the north end of the MF Facility or to OCSD’s outfall through Secondary Clarifier No. 32’s effluent box. See Drawing 100-G-040 and 100-G-041.

For dewatering of the area near Garfield Avenue at the south end of Plant 2, treated groundwater shall be discharged to OCSD’s outfall through Secondary Clarifier No. 33’s effluent box.

For dewatering of the area at OCSD’s Plant 2, treated groundwater shall be discharged to the existing Stormwater Pump Station located in the paved parking area east of the Service Center. Flow from the pump station is conveyed to the 84-inch Interplant Pipeline. In the event of a major storm event as defined by OCSD, dewatering discharge shall be temporarily rerouted to a storm drain located near the proposed Diversion Structure. See Drawing 100-G-042.

The Contractor shall be responsible for applying for and complying with all permit requirements including, but not limited to, the OCSD Internal Dewatering Permit. The permit includes requirements for metering flow, desilting, discharge water quality, and monitoring requirements. The location of the dewatering discharge points are shown in the plans. The dewatering pipeline shall be below grade at all road crossings and where above ground routing may interfere with operation and maintenance cart access. The final routing alignment and location of desanding/desilting boxes shall be coordinated with and approved by the Owner.

3-5. **TERMINATION OF DEWATERING.** The release of groundwater to its static level shall be performed in such a manner as to maintain the undisturbed state of the natural foundation soils, prevent disturbance of compacted backfill and prevent flotation or movement of structures, and pipelines.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers earthwork and shall include the necessary clearing, grubbing, and preparation of the site; removal and disposal of all debris; excavation; handling, storage, transportation, and disposal of all excavated material; all necessary sheeting, shoring, and protection work; preparation of sub-grades; pumping and dewatering as necessary; protection of adjacent property; backfilling; construction of fills and embankments; grading; and other appurtenant work performed on OCWD property.

1-2. GENERAL. With reference to the terms and conditions of the construction standards for excavations set forth in Cal/OSHA “Construction Safety Orders”, Subchapter 4 (Article 6) Section 1540, Contractor shall employ a competent person and, when necessary based on the regulations, a registered professional engineer to act upon all pertinent matters of the work of this section.

In-place density tests will be performed in accordance with ASTM D1556, ASTM D6938, or by other means acceptable to the Engineer. The Contractor shall cooperate in making such tests, allowing a reasonable time for the tests to be performed. Contractor shall make all excavations as required by Engineer for field testing and observations. Excavation, backfilling, and compaction necessary for soil testing and observation purposes shall be done by Contractor at no additional cost to the Owner.

Contractor shall remove fill as required in any area where its uniformity, gradation, placement, moisture content, or density does not fully comply with these specifications. After notification by Engineer, Contractor shall promptly remove and replace all fill that does not comply with these specifications. Engineer’s failure to observe or notify the Contractor shall not relieve Contractor of his responsibility to fully comply with the specifications. At Contractor’s discretion, Contractor may blend, disc, moisten, re-compact, or otherwise rework the fill until it complies with the specified requirements. Additional costs for all remedial measures needed to achieve the specified requirements for the fill material shall be borne by Contractor.

Contractor shall notify Engineer at least 3 days before completion of any excavation and shall allow Engineer a review period of at least one day before the exposed excavation subgrade is disturbed or is covered with backfill or with any construction material.
1-3. **SUBMITTALS.** Drawings, specifications, and data covering the proposed materials shall be submitted in accordance with the Submittals section.

1-3.01. **Filter Fabric Data.** Complete descriptive and engineering data for the fabric shall be submitted in accordance with the Submittals section. Data submitted shall include:

- A 12 inch square sample of fabric.
- Manufacturer’s descriptive product data.
- Installation instructions.

1-3.02. **Excavation and Dewatering Plan.** At least 30 days before starting construction, submit an excavation and dewatering plan for each planned excavation. The submittal shall include locations of the planned excavation support systems/protection systems. The excavation and dewatering plan shall be prepared by a professional engineer licensed or registered in the State of California. The submittal shall also include a monitoring plan for monitoring movement of the existing improvements that may be subject to distress or damage during the planned construction. Additional instructions are provided in the Dewatering section.

1-4. **BASIS FOR PAYMENT.**

1-4.01. **Ground Support for Structures.** No additional payment above the Contract Price will be made for excavation support systems left in place (with Engineer’s approval) in excavations for structures because of impracticality of removal.

1-5. **INSURANCE.** Professional Liability insurance shall be provided as specified in the General and Special Provisions.

**PART 2 - PRODUCTS**

2-1. **MATERIALS.**

2-1.01. **Filter Fabric.** Filter fabric shall be provided in rolls wrapped with covering for protection from mud, dirt, dust, and debris.

2-1.01.01. **Woven Geotextile.** Woven geotextile shall be TCI Mirafi “600X”, Amoco Fabrics and Fibers Company “Amoco 2006”, TNS Advanced Technology “W300”, or equal.

2-1.01.02. **Nonwoven Geotextile.** Geotextile for use in temporary drainage trenches shall be nonwoven and conform to the requirements for underdrains.
described in Caltrans Standard Specifications Section 88, paragraph 1.03 “Filter Fabric”.

2-1.02. **Vapor Barrier.** Plastic vapor barrier shall be 10 millimeters thick and shall satisfy the requirements of ASTM E 1745 (Class “A”). Vapor barrier shall have a water vapor transmission rate (WVTR) of 0.00 and testing tolerance of a WVTR of 0.008 when tested per ASTM E 96. Vapor barrier shall be installed per ASTM E 1643 and shall have joints taped and overlapped by a minimum of 6 inches.

2-1.03. **General Fill and Embankment Materials.** Not used.

2-1.04. **Granular Fill.** Not used.

2-1.05. **Select Backfill.** Select backfill shall be defined as the material placed around and outside of structures and within a minimum distance of 5 feet from the wall. When a structure is constructed in an excavation with laid back slopes, the entire backfill between the structure walls and the excavation slopes shall be considered select backfill. Select backfill shall meet the following criteria:

<table>
<thead>
<tr>
<th>Criteria</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum particle size (inches)</td>
<td>1</td>
</tr>
<tr>
<td>Maximum liquid limit (%)</td>
<td>25</td>
</tr>
<tr>
<td>Maximum plasticity index (%)</td>
<td>15</td>
</tr>
<tr>
<td>Maximum percentage passing the No. 200 sieve (%)</td>
<td>10</td>
</tr>
<tr>
<td>Maximum sand equivalent</td>
<td>20</td>
</tr>
</tbody>
</table>

Silts, sandy silts, or clays (ASTM D2487) shall be used in the top two feet of the finished grade below the topsoil to be placed in areas that will not receive pavements, structures, or concrete pads.

2-1.05.01. **Clean Sand Structure Backfill.** Not used.

2-1.06. **Import Fill.** Import fill shall be defined as the material placed beneath the structure foundations and slabs below any granular material layer, crushed layer or lean concrete slab indicated on the Drawings. Import fill shall be used to replace any unsuitable material below the structure foundations and slabs and to raise the site grades below and within 5 feet of structural footprints and at locations indicated on the Drawings. Import fill shall be used in all areas for which a fill is not specified. Import fill shall meet the following criteria:

<table>
<thead>
<tr>
<th>Criteria</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum particle size (inches)</td>
<td>4</td>
</tr>
<tr>
<td>Maximum liquid limit (%)</td>
<td>40</td>
</tr>
<tr>
<td>Maximum plasticity index (%)</td>
<td>20</td>
</tr>
<tr>
<td>Maximum percentage passing the No. 200 sieve (%)</td>
<td>40</td>
</tr>
</tbody>
</table>
2-1.06.01. **Clean Sand Select Fill.** Not used.

2-1.07. **Gravel Base Beneath Slabs.** Not used.

2-1.08. **Controlled Low Strength Material (CLSM).**

Controlled low strength material (CLSM), shall meet the requirements specified in SSPWC Greenbook, Section 201-6, Controlled Low Strength Material (CLSM), except as modified herein.

The 28-day compressive strength shall be within the allowable range of 100 psi to 150 psi when used as backfill beneath structures, and 50 psi to 110 psi when used as pipe embedment and trench backfill.

Contractor shall design and test the CLSM. Contractor shall submit the mix design and test results to Engineer for review and acceptance. Initial set time shall be 8 hours plus or minus one hours as determined by ASTM C403. CLSM shall have an efflux time of 10 to 26 seconds through a special flow cone with a 1/2 inch discharge tube.

The batch proportions accepted by Engineer shall apply only for materials from the same source and having the same characteristics as the materials used in the mix design. Materials from any other source shall be used only with the acceptance of Engineer.

If a change in sources of materials is proposed, a new mix design shall be developed by Contractor before the new material is used. When unsatisfactory results or other conditions make it necessary, Contractor shall develop a new mix design to get the desired results.

During the progress of the work, no change shall be made in the batch proportions of the ingredients without the acceptance of Engineer.

2-1.08.01. **Class A CLSM.** Not used.

2-1.08.02. **Class B CLSM.** Not used.

2-1.08.03. **Class C CLSM.** Not used.

2-1.09. **Imported Sand.** Imported sand shall be clean, cohesionless material with 100 percent (by weight) passing 3/8-inch sieve and at least 90 percent passing a No. 4 sieve. The sand equivalent valve shall be equal to or greater than 30 as determined in accordance with ASTM Test Method D2419.
2-1.10. **Crushed Rock.** Crushed rock shall be an imported material that consists of durable rock and gravel that is free of deleterious material and free from slaking or decomposition under the action of alternate wetting and drying. Crushed rock shall be 3/4-inch and shall meet the gradation requirements specified in Greenbook Table 200-1.2(A).

2-1.11. **Geocomposite Sheet Drains.** The geocomposite sheet drains shall consist of a continuous plastic three dimensional drainage core wrapped on one side in a non-woven filter fabric permeable to water flow. The filter fabric shall be bonded to the individual dimples of the molded plastic core to minimize fabric intrusion into the flow channels caused by the backfill pressure. The fabric shall extend beyond the edges of the core to provide overlap for the adjacent panels. The geocomposite sheet drain shall be Miradrain 6000 as manufactured by Mirafi, Inc., or Ameridrain 200 as manufactured by American Wick Drain Corporation, or equal.

2-1.12. **Permeable Material.** Not used.

2-2. **MATERIAL TESTING.**

2-2.01. **Preliminary Review of Materials.** As stipulated in the Quality Control section, all tests required for preliminary review of materials shall be made by an acceptable independent testing laboratory at the expense of Contractor. Two initial gradation tests shall be made for each type of select backfill, import fill, or other specified material, and one additional gradation test shall be made for each additional 500 tons of each material delivered to the jobsite.

All material testing on CLSM shall be made by an independent testing laboratory at the expense of Contractor.

2-2.02. **Field Testing Expense.** All moisture-density (Proctor) tests and relative density tests on the materials, and all in-place field density tests, shall be made by an independent testing laboratory at the expense of Owner. Contractor shall provide access to the materials and work area and shall assist the laboratory as needed in obtaining representative samples. Contractor shall bear the cost of all the failing tests performed by the Owner’s laboratory.

2-2.03. **Required Field Tests.** For planning purposes the following guidelines shall be used for frequency of field tests. Additional tests shall be performed as necessary for job conditions and number of failed tests. Test results shall be submitted as indicated in the Submittals section.

a. Two moisture-density tests in accordance with ASTM D1557 for each type of select import fill, or other material proposed.
b. One in-place field density and moisture test for every 100 to 200 cubic yards of select backfill or import fill.

c. One in-place density and moisture test whenever there is a suspicion of a change in the quality of moisture control or effectiveness of compaction.

d. At least one test for every full shift of compaction operations on mass earthwork.

e. Additional gradation, moisture density and relative density tests whenever the source or quality of materials changes.

f. Testing of CLSM shall be as follows.

Compressive Strength. For every 200 cubic yard of flowable fill placed, fill four 6 by 12 inch plastic cylinder molds to overflowing and then tap sides lightly. Cure cylinders in the molds covered until time of testing, at least 14 days. Strip the cylinders carefully using a knife to cut away the plastic mold. Cap the cylinders with high strength gypsum plaster or other capping process that will not break these low strength materials. Test cylinders in accordance with ASTM C39. Two cylinders shall be tested at 7 days and the other two cylinders shall be tested at 28 days.

Flow of Fill. Once each day that flowable fill is placed, test the fill material in accordance with ASTM C939 for the efflux time. Wet screening may be required to remove coarse particles.

Unit Weight and Yield. Once each day that flowable fill is placed, determine unit weight and yield in accordance with ASTM C138.

Air Content. Once each day that flowable fill is placed, determine air content in accordance with ASTM C231.

Penetration Resistance. Once each day that flowable fill is placed, determine early bearing strength in accordance with ASTM C403 penetration procedure.

PART 3 - EXECUTION

3-1. SITE PREPARATION. All sites to be occupied by permanent construction or embankments shall be cleared of all logs, trees, roots, brush, tree trimmings, and other objectionable materials and debris. All stumps shall be grubbed. Subgrades for fills and embankments and sites to be occupied by permanent construction shall be cleared and stripped of all surface vegetation, sod, and organic topsoil. Holes created by the grubbing process shall be backfilled with compacted earth fill. The upper approximately 6 inches of soil containing organics and suitable for plant growth shall be stripped and stockpiled separately for later use in landscaping. The actual depth of topsoil stripping shall be established in the field at the time of construction to ensure all material containing organics is removed while exercising care to not remove or mix any
inert soil with the topsoil. All waste materials shall be removed from the site and disposed of by and at the expense of Contractor.

3-2. **EXCAVATION.**

3-2.01. **General.** Excavations shall provide adequate working space and clearances for the work to be performed therein and for installation and removal of concrete forms. In no case shall excavation faces be undercut for extended footings.

Sub-grade surfaces shall be clean and free of loose material of any kind when concrete is placed thereon.

Excavations for manholes and similar structures constructed of masonry units shall have such horizontal dimensions that not less than 6 inches clearance is provided for outside plastering.

Information regarding existing utilities and structures shown on the Drawings is based on the as-built construction drawings provided by the Owner and limited pothole investigations completed during the design. Hand excavation to the depth shown on the Drawings will be required in areas where the need for sheeting and shoring is indicated in order to expose power and other utility lines in the area.

3-2.02. **Classification of Excavated Materials.** No classification of excavated materials will be made for payment purposes. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the work, regardless of the type, character, composition, or condition thereof.

3-2.03. **Unauthorized Excavation.** Except where otherwise authorized, indicated, or specified, all materials excavated below the bottom of concrete walls, footings, slabs on grade, and foundations shall be replaced with import fill at the expense of Contractor.

3-2.04. **Blasting.** Blasting or other use of explosives for excavation will not be permitted.

3-2.05. **Dewatering.** See Dewatering section.

3-2.06. **Sheeting Shoring and Excavation Support System.** Except where banks are cut back on a stable slope, excavations for structures and trenches shall be supported as necessary to prevent caving or sliding. Wherever sloped excavations are planned, temporary constructions excavations greater than 3 feet but less than 10 feet deep shall have slopes no steeper than 1.5H:1V
(horizontal to vertical). To avoid surcharging, excavated soils shall be stockpiled 15 feet or more from the sloped face.

Excavation support systems shall be furnished and installed as necessary to limit the extent of excavations for the deeper structures and necessary backfill under adjacent shallower structures, and to protect adjacent structures and facilities from damage due to excavation and subsequent construction. At a minimum, the excavation support system shall extend below the bottom of the excavation at least one-half the difference between the groundwater elevation and the excavation bottom elevation. The excavation support system embedment depth shall be determined by the Contractor with respect to the proposed construction dewatering scheme and groundwater levels encountered at the time of construction. Trench shields are not acceptable methods of providing excavation support. Contractor shall assume complete responsibility for, and install adequate protection systems for prevention of damage to existing facilities.

Excavation support systems and sheeting and shoring shall be removed or left in place as shown on the Drawings unless otherwise permitted by Engineer.

The design of the excavation support system shall be such as to permit complete removal while maintaining safety and stability in the excavation at all times. If the support system is left in place, it shall be off 3 feet below finished grade but not below adjacent foundation slabs of structures.

Installation of the support systems must not affect nearby structures/facilities. The subsurface conditions at the site also may limit the type of ground support measures that can be implemented during construction. The support systems shall be left in place where shown on the Drawings or if their removal might cause: (1) the excavation bottom or adjacent ground to become disturbed, (2) the excavation wall to collapse, and/or (3) damage a nearby structure or facility or the newly-completed structure/facility. Any voids created by the removal of support systems shall be completely filled with CLSM or neat cement grout, as appropriate.

The Contractor shall anticipate developing a program to continually monitor existing improvements to detect movement and allow for remedial actions. In addition, a complete survey of existing utilities, pavements, and structures adjacent to those portions of the proposed excavations that will be shored should be performed. The purpose of this review would be to evaluate the ability of the existing features to withstand horizontal and vertical movements associated with a shored and/or dewatered excavation. If movements are greater than the tolerance of existing project features, tie-backs, dead-man anchors, cross bracing, or alternative shoring or dewatering systems may be needed to reduce deflections.
Excavation support systems shall be checked frequently for lateral and vertical movement. If tension cracks appear in the ground surface adjacent to the shoring, the cracks shall be monitored and sealed to prevent infiltration of water, and the significance of the cracks shall immediately be evaluated. If large deflections (greater than 0.5 percent of the shoring height) are noted, the excavation support systems shall be checked and strengthened as needed.

Existing facilities and structure foundations adjacent to the required excavations may require underpinning during construction. Structures, pipelines, and any other improvement that may be subject to distress/damage during construction shall be periodically monitored and/or surveyed. If movement is detected, measures shall be undertaken immediately to prevent additional movement and damage. The Contractor shall be responsible for the repair of all damage that results from the new construction.

Excavation support systems shall be designed by a civil or structural professional Engineer, who is retained by the Contractor, and is registered in the State of California. Systems shall be designed to resist the earth pressure exerted by the retained soil plus any additional lateral force due to surcharge leading, i.e., construction equipment, foundations, roadways, etc., at or near the shoring.

3-2.07. Stabilization. Sub-grades for concrete structures shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact under the feet of the workers.

Sub-grades for concrete structures which are otherwise solid, but which become mucky on top due to construction operations, shall be reinforced with crushed. The stabilizing material shall be placed in such a manner that no voids remain in the crushed rock. All excess crushed rock with unfilled void space shall be removed. The finished elevation of stabilized sub-grades shall not be above sub-grade elevations indicated on the Drawings.

3-2.08. Ring-wall Excavation. Not used.

3-2.09. Roadway Excavation. Excavation for the roadways, drives, and parking areas shall conform to the lines, grades, cross sections, and dimensions indicated on the Drawings and shall include the excavation of all unsuitable material from the subgrade. After shaping to line, grade, and cross section, the subgrade shall be compacted to a depth of at least 12 inches and shall meet the following:

Test method to determine maximum density and moisture.  
ASTM D1557.
Relative compaction and moisture content relative to the optimum. 95%.

Moisture content relative to the optimum. 1% to 3%.

This operation shall include any reshaping and wetting or drying required to obtain proper compaction. All soft or otherwise unsuitable material shall be removed and replaced with suitable material.

3-3. **GENERAL FILLS AND EMBANKMENTS.** Not used.

3-4. **DESIGNATED FILLS.** Fills required or indicated to be designated fills shall be constructed using the specific materials and placement requirements as specified. In addition to the specific requirements specified herein, all requirements for general fills and embankments shall apply. These requirements include, but are not limited to organic or deleterious materials, subgrade preparation, lift thickness, and moisture conditioning requirements. All designated fills shall be constructed to the lines and grades indicated on the Drawings.

3-4.01. **Granular Fill.** Not used.

3-4.02. **Select Backfill.** Backfill materials shall be deposited in approximately horizontal layers not to exceed 8 inches in uncompacted thickness and shall meet the following requirements:

- Test method to determine maximum density and moisture. ASTM D1557.
- Relative compaction. 90% minimum
- Moisture content relative to the optimum. -1% to +3%. or more restrictive within the range, if required to achieve the specified relative compaction.

Compaction of select backfill shall be performed in such a manner that damage to the structure is prevented. Equipment weighing more than 10,000 pounds shall not be used closer to the wall than the horizontal distance equal to the depth of the fill at the time fill is placed. Compaction of select backfill by inundation with water will not be permitted.

No backfill shall be deposited or compacted in water.

Particular care shall be taken to compact select backfill which will be beneath pipes, drives, roads, parking areas, walks, curbs, gutters, or other surface construction or structures. In addition, wherever a trench pipe is to pass through
select backfill, the select backfill shall be placed and compacted to an elevation not less than 12 inches above the top of pipe elevation before the trench is excavated. Compacted areas, in each case, shall be adequate to support the item to be constructed or placed thereon.

3-4.03. Import Fill. Import fill shall be placed in nearly horizontal layers in uncompacted lift thickness of 8 inches or less and shall meet the following requirements:

- Test method to determine maximum density and moisture: ASTM D1557.
- Relative compaction: 90%.
- Moisture content relative to the optimum: 0% to 3%.

3-4.04. Gravel Base Beneath Slabs. Not used.

3-4.05. Controlled Low Strength Material (CLSM) Fill. Batching, mixing, and placing of CLSM may be started when weather conditions are favorable and when the temperature is at least 34°F and rising. At time of placement of CLSM the temperature shall be at least 40°F. Mixing and placing shall stop when the temperature is 38°F and falling. Each filling stage shall be as continuous an operation as is practicable.

CLSM shall be discharged from the mixer by an acceptable procedure into the area to be filled. CLSM shall be placed to limits indicated on the Drawings. Mixing CLSM with in-situ soil shall be avoided.

When CLSM is placed as backfill against structures, the fill shall be placed in lifts of 2 to 3 feet and the next lift shall not be placed until the previous lift has taken initial set and at least 16 hours have elapsed from the end of placement. Lift thickness shall be reduced as necessary to prevent floatation of the structure.

When CLSM is placed over culverts or pipelines, they shall be anchored to prevent flotation during the placement of CLSM. Unless otherwise required, CLSM shall be placed to one foot below subgrade elevation if the subgrade elevation is not more than 5 feet over the top of the culvert or pipe. If the finished grade is more than 5 feet over the top of the culvert or pipe fill, CLSM shall be placed to an elevation 2 feet over the top of the culvert or pipe, and the remainder shall be backfilled with soil designated by Engineer.

3-4.06. Crushed Rock. Thickness of crushed rock layer shall be a minimum of two feet unless otherwise indicated on the Drawings. Crushed rock shall be moistened thoroughly and compacted to a relative compaction of at least 90 percent, using approved plate or roller type vibratory compaction equipment.
3-5. **STRUCTURE FOUNDATION SUBGRADE PREPARATION.**

3-5.01. **Excavation.** Excavation below proposed foundations and slabs-on-grade, concrete pads, and concrete duct banks shall consist of removing all loose, soft or otherwise unsuitable material below the bearing level to the level of firm natural soils. Excavation shall be performed using methods and equipment that prevent disturbance of the bearing materials. Should bearing materials become disturbed due to excavation operations, they shall be removed and replaced with import fill to produce a firm, dense and thoroughly compacted and consolidated subgrade to the satisfaction of Engineer.

3-5.02. **Limits of Excavation.** Excavations of unsuitable materials shall extend beyond the edge of the footing a distance equal to the depth of overexcavation below the bottom of the concrete element or 2 feet, whichever is greater. In no case, however, shall proposed excavations undermine existing foundations. Foundations and slabs of existing structures shall be positively supported by means suitable to prevent damage to structures.

Damage to existing structures as a result of the Contractor's operations shall be corrected by the Contractor to the satisfaction of Engineer at no additional cost to the Owner.

3-5.03. **Subgrade Preparation.** Prior to placing fills below footings and slabs, the subgrade shall be inspected and tested for soft, loose, or unsuitable materials. All such materials shall be removed.

If after excavation to the required grades the exposed soil surface is adequately firm and uniform, and has not been disturbed (as determined by Engineer), the exposed surface shall be compacted with at least six passes of a smooth, vibrating drum roller that weights no less than 10,000 pounds to provide a reasonably smooth surface.

If the exposed soil surface is not sufficiently firm, is non-uniform, or has been disturbed (as determined by Engineer), the upper 8 inches of soil shall be scarified, plowed, disked, and bladed until it is uniform and free of large unbroken soil clods. The moisture content of the scarified soil shall be brought to within the optimum and +3 percent of the optimum and compacted to not less than 90 percent relative compaction per ASTM D1557. The compacted surface shall be bladed/trimmed and rolled with a smooth drum roller to provide a reasonably smooth surface upon which to build the structure pad.

3-5.04. **Replacement Materials.** Materials used to replace existing unsuitable materials shall meet the quality, classification and compaction requirements of import fill.
3-5.05. **Protection of Subgrade.** All exposed foundation and slab subgrades shall be protected as specified for protection of subgrades for fill from erosion, air or water slaking, and changes in moisture content. All granular-fill building pads shall be placed as quickly as possible after exposed surfaces are prepared and inspected. All damaged subgrades as a result of prolonged exposure shall be undercut and replaced with import fill of aggregate base material at no added cost to the Owner.

3-6. **FINAL GRADING AND PLACEMENT OF TOPSOIL.** Not used.

3-7. **DISPOSAL OF EXCAVATED MATERIALS.** Suitable excavated materials may be used in fills and embankments as needed. All excess excavated material shall be disposed of off-site at the expense of Contractor.

All debris, stones, logs, stumps, roots, and other unsuitable materials shall be removed from the site and disposed of by, and at the expense of, Contractor.

3-8. **RESODDING.** Not used.

3-9. **SETTLEMENT.** Contractor shall be responsible for all settlement of backfill, fills, and embankments and structures that may settle due to dewatering which may occur within the correction period stipulated in the General Conditions.

Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after notice from Engineer or Owner.

End of Section
PART 1 - GENERAL

1-1. SCOPE.

A. This section covers all the earthwork required for construction of the work on OCSD property (Plant 1 and Plant 2) and the work south of Plant 1 within the interplant corridor and SCE property. The earthwork shall include, but not be limited to necessary clearing, grubbing, loosening, removing, loading, transporting, depositing, grading and compacting in its final location of all materials wet and dry, as required for the purposes of completing the work specified in the Contract Documents, which shall include, but not be limited to, the furnishing, placing, and removing of sheeting, shoring and bracing necessary to safely support the sides of all excavation; supporting structures above and below ground; all pumping, ditching, draining, dewatering, and other required measures for the removal or exclusion of water from the excavation; stabilization of the bottom of the excavation, filling and compacting to elevations shown on the Contract Documents; all backfilling around structures and pipe and all backfilling of trenches and pits; the disposal of excess and unsuitable excavated materials; borrow of materials to make up deficiencies for fills; and all other incidental earthwork, all in accordance with the requirements of the Contract Documents.

B. The elevations shown on the Plans as existing are taken from the best available data and are intended to give reasonably accurate information. The Contractor is responsible for determining exact quantities of excavation and fill required.

C. Pits and fills used for the erection of the Contractor's construction facilities shall be filled or removed upon the completion of the work and leveled to meet the existing contours of the adjacent ground.

D. After all structures have been completed, the ground surface shall be brought to the finished grade elevations and relative compaction indicated on the Contract Documents.

E. All finished ground surfaces shall be bladed and dressed to present a surface not varying over 0.10 foot at local humps or depressions and to the satisfaction of the Engineer. Local depressions, which can contain water shall be no more than 0.05-foot deep.
F. A Geotechnical Site Investigation Reports have been prepared. The reports describes the subsurface conditions at the project sites and is provided to the Contractor for information purpose only. The Contractor shall notify the Owner immediately and in writing of differing site conditions in accordance with the Public Contract Code, Section 7104.

1-2. RELATED WORK SPECIFIED ELSEWHERE.

A. Division 01, Work Restrictions.
B. Division 02, Other Sections, as applicable.
C. Section 15000 Piping, General.

1-3. REFERENCE SPECIFICATION, CODES AND STANDARDS. With reference to the terms and conditions of the construction standards for excavations set forth in Cal/OSHA “Construction Safety Orders”, Subchapter 4 (Article 6) section 1540, Contractor shall employ a competent person and, when necessary based on the regulations, a registered professional engineer to act upon all pertinent matters of the work of this section.

A. Comply with the applicable reference specifications as specified in the General Requirements.

B. Comply with the current provisions of the following codes and standards:

1. Commercial Standards:
   - ASTM D422 Standard Test Method for Particle-Size Analysis of Soils
   - ASTM D1556 Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
   - AASHTO T180 Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in (457-mm) Drop
ASTM D2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D2901 Standard Test Method for Cement Content of Freshly-Mixed Soil-Cement
ASTM D6938 Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
UBC No. 29-2 Standard Test Method for Expansion Index of Soils

2. Standard Specifications:
   - SSPWC Sections 203-1, 203-2, 203-3 - Bituminous Materials
   - SSPWC Section 211 - Soil and Aggregate Tests
   - SSPWC Section 300 - Earthwork
   - SSPWC Section 306-1- Open Trench Operations


1-4. CONTRACTOR SUBMITTALS.

A. Submittals, including samples of materials, shall be in accordance with the General Requirements.

B. The Contractor’s attention is directed to the provisions for "Shoring and Bracing Drawings" in Section 6705 of the California Labor Code and SSPWC Section 306-1.1. The Contractor, prior to beginning any trench or structure excavation 5 feet deep or over shall submit to the Engineer and shall be in receipt of the Engineer’s written acceptance of the Contractor’s detailed plan showing design of all shoring, bracing, sloping of the sides of excavation, and other provisions for worker protection against the hazard of caving or heaving ground during the excavation of such trenches or structure excavation. The plans shall be prepared by a qualified civil or structural engineer licensed in the State of California and employed by an independent design consultant firm insured against errors and omissions to the extent required by the Engineer. The submittal(s) shall include a site location map referencing existing features; detailed plans; elevations, and various sections indicating all excavation slopes, shoring components and connections and showing all structures and utilities potentially influenced by the performance of shoring, trenching or structure
excavation along with supporting calculations; notes including sequence of construction, materials, and other clarification as required by the California Labor Code, SSPWC, and the contract documents.

C. The Contractor shall submit for the Engineer’s review, drawings and data showing his proposed design and plan for dewatering of all work areas, which shall include the planned method of dewatering, excavation and shoring, the location and capacity of such facilities as dewatering wells, well points, pumps, sumps, collection and discharge lines, flowmeters, the standby units proposed, and protective fills and ditches required for control of groundwater and surface water. The plan for dewatering shall be submitted to the Engineer 15 days prior to the start of construction. The Contractor shall furnish such other information as may be required for the complete understanding and analysis of the dewatering and excavation plan by the Engineer.

D. The Contractor shall submit an Excavation Plan for the Project. The plan shall show excavation areas and haul routes on a monthly basis. The plan shall contain truck traffic counts and planned use of local “public streets”. Explain the method and means for meeting the requirements of SCAQMD Rule 403, Fugitive Dust emissions.

E. Review by the Engineer shall not relieve the Contractor of the responsibility for the adequacy of the dewatering and excavation plans or for furnishing all equipment, labor, and materials necessary for performing the various parts of the work. If, during the progress of the work, it is determined by the Engineer that the dewatering system and excavation plan are inadequate or the Contractor’s plan of construction inoperative, the Contractor shall, at his expense, furnish, install and operate such additional dewatering equipment as may be necessary to perform the work in a manner satisfactory to the Engineer.

F. Provide a Stormwater Pollution Control Plan (SWPPP) as outlined in the Stormwater Pollution Control Plan section.

1-5. DEWATERING.

A. Discharge of water from dewatering operations is governed by a National Pollutant Discharge Elimination System (NPDES) permit issued by the Regional Water Quality Control Board. The Contractor shall design, provide and maintain, at all times during construction, ample means and devices with which to promptly remove and properly dispose of all water from any source, including water migrating through the bedding of existing trunk sewers, entering the excavations or other parts of the work. Dewatering shall be accomplished by methods that will ensure a dry and firm, unyielding excavation and preserve the final lines and grades of the bottoms of excavations. Said methods may include deep wells, well
points, sump pumps, suitable rock or gravel placed below the required bedding for draining and pumping purposes, temporary pipelines, or other approved means. The proposed method and proposed point of discharge of dewatering effluent shall be submitted to the Engineer for review and approval prior to excavation and installation of dewatering equipment.

B. Soft and wet conditions are expected for excavations below approximately EL5 to EL8 where static ground water was encountered. Construction dewatering can be designed for this range of groundwater level. Little to no perched water is expected above EL8. If perched water is encountered, it can be collected with sumps. Groundwater depths should be verified before construction to account for potential variation due to groundwater recharge activities, seasonal variations, or higher water levels in wet years. For design of permanent structures, a groundwater level of EL15 should be used in order to cope with wet years and potential impact from the adjacent groundwater recharge activities over the design life of the proposed structures. Dewatering wells should not penetrate into the Talbert Aquifer.

C. The dewatering shall be accomplished in a manner that will prevent loss of fines from the foundation, will maintain stability of all excavated slopes and bottoms of excavations, and will permit construction operations to be performed in the dry. Dewatering of excavations shall be performed to the extent required to permit placement of compacted fill materials in the dry and to prevent sloughing of the excavation side slopes.

D. Ground water table, and locally perched ground water tables, shall be lowered in advance of the excavation and maintained at least 5 feet below the bottom of the excavation. During placement and compaction of fill materials, the lowered level of ground water shall be maintained as described above until final grade is reached. Floatation of pipelines and structures shall be prevented by maintaining a positive and continuous removal of water until the construction is completed to the design grades.

E. No concrete or masonry footings, foundations, manhole bases, or floors shall be constructed in water, nor shall water be allowed to rise over them until the concrete or mortar has set at least 24 hours. Water shall not be allowed to rise unequally against walls until concrete has attained its 28-day strength. Water shall not be allowed to rise above pipe subgrade during pipe laying operations.

F. Dewatering equipment shall not cause noise nuisance. Noise levels shall, at a minimum, comply with the requirements of local jurisdictions or permitting agencies.
G. The Contractor shall construct and maintain all permanent and temporary slopes, dikes, levees, drainage ditches, and sumps necessary for removal of water from work areas.

H. Any damage or settlement to the foundation or other work or any existing structures caused by temporary or permanent failure or operation of the dewatering system shall be repaired to the satisfaction of the Engineer at the Contractor’s expense. The Contractor should consider the use of recharge systems or other methods of protection of existing facilities. The Contractor shall monitor settlement, and groundwater levels around existing structures during dewatering. Records of settlement and groundwater levels shall be kept and evaluated on a daily basis. The Contractor shall notify the Engineer immediately if excessive settlement or a significant drop in groundwater is recorded.

I. Standby pumping equipment shall be on the job-site. A minimum of one standby unit (a minimum of one for each ten in the event well points are used) shall be available for immediate installation should any well unit fail. The design and installation of well points or deep wells shall be suitable for the accomplishment of the work. Drawings indicating the proposed dewatering system shall be submitted to the Engineer for review.

J. If foundation soils are disturbed or loosened by the upward seepage of water or an uncontrolled flow of water, the affected areas shall be excavated and replaced with pipe bedding material or crushed rocks underlain by geotextiles as needed to stabilize the foundation soils at no cost to the Owner.

K. The Contractor shall dispose of the water from the work in a suitable manner without damage to adjacent property. Conveyance of the water shall not interfere with traffic flow or the operation of the treatment facilities. No water shall be drained into work built or under construction without prior consent of the Engineer. Upon written approval of the Engineer, water may be disposed of in the treatment plant effluent system or trunk sewer at a point designated by the Engineer. Water shall be desanded and desilted before disposal. Each disposal point to sewers or other Owner facilities must have a flowmeter to track the discharges into the facilities. The Contractor shall submit weekly reports showing the total discharge at each point with meter readings and other data as necessary to support the quantity reported. Disposal point and maximum flow rate for dewatering waste is subject to the Engineer’s review. The Engineer shall have the right to limit the maximum flow rate per disposal point and may direct the Contractor to provide additional disposal points as required at no additional cost.
L. The system used for desanding and desilting the water shall be a baffled structure and shall provide not less than 5 minutes detention time and have a "flow-through" velocity not exceeding 0.2 feet per second at the anticipated peak flow. The desanding and desilting box shall be cleaned as required to maintain the detention time and flow-through limitations specified above. The system used for desanding and desilting shall be attached with a stainless steel sampling port so that OCSD staff may collect dewatering flow samples from this port, and it will have a drip container below the port to capture any excess water spilled during sampling. The system used for desanding and desilting shall be located in a safe and easy access location so sampling can be performed by OCSD Environmental Sciences Laboratory staff. The method of desanding and desilting and point of disposal of water shall be subject to the Engineer’s approval. Water shall be disposed of in such a manner as not to be a menace to the public health and shall be done in accordance with Environmental Protection Agency and State Water Quality Control Board requirements. The total suspended solids (TSS) content of the water shall not exceed 100 mg/L.

M. Contractor shall dewater all water migrating from the bedding of existing sewers at no additional cost to the Owner.

N. Upon completion of the dewatering and control of water operation, all temporary works and dewatering facilities shall be removed in a manner satisfactory to the Engineer.

O. At OCSD Plant 1 and the interplant corridor, the treated groundwater shall be discharged to the Owner’s outfall through SEJB6, SEJB7, EJB, or the effluent box at Secondary Clarifier 33. The Contractor shall notify the Owner when discharge to SEJB6, SEJB7, EJB, or the effluent box at Secondary Clarifier 33 occurs so that sampling of the groundwater can be performed to verify that the discharged groundwater complies with the treatment requirements identified herein.

At OCSD Plant 2, the treated groundwater shall be discharged to the Owner’s outfall through the effluent box at Secondary Clarifier F. The Contractor shall notify the Owner when discharge to the effluent box at Secondary Clarifier F occurs so that sampling of the groundwater can be performed to verify that the discharged groundwater complies with the treatment requirements identified herein.
SHORING OF EXCAVATIONS.

A. The Contractor shall be fully responsible for providing and constructing shoring and bracing to prevent slides or cave-ins and to protect all existing improvements in the vicinity from damage as required.

1. Shoring and sheeting shall also be installed during excavation as necessary to prevent disturbing material that is under or adjacent to an existing structure or pipe. Displacements at the shoring face and at selected points adjacent to pipelines or structures shall be monitored. Groundwater conditions shall be verified prior to designing temporary shoring. Excavation below current groundwater level will require shoring and dewatering.

2. Whenever the Engineer considers any Owner facility in jeopardy due to excavation, the Contractor shall take the measures necessary, subject to approval of the Engineer, to protect the facility in question. All costs associated with these protective measures shall be borne by the Contractor. Backfill of any "unauthorized excavation" shall be performed as directed by the Engineer. Damage to existing structures due to "unauthorized excavation" shall be immediately repaired or replaced to the satisfaction of the Engineer at the Contractor's expense.

3. All piling required for shoring shall be installed by drilling. Driven piles of any types will not be allowed without the approval of the Engineer.

4. The Contractor shall not begin excavation operations until the shoring drawings have been reviewed by the Engineer. Review of the Contractor's shoring plans shall not be construed to invalidate other provisions of these Specifications or relieve the Contractor of the responsibilities inherent in the pursuance of the work. The Contractor shall, at its cost and for all its shoring work, obtain permits from all regulatory agencies as required.

5. The Contractor shall furnish all labor, equipment, and materials to construct, install, and remove the entire shoring system including removal of lagging, soldier beams, and bracing and de-tensioning of tiebacks. Full compensation for the shoring and its removal shall be considered as included in the Contract Price and no additional compensation will be allowed.

6. Design of shoring shall be in accordance with the applicable requirements of the Safety Orders of the Division of Industrial Safety, State of California. All temporary shoring must comply with current CAL-OSHA requirements. The Contractor shall be responsible for providing more extensive shoring or bracing systems than those required by the Construction Safety Orders when necessitated by
conditions indicated on the drawings, specified, or otherwise required by the Work.

7. The shoring and bracing shall be designed in accordance with the data provided in the Geotechnical Investigation Reports and shall consider all surcharge loads imposed.

8. Where the shoring support system is within 10 feet of a street, it shall be designed to withstand a minimum surcharge load equivalent to 2 feet in height of earth added to the active earth pressure in the upper 10 feet of shoring. Shoring support systems adjacent to other structures shall be designed to withstand all loads applied to the shoring system from adjacent structures.

9. Lateral earth design pressures for the design of temporary earth-retaining structures are dependent upon retaining structure movement, type of structure, and combination of imposed forces from soil, water (if allowed to accumulate), and surcharge loads. Such shoring system shall be designed by the Contractor. However, lateral pressures used in the design of a shoring system shall not be less than those shown in Figure 02200-2. A minimum 250 psf (equivalent to approximately 2 feet of soil) aerial surcharge shall be assumed at the top and around the excavated area to account for the adjacent structural and equipment loads, and where applicable, hydrostatic pressure shall be included.

   a. The embedment depth of the wall required to provide toe stability shall be determined by moment equilibrium about the top for cantilever walls, or about the tieback level for anchored walls. Sheet piles shall extend through alternating sand, silt, and clay layers, extending a minimum 20 feet below the bottom of the mass excavation. Temporary tieback anchors can be used with shoring systems so long as the tieback installation will not interfere with structural integrity of the adjacent pipeline and facilities.

   b. Facilities located beyond a distance of one times the depth of the excavation from the shoring limits (potential impact zone) will experience minimal impact from the excavation and foundation installation. Mitigation techniques such as deep soil mixing, grouting, secant piles, or alternative methods can be used and should be designed by a California State Licensed Civil or Structural Engineer and submitted by the Contractor for the Engineer’s record. Maximum deflection at the top of shoring shall be limited to ½-inch, horizontal and vertical.

10. Where shoring will support adjacent structures or facilities and excessive deflection can lead to structure settlement, braced or tieback shoring shall be utilized. Braced or tieback shoring supporting adjacent nearby facilities shall be designed and constructed to limit the maximum horizontal deflection of the shoring to 1/2 inch or less at the
shoring face, and ½-inch or less (horizontal deflection and vertical settlement) at a clear distance of 10 feet from the protected structure or pipeline as directed by the Engineer. Deflection of the shoring system shall be monitored on a weekly basis by a licensed surveyor employed by the Contractor. Monitoring of the shoring shall be performed in the presence of the Engineer, with a written report to be submitted to the Engineer within 24 hours. Installation of tiebacks should avoid damages to the adjacent pipelines and the associated backfill materials. Casings shall be used during installation of tiebacks under pipelines and existing structures, and the tieback alignment should be kept at a minimum clearance of 10 feet from the pipelines and foundations.

a. Temporary tieback anchors shall be installed at spacing no more than 8-foot on center. The anchor’s unbonded zone shall extend at least 20 feet beyond the active wedge. Drilling and grouting of tieback anchors shall be conducted such that the drilled holes will not collapse and loss of ground can be prevented. Casing should be made available at the site and be used as required.

b. The frictional resistance of an anchor is dependent on many factors, including soil consistency, groundwater conditions, and the contractor’s method and care of installation. Because of the many factors that may affect anchor capacity, the Contractor shall perform anchor testing to develop a final anchor design capacity. An allowable bond stress of 2,000 psf can be assumed for preliminary design; however, the results from the anchor testing shall be used for the final design capacity. The anchors shall be installed at an inclination no steeper than 15 degrees from the horizontal. The minimum anchor bond length should be at least 20 feet. Tieback anchor installation and testing shall be conducted in accordance with “recommendations for Prestressed Rock and Soil Anchors” (PTI, 1996).

11. Any delay and/or expense incurred due to excess shoring deflection shall be at the Contractor’s expense.

12. Shoring and sheeting/bracing needs to be installed and removed carefully such that the bedding surrounding the installation of pipes does not slough or move within the pipe zone which would affect the proper support for bedding material under the haunches of the pipe. If the bedding material moves from under the pipe haunches after removal of shoring or sheeting/bracing, Contractor shall re-compartmentalize the bedding underneath the pipe haunches at no additional cost to the Contract. Where holes are left from beams used for shoring, Contractor shall use pea-gravel or sand-cement grout to consolidate beam hole.
13. Contractor shall use the vibration method to install sheet piling in order to reduce construction noise.

1-7. SAFETY MEASURES.
A. Safe conditions shall be maintained at the jobsite meeting all provisions of the California OSHA and all other applicable safety codes. Barricades and lighting meeting the requirements of all agencies having jurisdiction shall be placed at each end of all excavations and at such places as may be necessary along excavations to warn all pedestrians and vehicular traffic of such excavations. Lights shall also be placed along excavations from sunset each day to sunrise of the next day until such excavation is entirely backfilled, compacted, and paved. All excavations within the treatment plant fenced property shall be barricaded and lighted in such a way as to prevent persons from falling or walking into any excavation. All excavations outside the treatment plant confines shall be fenced with a minimum 7-foot high chain link fence during all non-working hours. This fence shall be constructed to prevent any person from entering the excavation. Signs stating "Danger, Deep Hole" shall be clearly displayed on all sides of the excavation.

B. Safe and suitable ladders that project 2 feet above the top of the trench shall be provided for all trenches greater than 4 feet in depth. A minimum of one ladder shall be provided for each 50 feet of open trench.

1-8. QUALITY ASSURANCE.
A. General. All soils testing will be done by a testing laboratory of the Engineer’s choice at Owner’s expense except as specified in Subsection C and E below.

B. The Owner will pay for the initial cost of all compaction tests. If any compaction fails to meet the relative compaction tests set forth, the Contractor shall pay for subsequent compaction tests by deducting their costs from the Contract amount.

C. The Contractor shall make all necessary excavations for compaction tests as directed by the Engineer, and all work in connection with compaction testing by the Contractor shall be included in the various contract bid prices, and no additional allowance will be made therefore. Safe access shall be provided to conduct the test.

D. In accordance with Owner’s Plans and Standard Drawings, soil material is required to be compacted to a ASTM D 2922 percentage of maximum dry density. The maximum dry density at optimum moisture content will be determined in accordance with the latest version of ASTM D 1557, except for work completed in the CALTRANS right of way. In-place field density
tests will be performed in accordance with ASTM D 1556, (sand cone) and/or and ASTM D 6938 (nuclear gauge). The type, number and location of field density tests will be determined by the Engineer. One sand-cone test (ASTM D 1556) will be taken for every four nuclear tests (ASTM D 2922 and 6938). If soil material is not within two (2) percentage points of optimal moisture content, the Contractor shall either add water or dry the soil material by moving the soil to aerate it sufficiently such that the optimum moisture content is achieved at no additional cost to the Owner.

E. All imported fill material shall be sampled and tested at the Contractor’s expense and shall be subject to approval by the Engineer.

F. Where imported fill material is required to possess certain gradation, strength, and settlement properties, the grain size distribution of soils will be determined using ASTM D 422, the gradation of concrete aggregate and base materials will be determined using ASTM C 136, the sand equivalent of soils will be determined using ASTM D 2419, the consolidation of soils will be determined using ASTM D 2435, the unconfined compressive strength of soils will be determined using ASTM D 2166, and the expansion index of soils will be determined using UBC No. 29-2.

G. Testing of soils shall also comply with any permit conditions included as part of this contract.

PART 2 - PRODUCTS

2-1a. PLANT 1 ONSITE EXCAVATED MATERIALS.

A. General. The subsurface soils are highly variable and generally consist of several feet of fill materials, underlain by alluvial deposits of alternating layers of very loose to dense silty sand and sand, medium stiff to hard clays and clayey silts, and some Peat deposits and organic soils overlying the Talbert Aquifer which was reported at a depth of approximately 50 to 55 feet below the ground surface.

It is estimated that ½ to ¾ of the on-site soils to be excavated from the top 20 feet generally consist of silty sand (SM) and clean sand (SP) and can be used for compacted fill. The suitability of potential import sources, if required, should be evaluated by sampling and laboratory testing prior to shipment to the project site. Imported fill should consist of sandy soils with less than 50% fines, and be free from debris, vegetation and roots, organics, contaminants, or rock particles larger than 6 inches.
B. Excavated Material Classification. Excavated material will be classified as either suitable or unsuitable for backfill around the structures as shown in Figure 02200-1. Unsuitable soil will be segregated further into subcategories depending on the characteristics of the soil. A general description of each category is shown below:

1. **Suitable Material.** Excavated sandy soils with less than 50 percent fines (passing the No. 200 Sieve) and free of vegetation and roots, peat, organics, sludge, debris, grit, and broken concrete fragments or rock larger than 6 inches.

2. **Unsuitable Material.** Material containing excessive amounts of organic matter, peat, blue clay, trash or debris; or as designated by the Engineer; or debris produced by clearing, grubbing, and demolition of existing structures, pavement, or pipe; or soil classified by test method ASTM D2486 as groups other than SP or SM; or not meeting the grading or classification specified in 2.1.c.1. Unsuitable material shall be segregated into the following subcategories:
   a. **Uncontaminated.** The uncontaminated soil is any material determined to be unsuitable for backfill that is free from sludge, debris, or material uncharacteristic with the natural alluvium.
   b. **Contaminated.** Contaminated soil is any material that is determined to be associated with the sludge disposal practice as described in 2.1.B. This will include soil that is adversely impacted by the sludge disposal, either by mixing of materials or leaching of contaminants.

   Contaminated soil is further segregated into the following subcategories:
   
   (1) **Non-Hazardous.** Material determined to be non-hazardous for the purpose of disposal of investigation derived wastes
   
   (2) **Hazardous.** Material determined to be hazardous, requiring special handling and disposal requirements.

3. Any material that does not meet the requirements of “suitable material” or is not incorporated into the project shall be disposed of as described in 3.9.

4. The Contractor shall bear the cost of all sampling, testing and permitting required to dispose of excess excavated material.

2-1b. **PLANT 2 ONSITE EXCAVATED MATERIALS.**

A. General. The subsurface soils are highly variable and generally consist of several feet of fill materials, underlain by alluvial deposits of alternating layers of very loose to dense silty sand and sand, medium stiff to hard clays and clayey silts, and some Peat deposits and organic soils overlying
the Talbert Aquifer which was reported at a depth of approximately 50 to 55 feet below the ground surface.

It is estimated that ½ to ¾ of the on-site soils to be excavated from the top 20 feet generally consist of silty sand (SM) and clean sand (SP) and can be used for compacted fill. The suitability of potential import sources, if required, should be evaluated by sampling and laboratory testing prior to shipment to the project site. Imported fill should consist of sandy soils with less than 50% fines, and be free from debris, vegetation and roots, organics, contaminants, or rock particles larger than 6 inches.

B. Excavated Material Classification. Excavated material will be classified as either suitable or unsuitable for backfill around the structures as shown in Figure 02200-1. Unsuitable soil will be segregated further into subcategories depending on the characteristics of the soil. A general description of each category is shown below:

1. Suitable Material. Excavated sandy soils with less than 50 percent fines (passing the No. 200 Sieve) and free of vegetation and roots, peat, organics, sludge, debris, grit, and broken concrete fragments or rock larger than 6 inches.

2. Unsuitable Material. Material containing excessive amounts of organic matter, peat, blue clay, trash or debris; or as designated by the Engineer; or debris produced by clearing, grubbing, and demolition of existing structures, pavement, or pipe; or soil classified by test method ASTM D2486 as groups other than SP or SM; or not meeting the grading or classification specified in 2.1.c.1. Unsuitable material shall be segregated into the following subcategories

   a. Uncontaminated. The uncontaminated soil is any material determined to be unsuitable for backfill that is free from sludge, debris, or material uncharacteristic with the natural alluvium.

   b. Contaminated. Contaminated soil is any material that is determined to be associated with the sludge disposal practice as described in 2.1.B. This will include soil that is adversely impacted by the sludge disposal, either by mixing of materials or leaching of contaminants.

Contaminated soil is further segregated into the following subcategories:

(1) Non-Hazardous. Material determined to be non-hazardous for the purpose of disposal of investigation derived wastes

(2) Hazardous. Material determined to be hazardous, requiring special handling and disposal requirements.
3. Any material that does not meet the requirements of “suitable material” or is not incorporated into the project shall be disposed of as described in 3.9.

4. The Contractor shall bear the cost of all sampling, testing and permitting required to dispose of excess excavated material.

2-2. **SUITABLE FILL MATERIAL REQUIREMENTS.**

A. General. Fill materials shall be suitable selected or processed clean, fine earth, rock, or sand; free from peat, grass, roots, brush, and other organic materials; and free from debris, contamination, or deleterious material.

Suitable materials may be obtained from onsite excavations, may be processed onsite materials, or may be imported provided these materials meet all the requirements in the contract documents. If imported materials are required to meet the requirements of this Section or to meet the quantity requirements of the project, the Contractor shall provide the imported fill materials and the required reports of test results at no additional expense to the Owner.

B. Unclassified Fill. Unclassified fill shall be used for non-structural embankment fill unless otherwise designated. Unclassified fill shall conform to the requirements of SSPWC Section 300-4, subject to the Engineer’s approval.

C. Imported Sand. Wherever the term “imported sand” is used in the Contract Documents, it shall be defined as sand having a minimum sand equivalent of 70 as determined by the latest revision of the State of California, Department of Transportation, Test Method No. CA 217.

D. The following types of imported granular materials are designated and defined as follows:

   1. Crushed Aggregate Base (CAB) shall conform to the requirements of SSPWC Section 200-2.2.

   2. Crushed Miscellaneous Base (CMB) shall conform to the requirements of SSPWC Section 200-2.4.

   3. Crushed Rock: Crushed rock shall be the product of crushing rock or gravel. Fifty percent of the particles retained on a 3/8-inch sieve shall have their entire surface area composed of faces resulting from fracture due to mechanical crushing. Not over 5 percent shall be particles that show no faces resulting from crushing. Less than 20 percent of the particles that pass the 3/8-inch sieve and are retained on the No. 4 sieve shall be waterworn particles. Gravel shall not be added to crushed rock.
Where crushed rock is specified on the Contract Documents, it shall conform to the following gradation:

<table>
<thead>
<tr>
<th>Sieve Sizes</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 inches</td>
<td>-</td>
</tr>
<tr>
<td>1 1/2- inches</td>
<td>-</td>
</tr>
<tr>
<td>1 inch</td>
<td>100</td>
</tr>
<tr>
<td>3/4 inch</td>
<td>90-100</td>
</tr>
<tr>
<td>1/2 inch</td>
<td>30-60</td>
</tr>
<tr>
<td>3/8 inch</td>
<td>0-20</td>
</tr>
<tr>
<td>No. 4</td>
<td>0-5</td>
</tr>
<tr>
<td>No. 8</td>
<td>-</td>
</tr>
</tbody>
</table>

4. Drainrock shall be crushed rock or gravel and free from slaking or decomposition under the action of alternate wetting or drying. The material shall be uniformly graded and shall meet the following gradation requirements:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percentage Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-inch</td>
<td>100</td>
</tr>
<tr>
<td>3/4-inch</td>
<td>90 - 100</td>
</tr>
<tr>
<td>3/8-inch</td>
<td>40 - 100</td>
</tr>
<tr>
<td>No. 4</td>
<td>25 - 40</td>
</tr>
<tr>
<td>No. 8</td>
<td>18 - 33</td>
</tr>
<tr>
<td>No. 30</td>
<td>5 - 15</td>
</tr>
<tr>
<td>No. 50</td>
<td>0 - 7</td>
</tr>
<tr>
<td>No. 200</td>
<td>0 - 3</td>
</tr>
</tbody>
</table>

The drainrock shall have a sand equivalent value not less than 75. The finish-graded surface of the drainrock immediately beneath hydraulic structures shall be stabilized to provide a firm, smooth surface upon which to construct reinforced concrete floor slabs.

E. Structure Backfill material shall conform to the requirements of SSPWC Section 300-3.5.1. Excavated sandy soils with less than 50 percent fines free from peat, debris, grit, broken concrete and rock fragments larger than 6 inches, organic contaminants, and other deleterious materials can be stockpiled for use as backfill provided they are environmentally acceptable.
F. Pervious Backfill material shall conform to the requirements of SSPWC Section 300-3.5.2.

G. Pipe Bedding Material. Unless otherwise indicated, pipe-bedding material shall be crushed rock, aggregate fill, granular soil with less than 7% fines, imported sand, or 3/4-inch maximum gravel as specified herein.

1. Type A Bedding material shall conform to the requirements for 3/4-inch Crushed Rock, 1-inch Crushed Rock, No. 3 Concrete Aggregate, No. 4 Concrete Aggregate, or Portland Cement Concrete Sand in SSPWC Section 200-1 for pipes larger than 24 inches in diameter. Type A Bedding material shall conform to the requirements for Type B Bedding material or the requirements for Portland Cement Concrete Sand in SSPWC Section 200-1 for pipes 24 inches or smaller in diameter.

2. Type B Bedding material shall conform to the requirements for 1-inch Crushed Rock or No. 4 Concrete Aggregate in SSPWC Section 200-1.

3. Type C Bedding Material. On-site sandy soils free of debris, organic matter, oversize particles (greater than 3 inches) and other deleterious substances can be used for backfill in the pipe zone, and should be compacted to a minimum 90% relative compaction. Jetting can be used to densify the backfill in the pipe zone if the sand equivalent (SE) value of the soil is greater than 30.

4. Pipe zone materials for ductile iron pipe with polyethylene wrap shall be granular soil, imported sand, or 3/8-inch maximum gravel in conformance with the requirements of SSPWC Section 200-1.

5. Pipe zone materials for System 2 steel piping shall be imported sand.

H. Sand-Cement Slurry materials shall conform to the requirements of SSPWC Section 201-1 for Trench Backfill Slurry.

I. Soil Cement material shall conform to the requirements of SSPWC Section 301-3.1.

J. Topsoil material shall conform to the requirements of SSPWC Section 212-1.1.

2-3. USE OF FILL MATERIAL TYPES.

A. The Contractor shall use the types of materials as designated herein for all required fill, backfill, and embankment construction hereunder. Material limits within pipe zone and trench zone are shown on the Contract Drawings.

B. Fill and backfill types shall be used in accordance with the following provisions:
1. Embankment fills shall be constructed of unclassified fill material, unless otherwise designated.

2. Pipe zone backfill, as defined under "Pipe and Utility Trench Backfill" herein, shall consist of the following materials for each pipe material listed below.
   a. Mortar coated pipe, concrete pipe, and uncoated ductile iron pipe shall be provided Type A Bedding, Type B Bedding, or Concrete Pipe Bedding materials as defined herein for pipe zone backfill material.
   b. Coal tar enamel coated pipe, polyethylene encased pipe, tape wrapped pipe, and other non-mortar coated pipe shall be backfilled with Portland cement concrete sand conforming to SSPWC Section 200-1 or Concrete Pipe Bedding material as defined herein for pipe zone backfill material.
   c. Plastic pipe and vitrified clay pipe shall be backfilled with 3/4-inch Crushed Rock conforming to SSPWC Section 200-1 or Concrete Pipe Bedding material as defined herein for pipe zone backfill material.

3. Trench zone backfill for pipelines as defined under "Pipe and Utility Trench Backfill" shall be on-site sandy soils free of debris, organic matter, oversize particles (greater than 6 inches) and other deleterious substances can be used for backfill in the trench zone.

4. Final backfill material for pipelines under paved areas, as defined under "Pipe and Utility Trench Backfill" shall be Crushed Aggregate Base (CAB) or Crushed Miscellaneous Base (CMB) material as defined herein.

5. Trench backfill in the pipe zone and final backfill for pipelines under structures shall be the same material as used in the pipe zone, except where concrete encasement is required by the Contract Documents.

6. Backfill around or behind structures shall consist of Structure Backfill as defined herein unless indicated otherwise in the Contract Documents.

7. Fill materials beneath structures shall be as follows:
   a. Fill beneath hydraulic structures or other water retaining structures with underdrain systems shall be Drainrock material, as defined herein, constructed to the limits and thicknesses shown or specified.
   b. Fill beneath structures without underdrain systems shall be a 2-ft thick layer of compacted crushed rock as defined herein. The crushed rock shall extend a minimum of 5-ft beyond the perimeter of the structure.
8. Backfill used to replace pipeline trench over-excavation shall consist of Type B Bedding material as defined in Subsection 2.1.G.2.

9. Backfill around manholes in public streets above the concrete cast-in-place base and below the street zone shall be by sand-cement slurry with at least 1.5 sacks of cement for each cubic yard of slurry.

PART 3 - EXECUTION

3-1. CLEARING, GRUBBING AND STRIPPING.

A. Prior to conducting any grading operation, existing structures and active underground utilities shall be protected and/or rerouted. Obstructions and any debris, remnants of manmade features, previously abandoned foundations, and pavements shall be removed. Soils containing peat, organic materials or debris shall be removed and not used as backfill material.

3-2. GRADING AND STOCKPILING.

A. The Contractor shall control grading in a manner to prevent water from running into excavations. Obstruction of surface drainage shall be avoided and means shall be provided whereby storm water flow is not interrupted in existing gutters, and other surface drains, or temporary drains. Storm water management plans shall be as specified in the General Requirements of these Specifications. Material for backfill or for protecting excavation in public roads from surface drainage shall be neatly placed and kept shaped so as to cause the least possible interference with public travel. Free access must be provided to all fire hydrants, watergates, meters, and private drives.

B. Finished grading at any point shall not vary more than 0.10 foot above or below the grade established by the Contract Documents.

3-3. STRUCTURE, ROADWAY, AND EMBANKMENT EXCAVATION.

A. General. Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. The removal of said materials shall conform to the lines and grades shown or ordered. Unless otherwise provided, the entire construction site shall be stripped of all vegetation, debris, and all deleterious materials, and such materials shall be removed from the site prior to performing any excavation or placing any fill. The
Contractor shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavations, and all pumping, ditching, or other measures for the removal or exclusion of water, including taking care of storm water, groundwater (dewatering if required), and wastewater reaching the site of the work from any source so as to prevent damage to the work or adjoining property.

Excavations shall be sloped or otherwise supported in a safe manner in accordance with applicable State of California safety requirements and the requirements of OSHA Safety and Health Standards for Construction (29CFR1926), and the Contract Documents. If sufficient space is available, temporary excavations in firm silty and clayey soils extending to a depth of approximately 15 feet may be sloped at 1:1 (horizontal:vertical). In the areas where poorly graded sand is encountered, temporary excavation slope should be maintained at 1.5:1 (h:v) or flatter. Temporary shoring will be required for steeper and deeper excavations. Permanent slopes should be maintained no steeper than 2:1 (h:v).

The excavated area should be observed by the project geotechnical engineer for any potential sign of distress within or around the excavated area, and to clear all loose and soft spots and possible disturbance to existing facilities. Excavation below the existing groundwater level (approximately EL5 to EL8) will encounter wet and soft clays, peat, and organic materials, and will require the use of excavators with low contact pressure. The bottom of the excavation will require stabilization prior to mobilization of heavy construction equipment.

Structure excavation shall conform to the dimensions and elevations indicated on the Contract Documents for each structure including trenching for adjacent piping. In locations where soil of suitable bearing value is encountered at a different elevation from that indicated on the Contract Documents, the Engineer may direct in writing that the excavation be carried to elevations above or below those indicated on the Contract Documents. Excavation shall extend at least 24 inches from walls and footings to allow for placing and removal of forms, installation of services, and inspection. Undercutting will not be permitted.

Where a structure would be located partially on fill and partially on undisturbed native material, the entire area shall be over-excavated to a depth of 6 inches below the elevations indicated and recompacted as directed in the tabulation in Article 3.13.E of this specification section.

Safe and suitable ladders that project 2 feet above the top of the trench shall be provided for all trenches greater than 4 feet in depth. A minimum of one ladder shall be provided for each 50 feet of open trench.

**B. Excavation Beneath Structures and Embankments.** Except where otherwise specified for a particular structure or ordered by the Engineer, excavation shall be carried to the grade of the bottom of the footing or
slab. Where shown or ordered, areas beneath structures or fills shall be over-excavated. The subgrade areas beneath embankments shall be excavated to remove not less than the top 8 inches of native material and where such subgrade is sloped, the native material shall be benched. When such over-excavation is shown, both over-excavation and subsequent backfill to the required grade shall be performed by the Contractor. When such over-excavation is not shown on the plan and not specified but is ordered by the Engineer, such over-excavation and any resulting backfill will be paid for under a separate unit price bid item if such bid item has been established and approved by the Engineer prior to commencing the work; otherwise payment will be made in accordance with a negotiated price. After the required excavation or over-excavation has been completed, the exposed surface shall be scarified to a depth of 8 inches, brought to optimum moisture content, and rolled with heavy compaction equipment to obtain the required relative compaction.

C. Excavation in Poor Soil. If excessively wet, soft, spongy, unstable, or otherwise unsuitable material, as determined by the Engineer, is encountered at the bottom of the excavation or the surface upon which the pipe bedding material is to be placed including the vertical sides of a specified pipe trench, the unsuitable material shall be removed to a depth as required by the Engineer, disposed of, and replaced with a minimum 2 feet of ¾-inch crushed rock to provide foundation support and to stabilize the mass excavation subgrade where soft soils are encountered and cannot effectively support conventional construction equipment. A Geotex 1601, or equal, non-woven geotextile shall be used as a separation layer between the excavated subgrade and the crushed rock to avoid the rocks from sinking into the soft subgrade materials.

Removal and replacement of material so ordered shall be paid for by the Owner as "Extra Work" unless provided for in the Schedule of Prices. The Contractor shall maintain adequate dewatering procedures to ensure that an otherwise stable foundation will not be rendered unfit due to accumulation or movement of water in the excavation. If the necessity for such additional excavation and material has been occasioned by an act or failure to act on the part of the Contractor, the Contractor shall bear the full expense of the additional excavation and backfill to the required depth.

1. Overexcavation. A minimum of 2-ft of over-excavation shall be required for foundation support on all below grade, water bearing structures. Where excavation is carried below the limits shown on the Contract Documents, adjustments shall be made as determined by the Engineer to meet requirements incurred by the deeper excavation beneath pipe or structure. Overdepth excavation in such locations shall be rectified by backfilling with approved fill or bedding material or other means specified. Overexcavation not required by the Contract
Documents or directed by the Engineer shall be rectified at the expense of the Contractor.

2. **Excavation Beneath Paved Areas.** Excavation under areas to be paved shall extend to the bottom of the aggregate base, if such base is called for; otherwise it shall extend to the paving thickness. After the required excavation has been completed, the exposed surface shall be scarified to a depth of at least 12 inches, brought to optimum moisture content, and rolled with heavy compaction equipment to obtain a minimum percent of maximum dry density compaction as directed in the tabulation in Article 3.13.E of this specification section.

3. Excavation Subgrade and Below Subgrade:

   a. Excavate and shape subgrade to line, grade, and cross-section shown on Drawings. Following receipt of written acceptance for the subgrade by the Engineer, compact the subgrade with approved equipment until the top 6-inches is compacted to 95 percent of maximum dry density at optimum moisture content as determined by ASTM D 1557, depending upon the appropriate zone or location of fill in accordance with the requirements of the tabulation in Article 3.13.E “Compaction Requirements” of this specification section. Remove all soft, loose, or otherwise unsuitable material and replace with suitable sandy material. The finished subgrade shall be firm, hard and unyielding. The subgrade shall be considered to extend over the full width of the base course. Compaction shall extend 18 inches beyond the edge of paving, curb, or form.

   b. Where the Engineer deems subgrade material to be unsatisfactory, excavation below subgrade will be required to such depths as necessary to remove the unsatisfactory material. Excavation below grade shall be of the same classification as that above it provided it is removed in the same operation as the normal excavation. Special equipment or hand excavation may be required because of the presence of shallow utilities or other unforeseen conditions.

4. **Notification of Engineer.** The Contractor shall notify the Engineer at least 2 working days in advance of completion of any structure excavation and shall allow the Engineer a review period of at least one day before the exposed foundation is scarified and compacted or is covered with backfill or with any construction materials.

3-4. **PIPELINE AND UTILITY TRENCH EXCAVATION.**

   A. **General.** Any water evident in the excavation shall be pumped out or otherwise removed per Subsection 1.5 as necessary to keep the bottom of the excavation free and clear of water during the progress of the work.
B. **Pipes Over 42-inches In Diameter.** The overall trench width for pipes with diameters larger than 42 inches shall not be more than 24 inches nor less than 12 inches wider than the largest outside diameter of the pipe to be laid therein, measured at a point 12 inches above the top of the pipe, exclusive of branches. Excavation and trenching shall be true to line so that the pipe is centered within the trench and a clear space of not more than 12 inches nor less than 6 inches in width is provided on each side of the largest outside diameter of the pipe in place. For this purpose, the largest outside diameter shall be the outside diameter of the bell on bell and spigot pipe.

C. **Pipes Under 42-inches In Diameter.** The overall trench width for pipes with diameters of 42 inches or less shall not be more than 16 inches nor less than 12 inches wider than the largest outside diameter of the pipe to be laid therein, measured at a point 12 inches above the top of the pipe, exclusive of branches. Excavating and trenching shall be true to line so that the pipe is centered within the trench and a clear space of not more than 8 inches nor less than 6 inches in width is provided on each side of the largest outside diameter of the pipe in place. For this purpose, the largest outside diameter shall be the outside diameter of the bell, on bell and spigot pipe.

Where the trench width, measured at a point 12 inches above the top of the bell of the pipe is wider than the maximum set forth above for all pipe sizes, the trench area around the pipe shall be set with steel reinforcing and backfilled with Class C concrete to form a cradle for the pipe as shown on the Figure 02200 S-020. Special care shall be used when pouring the concrete cradle around the pipe so no displacement will occur. In the event of movement, the Contractor shall remove and replace all pipe and cradle affected. Concrete cradle work as required above shall be performed at the expense of the Contractor and shown on the record drawings.

D. **Limit of Open Trench.** Except by express written permission of the Engineer, the maximum amount of open trench permitted in any one location shall be 500 feet, or the length necessary to accommodate the amount of pipe installed in a single day, whichever is less. All trenches shall be fully backfilled and paved with the first course of pavement at the end of each day or, in lieu thereof, shall be covered by heavy steel plates adequately braced and capable of supporting vehicular traffic in those locations where it is impractical to backfill at the end of each day. Base paving finished to grade shall be flush with existing grade and finished smooth to create a smooth ride. The above requirements for backfilling or use of steel plate will be waived in cases where the trench is located further than 100 feet from any traveled roadway or occupied structure. In such cases, however, barricades and warning lights meeting OSHA...
requirements shall be provided and maintained. The maximum working length allowed without the first course of pavement is 500 feet, unless otherwise approved by the Engineer.

E. **Trench Bottom.** The bottom of the trench shall be excavated uniformly to at least 12 inches below the grade of the bottom of the pipe. The pipe bedding of 12 inches minimum thickness shall then be placed on the trench bottom and shall be given a final trim, using a string line for establishing grade, such that each pipe section when first laid will be continually in contact with the ground along the extreme bottom of the pipe. Rounding out the trench to form a cradle for the pipe will not be allowed. Trench bottom raked by toothed excavators is not acceptable.

F. **Trench Over-Excavation.** Where the Drawings indicate that trenches shall be over-excavated, they shall be excavated to the depth shown, and then backfilled to the grade of the bottom of the pipe.

G. **Excavation in Poor Soil.** If excessively wet, soft, spongy, unstable, or otherwise unsuitable material, as determined by the Engineer, is encountered at the bottom of the excavation or the surface upon which the pipe bedding material is to be placed including the vertical sides of a specified pipe trench, the unsuitable material shall be removed to a depth as required by the Engineer, disposed of, and replaced with approved fill, crushed rock, or bedding material wrapped in geotextile. Removal and replacement of material so ordered shall be paid for by the Owner as "Extra Work" unless provided in the schedule of prices. The Contractor shall maintain adequate dewatering procedures to ensure that an otherwise stable foundation will not be rendered unfit due to accumulation or movement of water in the excavation. If the necessity for such additional excavation and material has been occasioned by an act or failure to act on the part of the Contractor, the Contractor shall bear the full expense of the additional excavation and backfill to the required depth.

H. Where pipelines are to be installed in embankment or structure fills, the fill shall be constructed to a level at least one foot above the top of the pipe before the trench is excavated.

I. Obtain Engineer’s approval before beginning excavation. Complete clearing and grubbing prior to the start of trenching. Do not permit excavated materials to cover brush or trees prior to disposal.

3-5. **OVER-EXCAVATION NOT ORDERED, SPECIFIED, OR SHOWN.**

A. Any over-excavation by the Contractor carried below the grade not ordered, specified, or shown, shall be backfilled to the required grade with the specified material and compaction. Such work shall be performed by the Contractor at his own expense.
3-6. **EXCAVATION IN LAWN AREAS.**

A. Where excavation occurs in lawn areas, the sod shall be carefully removed and stockpiled to preserve it for replacement. Excavated material may be placed on the lawn; provided, that a drop cloth or other suitable method is employed to protect the lawn from damage. The lawn shall not remain covered for more than 72 hours. Immediately after completion of backfilling, compaction and testing of the pipeline, the sod shall be replaced in a manner so as to restore the lawn as near as possible to its original condition and to the satisfaction of the Engineer. Contractor shall provide new sod if stockpiled sod has remained so for more than 72 hours within the scope of the contract. The top 3” of backfill shall remain uncompacted to promote growth. Existing irrigation lines shall be marked, isolated and replaced in kind.

3-7. **EXCAVATION IN VICINITY OF TREES.**

A. Except where trees are shown to be removed, trees shall be protected in place from injury during construction operations. No tree roots over 2 inches in diameter shall be cut without express permission of the Engineer. Trees shall be supported and irrigated during excavation by means previously reviewed by the Engineer. The Contractor shall replace all trees that die that are shown on the Contract Drawings as being protected in place.

3-8. **ROCK EXCAVATION.**

A. Rock excavation shall include removal and disposal of the following: (1) all boulders measuring 1/3 of a cubic yard or more in volume; (2) all rock material in ledges, bedding deposits, and unstratified masses which cannot be removed without systematic drilling and blasting; (3) concrete or masonry structures which have been abandoned; and (4) conglomerate deposits which are so firmly cemented that they possess the characteristics of solid rock and which cannot be removed without systematic drilling and blasting.

Where solid rock, or rock excavation as defined above, is encountered, it shall be removed below grade and the excavation backfilled with approved pipe-bedding material to provide a compacted foundation cushion with a minimum thickness of 3 inches under the pipe bell. Removal of rock and additional pipe bedding material over and above bedding required in the Contract Documents shall be paid for by the Owner as "Extra Work" unless provided for in the Schedule of Prices.
Cobbles or boulders encountered at the trench bottom or pipe subgrade shall be removed a minimum of 12-inches beneath the pipe and replaced with approved pipe bedding material. Bedding material shall be compacted as directed in the tabulation in Article 3.13.E of this specification section and per the Contract Documents to provide uniform support and a firm foundation.

B. Said rock excavation shall be performed by the Contractor; provided, that should the quantity of rock excavation be affected by any change in the scope of the work, an appropriate adjustment of the contract price will be made under a separate bid item if such bid item has been established; otherwise payment will be made in accordance with a negotiated price.

C. Explosives and Blasting. Blasting will not be permitted, except by express permission of the Engineer and other governing agencies on a case-by-case basis. The use of explosives will be subject to the approval and regulations of all agencies having jurisdiction. If blasting is utilized at the site of the Work, the Contractor shall take all precautions and provide all protective measures necessary to prevent damage to property and structures or injury to person. Prior to blasting, the Contractor shall secure all permits required by law for blasting operations and shall provide any additional hazard insurance required by the Owner. The Contractor shall have fully qualified and experienced blasting personnel and foreman in charge of all blasting operations.

D. All operations involving the handling, storage, and use of explosives shall be conducted in accordance with the requirements of the OSHA Standards for Construction, and in accordance with all local laws and regulations.

3-9. DISPOSAL OF EXCESS EXCAVATED MATERIAL.

A. The Contractor shall remove and legally dispose of all excess excavated material at a site selected by the Contractor and reviewed by the Engineer. All incurred expenses including soil handling, transportation and tipping fees, if applicable, shall be borne by the Contractor.

B. All unsuitable and surplus material outside of the confines of the treatment plants shall be disposed of in a legal manner by the Contractor and all costs associated with disposal shall be borne by the Contractor. No unsuitable or surplus material shall be dumped on private property unless written permission is furnished by the owner of the property and unless a grading permit is issued from the local jurisdiction. In addition to written permission from land owner, the land owner and contractor shall provide the Owner with release of all claims arising from said dumping of materials.
C. Unsuitable and surplus material within the confines of the treatment plants shall be disposed of by the Contractor as specified above.

D. Excess unsuitable and surplus materials shall be kept separated from materials of other Contractors working in the same area.

3-10. PROTECTION OF SUBGRADE.

A. After preparing the subgrade as specified, all traffic on the subgrade shall be avoided. Should it be necessary to haul over the prepared subgrade, the Contractor shall drag and roll the traveled way as frequently as may be necessary to remove ruts, cuts, and breaks in the surface. All cuts, ruts, and breaks in the surface of the subgrade that are not removed by the above operations shall be raked and hand tamped. All equipment used for transporting materials over the prepared subgrade shall be equipped with pneumatic tires.

B. Continued use of sections of prepared subgrade for hauling, so as to cut up or deform it from the true cross-section, will not be permitted. The Contractor shall protect the prepared subgrade from all traffic.

C. The Contractor will be required to plank the subgrade before hauling materials or equipment over it.

D. The subgrade shall be maintained in the finished condition until the first layer of structural base placed.

E. The Engineer has the right to test the reworked subgrade and approve or disapprove the subgrade depending on its condition.

3-11. FILL – GENERAL.

A. Fill consists of the preparation and placement of materials for crushed rock base under structures, pipeline bedding, backfill for excavations and fill for roadways and embankments. In public rights-of-way, the requirements of the local agency having jurisdiction shall take precedence over these Specifications.

B. Fill shall not be dropped directly upon any structure or pipe. Backfill shall not be placed around or upon any structure until the concrete has attained specified strength to withstand the loads imposed. Backfill around water retaining structures shall not be placed until the structures have been hydrostatically tested and coated, and the structures shall be full of water while backfill is being placed.

C. Material used in the work shall be uniform and shall contain no trash, wood, vegetation, sludge, peat and no rocks or clods larger than the size allowed by the Contract Documents. No material greater than 4 inches in
any dimension shall be placed within 1 foot of any pipe, manhole or structure. Excavated material and material from borrow sites may be used where they meet the requirements of the Contract Documents. Blending or other processing may be necessary before a material is acceptable to the Engineer. All costs for testing, processing and transporting materials are included in the Contract price.

D. Except for drainrock materials being placed in over-excavated areas or trenches, fill shall be placed after all water is removed from the excavation.

E. For vaults and yard structures located within the top 15-feet of grade, a minimum 2 feet of compacted fill shall be used. The compacted fill shall extend a minimum of 5-feet beyond the perimeter of the footings or foundation mat. The compacted fill can be placed on stiff clays or dense sands. Local loose and soft spots should be removed and replaced with compacted fill. Excavated sandy soils with less than 50% fines free from peat, debris, grit, broken concrete, and rock fragments larger than 6 inches, organic contaminants, and other deleterious materials can be stockpiled for use as backfill. A schematic diagram of the fill profile is shown in Figure 02200-3.

F. For heavy structures extending more than 15-feet below grade, piles shall be used unless otherwise noted on the Drawings. A minimum of 2-feet of compacted crushed rock shall be provided under the foundations. The compacted crushed rock can be placed on stiff clays or dense sands. Local loose and soft spots should be removed and replaced with compacted fill prior to placing rock. A schematic diagram of the fill profile is shown in Figure 02200-3.

3-12. PLACING AND SPREADING OF BACKFILL MATERIALS.

A. Fill materials shall be carefully placed, leveled and compacted in horizontal layers of the depth specified in the Contract Documents. Structural fill shall be placed in uniform, horizontal loose lifts not exceeding 8 inches in thickness, moisture conditioned to within 2% of the optimum moisture content, and compacted by mechanical means to at least 95% relative compaction determined by the ASTM Test Method D1557. The fill should be tested a minimum one test per lift for compliance with the specified relative compaction. Each layer of fill material shall cover the length and width of the area to be filled before the next layer of material is placed. The moisture content of the material shall be controlled and water shall be applied as necessary to achieve the specified compaction and for the prevention of dust nuisance. No fill or rock shall be placed on standing water in any excavation.
B. **Structural Base.** The fill under structures, including fill to replace unsuitable material removed below the specified excavation or unauthorized over-excavation, shall be constructed in horizontal layers of crushed rock not to exceed 8 inches in depth, or if under footings, the heights of the walls or footings shall be increased, or space shall be refilled with Class C concrete at the expense of the Contractor, as may be directed by the Engineer. Any fill material used shall be compacted to a minimum relative compaction of 95 percent throughout.

Where the underlying soil has been disturbed by any activity, such as clearing and grubbing, it shall be compacted to a minimum relative compaction of 95 percent before placing any fill.

C. **Structural Backfill.** All backfill around structures shall be made with select material or imported sand compacted to a minimum relative compaction of 95 percent up to the street zone, moisture conditioned to within 2% of the optimum moisture content. Compaction shall be performed in uniform, horizontal loose lifts not to exceed 8 inches in thickness. No backfill shall be placed against concrete structures until the 28-day concrete strength has been reached as specified. The fill should be tested a minimum one test per lift for compliance with the specified relative compaction.

D. During spreading each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer. Pipe zone backfill materials shall be manually spread around the pipe so that when compacted the pipe zone backfill will provide uniform bearing and side support.

E. Where the backfill material moisture content is below the optimum moisture content water shall be added before or during spreading until the proper moisture content is achieved.

F. Where the backfill material moisture content is too high to permit the specified degree of compaction the material shall be dried until the moisture content is satisfactory, at or slightly above optimum moisture content.

3-13. **COMPACTION OF FILL MATERIALS.**

A. Each layer of fill shall be mechanically compacted using proper compaction equipment (not rubber tire or wheel rolling) to the specified percentage of maximum dry density at optimum moisture content. Equipment that is consistently capable of achieving the required degree of compaction shall be used and each layer shall be compacted over its entire area while the material is at the required moisture content.
The fill shall be placed in horizontal layers of the specified depths or of such depths approved by the Engineer and compatible with the compacting equipment being used and the backfill material being placed. Each layer shall be evenly spread, properly moistened, or dried as necessary and compacted to the specified relative compaction. Any damage or displacement to pipes or structures as a result of the Contractor’s operation shall be repaired or replaced at the Contractor’s expense.

B. Fill on reservoir and structure roofs shall not be placed until at least 30 days after the concrete roof slab has been placed or the concrete has reached design strength as approved by the Engineer. Equipment weighing more than 10,000 pounds when loaded shall not be used on a roof. A roller weighing not more than 8,000 pounds shall be used to compact fill on a roof.

C. Flooding, ponding, or jetting shall not be used to densify any fill materials with the exception of holes remaining from the extraction of H-beams, plates and piles or otherwise approved by the Engineer.

D. Equipment weighing more than 10,000 pounds shall not be used closer to walls than a horizontal distance equal to the depth of the fill at that time, but not less than 5 feet. Hand operated power compaction equipment shall be used where use of heavier equipment is impractical or restricted due to weight limitations.

E. Compaction Requirements. The following compaction test requirements shall be in accordance with ASTM D 1557. Where agency or utility company requirements govern, the highest compaction standards shall apply.
<table>
<thead>
<tr>
<th>Location or Use of Fill</th>
<th>Percentage of Maximum Density</th>
</tr>
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<tbody>
<tr>
<td>Pipe zone backfill of bedding material and over-excavated zones under bedding</td>
<td>90</td>
</tr>
<tr>
<td>Trench zone backfill material</td>
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<tr>
<td>Street zone backfill of compacted sub base and base material</td>
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<td>Street zone final backfill, not beneath paved areas or structures</td>
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<tr>
<td>Street zone backfill of compacted aggregate base material</td>
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<tr>
<td>Embankments, not beneath paved areas or structures</td>
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<tr>
<td>Embankments, beneath paved areas or structures</td>
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</tr>
<tr>
<td>Backfill beneath structures, hydraulic structures</td>
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<tr>
<td>Backfill around structures, on reservoir or structure roof</td>
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</tr>
<tr>
<td>Trench Zone backfill, beneath paved areas, within a depth of 12-inches</td>
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</tr>
<tr>
<td>Trench Zone backfill, beneath paved areas, below 12-inches</td>
<td>90</td>
</tr>
</tbody>
</table>

3-14. **PIPE AND UTILITY TRENCH BACKFILL.**

A. **Pipe Zone Backfill.** The pipe zone is defined as that portion of the vertical trench cross-section lying between a plane 12 inches below the bottom surface of the pipe, i.e., the trench subgrade foundation line, and a plane at a point 12 inches above the top surface of the pipe. The bedding for flexible the pipe is defined as that portion of pipe zone backfill material between the trench subgrade foundation line and 12 inches above the bottom top of the pipe.

All backfill shall be placed in uniform, horizontal loose lifts not exceeding 8 inches in thickness, moisture conditioned as necessary, and compacted to at least 90% of the maximum dry density determined by the ASTM Test Method D1557. The fill shall be tested a minimum one test per lift and
B. Bedding. The bottom of a pipe trench excavation indicated on Figure 02200 S-010 is the foundation line where pipe-bedding material is placed. Contractor shall replace any material below the foundation line that has been disturbed or removed during excavation at no additional cost to the Owner. Material shall be replaced with crushed rock bedding, CAB, CMB as directed by the Engineer. Bedding shall be compacted to minimum relative density of 90 per cent before laying pipe. Crushed rock bedding shall be mechanically consolidated to the satisfaction of the Engineer before laying pipe. Where poor soil is encountered, it shall be replaced as specified in the Pipeline and Utility Trench Excavation section of this specification.

At least 12 inches of bedding materials should be placed at the bottom of the trench prior to pipe placement. In areas where the native soil exposed at the bottom of the excavation is adequate for use as bedding material, it shall be scarified to a depth of six inches and compacted.

C. After compacting the bedding the Contractor shall perform a final trim using a string line for establishing grade, such that each pipe section when first laid will be continually in contact with the bedding along the extreme bottom of the pipe. Prior to backfilling, Contractor shall ensure that pipe spigot is fully pressed and locked into pipe bell per manufacturer’s requirements.

Pipe shall be carefully bedded as shown on Figure 02200 S-010. Particular attention shall be given to the underside of the pipe and fittings to provide a firm bedding support along the full length of the pipe. The Contractor shall be responsible for accurately shaping the bedding underneath the pipe bells such as bell holes shaped to allow the pipe bell to be fully supported, including full support along the pipe barrel without point loading.

Each bell and spigot joint shall be recessed in the bedding material in such a manner as to minimize loading on the bell of the pipe. CAB and CMB material shall be compacted to a minimum relative density of 95 percent. Backfilling shall be carried on simultaneously on each side of the pipe to prevent displacement. Care shall be exercised in backfilling to avoid damage to the pipe. Contractor shall sluice the bedding material mechanically by hand underneath pipe haunches prior to covering pipe completely with compacted bedding material.

D. The pipe zone shall be backfilled with the specified backfill material. The Contractor shall exercise care to prevent damage to the pipeline coating,
cathodic bonds, or the pipe itself during the installation and backfill operations.

E. **Pipe Zone.** On-site sandy soils free of debris, organic matter, oversize particles (greater than 3 inches) and other deleterious substances can be used for backfill in the pipe zone, and should be compacted to a minimum 90 percent relative compaction. Jetting can be used to densify the backfill in the pipe zone if the sand equivalent (SE) value of the soil is greater than 30. However, jetting should be assisted by using vibratory or mechanical devices to ensure no voids or loose spots are left within the backfill materials. If the SE value of soils is less than 30, jetting may not be the most appropriate compaction method, in which case the pipe zone backfill should be manually compacted without damaging the pipe. In both cases, care should be taken to densify the soils below the spring line of the pipe.

F. Backfill at materials for manholes over 60-inches in diameter shall be the same specified backfill material composition and compaction as in the adjacent pipe trench. Backfill materials for manholes 60-inches and less in diameter shall be backfilled with sand-cement slurry per Subsection 2.2.H.

G. **Trench Zone Backfill.** After the pipe zone backfill has been placed as specified above, and after all excess water has completely drained from the trench, backfilling of the trench zone may proceed. The trench zone is defined as that portion of the vertical trench cross-section lying between a plane 12 inches above the top surface of the pipe and a plane at a point 30 inches below the finished surface grade, or if the trench is under pavement, 18 inches below the roadway subgrade. If concrete or sand-cement slurry backfill are used, the Contractor shall secure the pipe to prevent flotation. On-site sandy soils free of debris, organic matter, oversize particles (greater than 6 inches) and other deleterious substances can be used for backfill in the trench zone. Trench backfill under pavement shall be compacted to a minimum 95% of the maximum laboratory dry density within a depth of 12 inches below the pavement section, and a minimum 90% below 12 inches. All aggregate base for pavements shall be compacted to 95% relative compaction. The trench zone may be compacted mechanically provided that the compaction equipment does not affect the pipe integrity.

H. **Final Backfill.** Final backfill is all backfill in the trench cross-sectional area within 18 inches of finished grade, or if the trench is under pavement, all backfill within 18 inches of the roadway surface. Street zone backfill shall also include provision for a minimum thickness of 30 inches of compacted sub base material below final aggregate base subgrade material under paved areas. The street zone backfill shall be compacted as directed in the tabulation in Article 3.13.E of this specification section.
3-15. **EMBANKMENT CONSTRUCTION.**

A. Embankments and roadway fills shall mean all earth fills in holes, pits or depressions necessary to bring the final grade or pavement subgrade to the specified contours.

B. The area where an embankment is to be constructed shall be cleared of all vegetation, roots and deleterious materials. Following this, the surface shall be moistened, scarified to a depth of 6 inches, and rolled or otherwise mechanically compacted. Embankment fill material shall be placed and spread evenly in horizontal layers. Each layer shall be moistened or aerated, as necessary. Each layer shall not exceed 6 inches of compacted thickness. The embankment fill and the scarified layer of underlying ground shall be compacted to 90 or 95 percent of maximum dry density per the requirements of the Article 3.13.E. of this specification section.

C. Material for embankments or roadway fills may consist of excavated material from structures or of a mixture of such excavated materials and materials borrowed by the Contractor from other approved sources. The material shall have no rocks or clods larger than 6 inches and shall be compacted in 8-inch maximum lifts to a minimum relative compaction of 90 percent, up to the street zone.

D. If the ground surface is in a loose, uncompacted condition, it shall be compacted to a minimum relative compaction as directed in the tabulation in Article 3.13.E of this specification section if included in the street zone.

E. No material shall be placed beyond the sloping lines of embankment unless so ordered by the Engineer. Compaction shall be as specified for each zone.

F. When an embankment fill is to be made and compacted against hillsides or fill slopes steeper than 4:1, the slopes of hillsides or fills shall be horizontally benched to key the embankment fill to the underlying ground. A minimum of 12 inches normal to the slope of the hillside or fill shall be removed and recompressed as the embankment fill is brought up in layers. Material thus cut shall be recompressed along with the new fill material at the Contractor’s expense. Hillside or fill slopes 4:1 or flatter shall be prepared in accordance with Paragraph A, above.

G. Where embankment or structure fills are constructed over pipelines, the first 4 feet of fill over the pipe shall be constructed using light placement and compaction equipment that does not damage the pipe.

End of Section
OCSD Section 02200-2

BRACED EXCAVATIONS

LATERAL EARTH PRESSURE

\[ q \text{ (Surcharge)} \]

\[ P = P_d + P_s \]

\[ = 0.4q + 40H_1 \text{ (300 psf minimum)} \]

\[ P_d = 300 \frac{H_2}{2} \leq 2,000 \text{ psf} \]

(appplied over twice the pile width)

TIEBACKS

ACTIVE WEDGE LINE

\[ \theta = 60^\circ \]

\[ B = 10\text{–}15 \text{ degrees} \]

\[ C = 10 \text{ ft (minimum)} \]

\[ l_u = \text{Unbonded length, 20’ min beyond active wedge (not to be used for tieback capacity)} \]

\[ l_b = \text{Bonded length, 20’ min (allowable tieback length for capacity)} \]

\[ f_{all} = \text{Allowable tieback friction/square foot surface area} = 2,000 \text{ psf} \]

Notes:

1. All values of height (H) in feet, pressure (P) and surcharge (q) in pounds per square foot (psf).

2. Values for temporary excavations in medium stiff to stiff clay using braced flexible walls.

3. For traffic surcharge, assume a 250 psf uniform pressure along the top 10 feet.

4. Earth pressures assume no hydrostatic pressures. If hydrostatic pressures are allowed to build up, the incremental earth pressures below the groundwater level should be reduced by 50 percent and added to hydrostatic pressure for total lateral pressure.
NOTE:
TRENCH WIDTH, BEDDING AND BACKFILL MATERIALS, COMPACTION AND PAVING PER SPECIFICATIONS.
### OCSD Section 02200-S-020

**Type I**

- **Existing Sewer**
- **2' Min.**
- **Concrete Encasement of VCP (or install ductile iron pipe w/o encasement)**
- **Banded Rubber Couplings (Typ.)**

**Type II**

- **3' Min. Clearance**
- **6' Min. (Typ.)**
- **Pipe Encasement Per S-100**

**Depth of Cover**

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<th>8' TO 16'</th>
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<td>10'</td>
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**NOTE:**

( ) Denotes Metric System.
OCSD Section 02201

GEOTEXTILE SEPARATION AND STABILIZATION

PART 1 – GENERAL

1-1. SECTION INCLUDES.

A. Separation and Stabilization Geotextile:
   1. This section is applicable to the use of a geotextile in wet, saturated conditions to provide the coincident functions of separation and filtration. In some installations, the geotextile may also provide reinforcement. This section shall only be used for work performed on OCSD property.

1-2. RELATED SECTIONS.

A. OCSD Earthwork section.

B. OCSD Preparation of Pavement Subgrade section.

1-3. REFERENCES.


B. AASHTO Test Standards:

C. American Society for Testing and Materials (ASTM):


E. Geosynthetic Accreditation Institute - Laboratory Accreditation Program (GAI-LAP).


1-4. DEFINITIONS.

A. California Bearing Ratio (CBR): The ratio of (1) the force per unit area required to penetrate a soil mass with a 3 sq in circular piston (approximately 2 in diameter) at the rate of.05 in/min. to 2 that required for corresponding penetration of a standard material, refer to ASTM D 1883.
B. Minimum Average Roll Value (MARV): Property value calculated as typical minus two standard deviations. Statistically, it yields a 97.7 percent degree of confidence that any sample taken during quality assurance testing will exceed value reported.

C. Typical Roll Value: Property value calculated from average or mean obtained from test data.

1-5. SUBMITTALS.

A. Submittals, including samples of materials, shall be in accordance with the General Requirements.

1. Certification:
   a. The Contractor shall provide the Engineer a certificate stating the name of the geotextile manufacturer, product name, style, chemical compositions of filaments or yarns and other pertinent information to fully describe the geotextile.
   b. The Manufacturer is responsible for establishing and maintaining a quality control program to assure compliance with the requirements of the specification. Documentation describing the quality control program shall be made available upon request.
   c. The manufacturer’s certificate shall state that the furnished geotextile meets MARV requirements of the specification as evaluated under the manufacturer’s quality control program. The certificate shall be attested to by a person having legal authority to bind the Manufacturer.

2. Manufacturing Quality Control (MQC) test results shall be provided upon request.

1-6. DELIVERY, STORAGE, AND HANDLING.

A. Geotextile labeling, shipment and storage shall follow ASTM D 4873.

B. Product labels shall clearly show the manufacturer or supplier name, style name, and roll number.

C. Each shipping document shall include a notation certifying that the material is in accordance with the manufacturer’s certificate.

D. Each geotextile roll shall be wrapped with a material that will protect the geotextile from damage due to shipment, water, sunlight, and contaminants.
E. The protective wrapping shall be maintained during periods of shipment and storage. If the wrapping is damaged prior to installation, the outer wrap of geotextile material must be discarded before installation.

F. During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from the following: Site construction damage, extended exposure to ultraviolet (UV) radiation, precipitation, chemicals that are strong acids or strong bases, flames, sparks, temperatures in excess of 160 deg F and any other environmental condition that might damage the geotextile.

1-7. QUALITY ASSURANCE SAMPLING, TESTING, AND ACCEPTANCE.

A. Geotextile:

1. Geotextiles shall be subject to sampling and testing to verify conformance with this specification. Sampling for testing shall be in accordance with ASTM D 4354.

2. Acceptance shall be in accordance with ASTM D 4759 based on testing of either conformance samples obtained using Procedure A of ASTM D 4354, or based on manufacturer’s certifications and testing of quality control samples obtained using Procedure B of ASTM D 4354.


B. Sewn Seams:

1. For seams that are to be sewn in the field, the Contractor shall provide at least a 6 ft length of sewn seam for sampling by the Engineer before the geotextile is installed.

2. For seams that are sewn in the factory, the Engineer shall obtain samples of the factory seams at random from and roll of geotextile that is to be used on the project.

3. If seams are to be sewn in both directions, samples of seams from both directions shall be provided.

4. For seams that are field sewn, the seams sewn for sampling shall be sewn using the same equipment and procedures as will be used for the production seams.

5. The seam assembly description shall be submitted by the Contractor along with the sample of the seam. The description shall include the seam type, sewing thread, and stitch density.
PART 2 – PRODUCTS

2-1. **MATERIALS.**

A. Geotextile:

1. The geotextile construction shall be woven slit film polypropylene geotextile; individual slit films woven together in manner to provide dimensional stability relative to each other including selvages.

2. Resistant to UV degradation and biological and chemical environments normally encountered in soils.

3. Minimum Average Roll Values (MARV) for woven geotextile (SI Geosolutions’ Geotex 4x4, Mirafi’s Geolon HP570, or equal):

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Units</th>
<th>Property Requirement (Machine Direction x Cross-machine Direction)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wide Width Tensile Strength (at ultimate)</td>
<td>ASTM D 4595</td>
<td>lb/ft</td>
<td>4,800 x 4,800</td>
</tr>
<tr>
<td>Wide Width Tensile Strength (at 2% strain)</td>
<td>ASTM D 4595</td>
<td>lb/ft</td>
<td>480 x 840</td>
</tr>
<tr>
<td>Wide Width Tensile Strength (at 5% strain)</td>
<td>ASTM D 4595</td>
<td>lb/ft</td>
<td>2,400 x 2,400</td>
</tr>
<tr>
<td>Wide Width Tensile Strength (at 10% strain)</td>
<td>ASTM D 4595</td>
<td>lb/ft</td>
<td>3,900 x 3,900</td>
</tr>
<tr>
<td>Grab Tensile Strength</td>
<td>ASTM D 4632</td>
<td>lbs</td>
<td>450 x 410</td>
</tr>
<tr>
<td>Grab Elongation</td>
<td>ASTM D 4632</td>
<td>Percent</td>
<td>12 x 6</td>
</tr>
<tr>
<td>Puncture Strength</td>
<td>ASTM D 4833</td>
<td>lbs</td>
<td>195</td>
</tr>
<tr>
<td>Mullen Burst</td>
<td>ASTM D 3786</td>
<td>psi</td>
<td>1,200</td>
</tr>
<tr>
<td>Trapezoidal Tear</td>
<td>ASTM D 4533</td>
<td>lbs</td>
<td>180 x 180</td>
</tr>
<tr>
<td>Apparent Opening Size</td>
<td>ASTM D 4751</td>
<td>US Std. Sieve</td>
<td>30</td>
</tr>
<tr>
<td>Permittivity</td>
<td>ASTM D 4491</td>
<td>Sec-1</td>
<td>0.4-0.6</td>
</tr>
<tr>
<td>Water Flow Rate</td>
<td>ASTM D 4491</td>
<td>gpm/ft²</td>
<td>30-45</td>
</tr>
<tr>
<td>Property</td>
<td>Test Method</td>
<td>Units</td>
<td>Property Requirement (Machine Direction x Cross-machine Direction)</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>--------------</td>
<td>----------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td>UV Resistance (percent retained at 500 hours)</td>
<td>ASTM D 4355</td>
<td>Percent</td>
<td>70</td>
</tr>
</tbody>
</table>

4. Minimum Average Roll Values for non-woven geotextile (Geotex 1601, Mirafi 1160N, or equal):

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Units</th>
<th>Property Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grab Tensile Strength</td>
<td>ASTM D 4632</td>
<td>kN (lbs)</td>
<td>1.69 (380)</td>
</tr>
<tr>
<td>Grab Elongation</td>
<td>ASTM D 4632</td>
<td>Percent</td>
<td>50</td>
</tr>
<tr>
<td>Puncture Strength</td>
<td>ASTM D 4833</td>
<td>kN (lbs)</td>
<td>1.05 (235)</td>
</tr>
<tr>
<td>Mullen Burst</td>
<td>ASTM D 3786</td>
<td>kPa (psi)</td>
<td>5098 (740)</td>
</tr>
<tr>
<td>Trapezoidal Tear</td>
<td>ASTM D 4533</td>
<td>kN (lbs)</td>
<td>0.62 (140)</td>
</tr>
<tr>
<td>Apparent Opening Size (Maximum Avg. Roll Value)</td>
<td>ASTM D 4751</td>
<td>mm (US Std. Sieve)</td>
<td>0.150 (100)</td>
</tr>
<tr>
<td>Permittivity</td>
<td>ASTM D 4491</td>
<td>Sec-1</td>
<td>0.7</td>
</tr>
<tr>
<td>Water Flow Rate</td>
<td>ASTM D 4491</td>
<td>l/min/m² (gpm/ft²)</td>
<td>2,037 (50)</td>
</tr>
<tr>
<td>UV Resistance (percent retained at 500 hours)</td>
<td>ASTM D 4355</td>
<td>Percent</td>
<td>70</td>
</tr>
</tbody>
</table>

5. Quality Control.
   a. exceeding ASTM D 4354.

B. Sewing Thread (if required):
   1. Sewing thread shall consist of high strength polypropylene or polyester (Nylon shall not be used).
2. The thread shall be of a contrasting color to the geotextile.

PART 3 – EXECUTION

3-1. PREPARATION.

A. Clear, grub, and excavate/fill installation site to design grade. Remove topsoil, vegetation, and other unsuitable materials.

B. Woven geotextiles shall be used in areas with soft to medium subgrade where SPT-N blow count is less than 8 (or CBR is less than or equal to 1.6) to provide both separation and stabilization where a minimum two feet of crushed rock shall be placed over the geotextile.

C. Non-woven geotextiles shall be used in areas with medium to stiff subgrade where SPT-N blow count is between 8 and 15 (or CBR between 1.6 and 3.2) to provide both separation and stabilization where a minimum two feet of crushed rock shall be placed over the geotextile.

3-2. INSTALLATION.

A. The geotextile shall be laid smooth without wrinkles or folds on the prepared subgrade in the direction of construction traffic.

B. Adjacent geotextiles rolls shall be overlapped, sewn or joined as required below:

<table>
<thead>
<tr>
<th>Subgrade CBR</th>
<th>Minimum Overlap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater than 3</td>
<td>300 – 450 mm (12 – 18 in)</td>
</tr>
<tr>
<td>1 – 3</td>
<td>600 – 1000 mm (24 – 36 in)</td>
</tr>
<tr>
<td>0.5 – 1</td>
<td>1000 mm (36 in) or sewn</td>
</tr>
<tr>
<td>Less than 0.5</td>
<td>Sewn</td>
</tr>
<tr>
<td>All roll ends</td>
<td>1000 mm (36 in) or sewn</td>
</tr>
</tbody>
</table>

C. When sewn seams are required, the seam strength, as measured by ASTM D4632 shall be equal to or greater than 90 percent of the specified grab strength.
D. On curves, the geotextile may be folded or cut to conform to the curves. The fold or overlap shall be in the direction of construction and held in place by pins, staples, or piles of fill or rock.

E. Prior to covering, the geotextile shall be inspected by a certified inspector of the Engineer to ensure that it has not been damaged during installation.

F. Damaged areas, as identified by the Engineer, shall be repaired immediately by covering the damaged area with a geotextile patch that extends an amount equal to the required overlap beyond the damaged area.

G. The crushed rock shall be placed by end dumping onto the geotextile, or over previously placed materials such that at least the minimum specified lift thickness shall be between the construction equipment tires or tracks and the geotextile at all times.

H. Pretensioning Geotextile:
   1. Proof roll with rubber-tired vehicle. Wheel load of truck shall be equivalent to maximum expected for site. Vehicle to make at least four passes over first lift in each area of site.

I. If required, staple or pin geotextile at overlaps to maintain position during construction activities. Use 250 to 300 mm (10 to 12 in) long nails placed at minimum 15 m (50 ft) on center for parallel rolls and 1.5 m (5 ft) on center for roll ends.

J. Do not place overlaps along anticipated primary wheel path locations. Place overlaps at end of rolls in direction of backfill placement with previous roll on top.

K. Compaction of subsequent backfill materials shall meet specified requirements.

L. Fill ruts formed during construction to maintain adequate cover over geotextile. Do not blade ruts down.

3-3. PROTECTION.

A. Atmospheric exposure of the geotextile to the elements following laydown shall be limited to 14 days to prevent damage.

B. Equipment in operation:
   1. For extremely soft soils, use lightweight construction vehicles for access on first lift.
2. Limit construction vehicles in size and weight to limit rutting in initial lift to 75 mm (3 in).

3. If rut depths exceed 75 mm (3 in), decrease construction vehicle size or weight or increase lift thickness.

C. Turning not permitted on first lift of backfill placement.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers clearing, grubbing, and preparation of the site; removal and disposal of all debris; excavation and trenching; the handling, storage, transportation, and disposal of all excavated material; all necessary sheeting, shoring, and protection work; preparation of subgrades; pumping and dewatering as necessary; protection of adjacent property; backfilling; pipe embedment; surfacing and grading; and other appurtenant work performed on OCWD property.

1-2. GENERAL. With reference to the terms and conditions of the construction standards for excavations set forth in OSHA "Safety and Health Regulations for Construction", Chapter XVII of Title 29, CFR, Part 1926, Contractor shall employ a competent person and, when necessary based on the regulations, a registered professional engineer, to act upon all pertinent matters of the work of this section.

1-3. SUBMITTALS. Drawings, specifications, and data covering the proposed materials shall be submitted in accordance with the Submittals section.

1-3.01. Filter Fabric Data. Complete descriptive and engineering data for the fabric shall be submitted in accordance with the Submittals section. Data submitted shall include:

- A 12 inch square sample of fabric.
- Manufacturer's descriptive product data.
- Installation instructions.

1-4. BASIS FOR PAYMENT.

1-4.01. Trench Sheeting. No additional payment above the Contract Price will be made for trench sheeting left in place.

1-5. INSURANCE. Professional Liability insurance shall be provided as specified in the General and Special Provisions.
PART 2 - PRODUCTS

2-1. MATERIALS.

2-1.01. Filter Fabric. The fabric shall be provided in rolls wrapped with covering for protection from mud, dirt, dust, and debris.

2-1.01.01. Woven Geotextile. Woven geotextile shall be TCI Mirafi “600X”, Amoco Fabrics and Fibers Company “Amoco 2006”, TNS Advanced Technology “W300”, or equal.

2-1.01.02. Nonwoven Geotextile. Geotextile for use in temporary drainage trenches shall be nonwoven and conform to the requirements for underdrains described in Caltrans Standard Specifications Section 88, paragraph 1.03 “Filter Fabric”.

2-1.02. Polyethylene Film. Not used.

2-1.03. Tunnel Liner Plates. Not used.

2-1.04. Smooth Steel Pipe. Not used.

2-1.05. Wood Skids. Not used.

2-1.06. Casing Insulators. Not used.

2-1.07. Stabilized Sand Backfill. Not used.

2-1.08. End Closure. Not used.

2-1.09. Inundated Sand Fill. Sand fill shall be clean, with not more than 25 percent retained on a No. 4 sieve and not more than 7 percent passing a No. 200 sieve, and shall have an effective size between 0.10 and 0.30 mm.

2-1.10. Select Backfill. Select backfill for compacted trench backfill shall conform to the following criteria:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum particle size (inches)</td>
<td>1</td>
</tr>
<tr>
<td>Maximum liquid limit (%)</td>
<td>25</td>
</tr>
<tr>
<td>Maximum plasticity index (%)</td>
<td>15</td>
</tr>
<tr>
<td>Maximum percentage passing the No. 200 sieve (%)</td>
<td>10</td>
</tr>
<tr>
<td>Maximum sand equivalent</td>
<td>20</td>
</tr>
</tbody>
</table>
The select backfill mixture shall contain no clay lumps or organic matter.

2-1.11. Controlled Low Strength Material (CLSM) Fill. Refer to the GWRS Earthwork section for CLSM material requirements.

2-1.12. Sand Bedding. Sand bedding material shall be per Caltrans Specification 19-3.025B. Sand bedding material shall be free from clay or organic material, suitable for the purpose intended, and shall be of such size that 90 percent to 100 percent will pass a No. 4 sieve and not more than 5 percent will pass a No. 200 sieve.

2-2. MATERIALS TESTING.

2-2.01. Preliminary Review of Materials. As stipulated in the Quality Control section, all tests required for preliminary review of materials shall be made by an acceptable independent testing laboratory at the expense of Contractor. Two initial gradation tests shall be made for each type of select backfill, sand bedding, or other material, and one additional gradation test shall be made for each additional 500 tons of each material delivered to the jobsite.

All material testing on CLSM shall be made by an independent testing laboratory at the expense of Contractor.

2-2.02. Field Testing Expense. All moisture-density tests and relative density tests on the materials, and all in-place field density tests, shall be made by an independent testing laboratory at the expense of Owner. Contractor shall provide access to the materials and work area and shall assist the laboratory as needed in obtaining representative samples. Contractor shall bear the cost of all the failing tests performed by the Owner's laboratory.

2-2.03. Required Tests. For planning purposes the following guidelines shall be used for frequency of field tests. Additional tests shall be performed as necessary for job conditions and number of failed tests. Test results shall be submitted as indicated in the Submittals section.

a. Two moisture-density tests in accordance with ASTM D1557 for each type of select backfill, sand bedding, or other material proposed.

b. One in-place field density and moisture test for every 100 to 200 cubic yards of select backfill or sand bedding.

c. One in-place density and moisture test whenever there is a suspicion of a change in the quality of moisture control or effectiveness of compaction.

d. At least one test for every full shift of compaction operations on mass earthwork.
e. Additional gradation, moisture-density and relative density tests whenever the source or quality of materials changes.

f. Testing of CLSM shall be as required in the GWRS Earthwork section.

PART 3 - EXECUTION

3-1. CLEARING. All clearing shall be performed as necessary for access, stringing of pipeline materials, and construction of the pipeline and appurtenant structures.

3-2. EXCAVATION. Excavations shall provide adequate working space and clearances for the work to be performed therein and for installation and removal of concrete forms. In no case shall excavation faces be undercut for extended footings.

Subgrade surfaces shall be clean and free of loose material of any kind when concrete is placed thereon.

Except where exterior surfaces are specified to be damp-proofed, monolithic concrete manholes and other concrete structures or parts thereof, which do not have footings that extend beyond the outside face of exterior walls, may be placed directly against excavation faces without the use of outer forms, provided that such faces are stable and also provided that a layer of polyethylene film is placed between the earth and the concrete.

Excavations for manholes and similar structures constructed of masonry units shall have such horizontal dimensions that not less than 6 inches clearance is provided for outside plastering.

3-2.01. Classification of Excavated Materials. No classification of excavated materials will be made for payment purposes. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the work, regardless of the type, character, composition, or condition thereof.

3-2.02. Preservation of Trees. No trees shall be removed outside excavated or filled areas, unless their removal is authorized by Owner. Trees left standing shall be adequately protected from damage by construction operations.

3-2.03. Blasting. Blasting or other use of explosives for excavation will not be permitted.

3-2.04. Dewatering. See Dewatering section.
3-2.05. **Sheeting and Shoring.** Except where banks are cut back on a stable slope, excavations for structures and trenches shall be supported with steel sheet piling and shoring as necessary to prevent caving or sliding. Wherever sloped excavations are planned, temporary constructions excavations greater than 3 feet but less than 10 feet deep shall have slopes no steeper than 1.5H:1V (horizontal to vertical). To avoid surcharging, excavated soils shall be stockpiled 15 feet or more from the sloped face.

Sheet piling or other excavation support systems shall be installed as necessary to limit the extent of excavations for deeper structures and to protect adjacent structures and facilities from damage due to excavation and subsequent construction. Contractor shall assume complete responsibility for, and shall install adequate protection systems for prevention of damage to existing facilities. At a minimum, the excavation support system shall extend below the bottom of the excavation at least one-half the difference between the groundwater elevation and the excavation bottom elevation. The excavation support system embedment depth shall be determined by the Contractor with respect to the proposed construction dewatering scheme and groundwater levels encountered at the time of construction. Trench shields are not acceptable methods of providing excavation support.

Sheeting, shoring and excavation support systems shall be designed by a professional engineer registered in the state where the project is located.

Trench sheeting may be removed if the pipe strength is sufficient to carry trench loads based on trench width to the back of sheeting. Trench sheeting shall not be pulled after backfilling. Where trench sheeting is left in place, it shall not be braced against the pipe, but shall be supported in a manner which will preclude concentrated loads or horizontal thrusts on the pipe. Cross braces installed above the pipe to support sheeting may be removed after pipe embedment has been completed. Trench sheeting shall be removed unless otherwise permitted by Engineer. Trench sheeting will not be removed, if in the opinion of Engineer, removal of the sheeting will cause damage to the facility it is protecting. If left in place, the sheeting shall cut off 12 inches below finished grade but not below adjacent foundation slabs of structures. The design of the support system shall be such as to permit complete removal while maintaining safety and stability at all times.

3-2.06. **Stabilization.** Sub-grades for concrete structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact under the feet of the workers.

Sub-grades for concrete structures or trench bottoms which are otherwise solid, but which become mucky on top due to construction operations, shall be reinforced with crushed rock as specified in the GWRS Earthwork section.
stabilizing material shall be placed in a manner that no voids remain in the crushed rock. All excess crushed rock with unfilled void space shall be removed. The finished elevation of stabilized sub-grades shall not be above sub-grade elevations indicated on the Drawings.

3-3. TRENCH EXCAVATION. No more trench shall be opened in advance of pipe laying than is necessary to expedite the work. One block or 400 feet, whichever is the shorter, shall be the maximum length of open trench on any line under construction.

Except where tunneling is indicated on the drawings, is specified, or is permitted by Engineer, all trench excavation shall be open cut from the surface.

3-3.01. Alignment, Grade, and Minimum Cover. The alignment and grade or elevation of each pipeline shall be fixed and determined from offset stakes. Vertical and horizontal alignment of pipes, and the maximum joint deflection used in connection therewith, shall be in conformity with requirements of the section covering installation of pipe.

Where pipe grades or elevations are not definitely fixed by the contract drawings, trenches shall be excavated to a depth sufficient to provide a minimum depth of backfill cover over the top of the pipe of 36 inches over pipes below paved and graded streets and, of 24 inches over pipes in other locations. Greater pipe cover depths may be necessary on vertical curves or to provide adequate clearance beneath existing pipes, conduits, drains, drainage structures, or other obstructions encountered at normal pipe grades. Measurement of pipe cover depth shall be made vertically from the outside top of pipe to finished ground or pavement surface elevation, except where future surface elevations are indicated on the Drawings.

3-3.02. Maximum Trench Widths. Not used.

3-3.03. Minimum Trench Widths. Except when maximum trench width is required for certain conduits, trenches shall be excavated to the minimum trench widths indicated on the Drawings. Trenches shall be excavated to a width which will provide adequate working space and sidewall clearances for proper pipe installation, jointing, and embedment.

Specified minimum sidewall clearances are not minimum average clearances but are minimum clear distances which will be required to the trench excavation or the trench protective system.

Cutting trench banks on slopes to reduce earth load to prevent sliding and caving shall be used only in areas where the increased trench width will not interfere with surface features or encroach on right-of-way limits.
3-3.04. **Mechanical Excavation.** The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground. In all such locations, hand excavating methods shall be used.

Mechanical equipment used for trench excavation shall be of a type, design, and construction, and shall be so operated, that the rough trench excavation bottom elevation can be controlled, and that trench alignment is such that pipe, when accurately laid to specified alignment, will be centered in the trench with adequate sidewall clearance. Undercutting the trench sidewall to obtain sidewall clearance will not be permitted.

In locations where maximum trench widths are required for designated rigid conduits, mechanical equipment shall be operated so that uniform trench widths and vertical sidewalls are obtained at least from an elevation 12 inches above the top of the installed pipe to the bottom of the trench.

3-3.05. **Cutting Concrete Surface Construction.** Cuts in concrete pavement and concrete base pavements shall be no larger than necessary to provide adequate working space for proper installation of pipe and appurtenances. Cutting shall be started with a concrete saw in a manner which will provide a clean groove at least 1-1/2 inches deep along each side of the trench and along the perimeter of cuts for structures.

Concrete pavement and concrete base pavement over trenches excavated for pipelines shall be removed so that a shoulder not less than 6 inches in width at any point is left between the cut edge of the pavement and the top edge of the trench. Trench width at the bottom shall not be greater than at the top and no undercutting will be permitted. Pavement cuts shall be made to and between straight or accurately marked curved lines which, unless otherwise required, shall be parallel to the center line of the trench.

Pavement removal for connections to existing lines or structures shall not exceed the extent necessary for the installation.

Where the trench parallels the length of concrete walks, and the trench location is all or partially under the walk, the entire walk shall be removed and replaced. Where the trench crosses drives, walks, curbs, or other surface construction, the surface construction shall be removed and subsequently replaced between existing joints or between saw cuts as specified for pavement.

3-3.06. **Excavation Below Pipe Sub-grade.** Except where otherwise required, pipe trenches shall be excavated below the underside of the pipe, as indicated on the Drawings, to provide for the installation of bedding material.
Bell holes shall provide adequate clearance for tools and methods used for installing pipe. No part of any bell or coupling shall be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.

3-3.07. Artificial Foundations in Trenches. Whenever unsuitable or unstable soil conditions are encountered, trenches shall be excavated below grade and the trench bottom shall be brought to grade with suitable material. In such cases, adjustments will be made in the Contract Price in accordance with the provisions of the General and Special Provisions.

3-4. PIPE EMBEDMENT. Embedment materials both below and above the bottom of the pipe and placement and compaction of embedment materials shall conform to the requirements indicated on the Drawings and to the following supplementary requirements.

Embedment material shall contain no cinders, clay lumps, or other material which may cause pipe corrosion.

3-4.01. Embedment Classes. Not used.

3-4.02. Embedment for Ductile Iron, Steel, FRP, HDPE, and PVC Pipelines. Embedment for ductile iron, coal tar coated steel, FRP, HDPE, and PVC pipelines shall be sand bedding. Crushed rock with sharp edges which could cause significant scratching or abrasion of the pipe or damage to the polyethylene tube protection shall not be used. Embedment shall be placed in the pipe zone as shown on the Drawings.

Embedment for mechanical coupling connections shall be sand. Sand shall be uniformly distributed and compacted on both sides of the coupling. During placement, the sand shall be compacted with a mechanical probe type vibrator. Sand shall be compacted to 90 percent relative compaction specified. If the required compaction cannot be achieved, placement and compaction methods shall be altered.

3-4.03. Placement and Compaction. Embedment material shall be spread and the surface graded to provide a uniform and continuous support beneath the pipe at all points between bell holes or pipe joints. It will be permissible to slightly disturb the finished subgrade surface by withdrawal of pipe slings or other lifting tackle.

After each pipe has been graded, aligned, and placed in final position on the bedding material, and shoved home, sufficient pipe embedment material shall be deposited and compacted under and around each side of the pipe and back of the bell or end thereof by shovel slicing or other suitable methods to hold the pipe in proper position and alignment during subsequent pipe jointing and embedment operations.
Embedment material shall be deposited and compacted uniformly and simultaneously on each side of the pipe to prevent lateral displacement.

Each lift of embedment material shall be vibrated with a mechanical probe type vibrator or shovel sliced during placement to ensure that all spaces beneath the pipe are filled. Embedment shall be placed in maximum lift thickness of 6 inches and compacted. Each lift of embedment material shall be compacted with three passes (round trip) of a platform type vibrating compactor.

Where indicated on the Drawings, migration of soil into the embedment material shall be prevented with filter fabric. Filter fabric shall be placed on the trench surfaces so that it completely surrounds the embedment material. Joints shall be lapped 12 inches.

3-4.04. **Groundwater Barrier.** Not used.

3-5. **TRENCH BACKFILL.** All trench backfill above pipe embedment shall be select backfill material, shall be compacted, and shall be coordinated with the Drawings as follows.

<table>
<thead>
<tr>
<th>STREET ZONE</th>
<th>MIN. THICKNESS (FT)</th>
<th>MIN. RELATIVE COMPACCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>95%</td>
</tr>
<tr>
<td>TRENCH ZONE</td>
<td>VARIES</td>
<td>90%</td>
</tr>
</tbody>
</table>

3-5.01. **Compacted Backfill.** Not used.

3-5.01.01. **Job Excavated Material.** Not used.

3-5.01.02. **Inundated Sand.** Not used.

3-5.01.03. **Graded Gravel.** Not used.

3-5.02. **Ordinary Backfill.** Not used.

3-5.03. **Water-Settled Earth Backfill.** Settlement or consolidation of trench backfill using water jetting or ponding shall not be performed.

3-5.04. **Structure Backfill.** Not used.

3-5.05. **Controlled Low Strength Material (CLSM).** Refer to the GWRS Earthwork section for CLSM placement requirements.

3-6. **TUNNEL EXCAVATION.** Not used.
3-7. **DRAINAGE MAINTENANCE.** Trenches across roadways, driveways, walks, or other trafficways adjacent to drainage ditches or watercourses shall not be backfilled prior to completion of backfilling the trench on the upstream side of the trafficway, to prevent impounding water after the pipe has been laid. Bridges and other temporary structures required to maintain traffic across such unfilled trenches shall be constructed and maintained by Contractor. Backfilling shall be done so that water will not accumulate in unfilled or partially filled trenches. All material deposited in roadway ditches or other watercourses crossed by the line of trench shall be removed immediately after backfilling is completed, and the original section, grades, and contours of ditches or watercourses shall be restored. Surface drainage shall not be obstructed longer than necessary.

3-8. **PROTECTION OF TRENCH BACKFILL IN DRAINAGE COURSES.** Where trenches are constructed in ditches or other watercourses, backfill shall be protected from surface erosion. Where the grade of the ditch exceeds 1 percent, or as otherwise required, ditch checks shall be installed. Unless otherwise indicated on the drawings, ditch checks shall be concrete. Ditch checks shall extend at least 2 feet below the original ditch or watercourse bottom for the full bottom width and at least 18 inches into the side slopes, and shall be at least 12 inches thick.

3-9. **FINAL GRADING AND PLACEMENT OF TOPSOIL.** Not used.

3-10. **DISPOSAL OF EXCESS EXCAVATED MATERIALS.** Disposal of excess material from trench excavations on plant and major facility construction sites shall be accomplished as indicated in the GWRS Earthwork section of the specifications for the major construction.

Disposal of excess material from other trench excavation sites shall be as follows. Except as otherwise permitted, all excess excavated materials shall be disposed of away from the site.

Broken concrete and other debris resulting from pavement or sidewalk removal, excavated rock in excess of the amount permitted to be installed in trench backfill, debris encountered in excavation work, and other similar waste materials shall be disposed of away from the site.

Excess earth from excavations located in unimproved property may be distributed directly over the pipe trench and within the pipeline right-of-way to a maximum depth of 6 inches above the original ground surface elevation at and across the trench and sloping uniformly each way. Material thus wasted shall be carefully finished with a drag, blade machine, or other suitable tool to a smooth, uniform surface without obstructing drainage at any point. Wasting of excess excavated material in the above manner will not be permitted where the line of trench crosses or is within a railroad, public road, or highway right-of-way. The disposal of waste...
and excess excavated materials, including hauling, handling, grading, and surfacing, shall be a subsidiary obligation of Contractor and no separate payment will be made therefore.

3-11. RESODDING. Not used.

3-12. SETTLEMENT. Contractor shall be responsible for all settlement of trench backfill which may occur within the correction period stipulated in the General Conditions.

Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after notice from Engineer or Owner.

End of Section
PART 1 – GENERAL

1-1. THE REQUIREMENT.

A. The Contractor shall furnish all tools, equipment, materials, and supplies and shall perform all labor required to complete the work of preparation of subgrade requirements on OCSD property as indicated on the Drawings and specified herein.

B. The subgrade will be considered as those areas and surfaces, new or existing, upon which subbase or base material, pavement, curbs and gutters, driveways, or sidewalks are to be placed.

C. All underground work in the area of the subgrade shall be completed and properly backfilled and compacted in compliance with the OCSD Earthwork section, before subgrade work is started.

1-2. RELATED WORK SPECIFIED ELSEWHERE.

A. OCSD Earthwork section.

B. Demolition section.

C. Asphalitic Concrete Pavement section.

1-3. REFERENCE SPECIFICATIONS, CODES AND STANDARDS.

A. Comply with the applicable reference specifications of the GENERAL REQUIREMENTS.

B. Comply with SSPWC Section 301-1 unless otherwise specified in this section.

1-4. CONTRACTOR SUBMITTALS.

A. Submittals shall be made in accordance with the General Requirements and other Contract Document requirements.

1-5. QUALITY ASSURANCE.

A. Quality assurance shall be as specified in the OCSD Earthwork section.
PART 2 – PRODUCTS

2-1. **EXCAVATION AND EMBANKMENT.**

A. The excavation shall include removal of materials which are encountered in excavating to the required grades as shown on the Contract Drawings, including existing pavement, sidewalks and curbs designated to be removed, or other deleterious materials as required to accomplish the construction.

B. Unsuitable material below the processing depth for subgrade shall be excavated and disposed of as specified in the OCSD Earthwork section or as directed by the Engineer.

PART 3 - EXECUTION

3-1. **SUBGRADE.**

A. Scarify and compact the top 30 (thirty) inches of subgrade to at least 95 percent of the maximum dry density attainable as determined by ASTM D 1557 except clay soils with a Liquid Limit greater than or equal to 50 percent and a plasticity index greater than or equal to 20 shall be prepared according to the recommendation of the Engineer. Remove all soft or otherwise unsuitable material and replace with suitable material as specified in the OCSD Earthwork section. In sandy soils the moisture content shall be kept at or slightly above the optimum moisture content. However, in Clayey and Silty soils, the moisture content shall be kept at about 2% above the optimum moisture content. The finished subgrade shall be firm, hard and unyielding. The subgrade shall be considered to extend over the full width of the base course. Compaction shall extend a minimum of 18 inches beyond the edge of paving, curb, or form.

B. Subgrade tolerances for roadway structures, sidewalk, curb and gutter and driveways shall be in conformance with SSPWC Section 301-1.4.

3-2. **EXCAVATION BELOW SUBGRADE.**

A. Where the Engineer determines the subgrade material to be unsuitable, excavation below subgrade will be required to such depths as necessary to remove the unsuitable material. Special equipment may be required because of the presence of shallow utilities or other unforeseen conditions.
B. The over excavated unsuitable subgrade shall be replaced with suitable material per the OCSD Earthwork section.

3-3. PROTECTION OF SUBGRADE.

A. After preparing the subgrade as specified, all traffic on the subgrade shall be avoided prior to paving. Should it be necessary to haul over the prepared subgrade, the Contractor shall drag and roll the traveled way as frequently as may be necessary to remove ruts, cuts, and breaks in the surface. All cuts, ruts, and breaks in the surface of the subgrade that are not removed by the above operations shall be raked and hand tamped. All equipment used for transporting materials over the prepared subgrade shall be equipped with pneumatic tires.

B. Continued use of sections of prepared subgrade for hauling that cause it to be cut up or deform it from the true cross-section, will not be permitted. The Contractor shall protect the prepared subgrade from all traffic.

C. The Contractor will be required to plank the subgrade before hauling materials or equipment over it.

D. The subgrade shall be maintained in the finished condition as required by Subsection 3.1 A, until the first succeeding course is placed.

End of Section
PART 1 - GENERAL

1-1. **SCOPE.** This section covers materials and installation of continuous flight auger pressure-grouted piles (CFA).

1-2. **GENERAL.** The Contractor shall furnish all tools, equipment, materials, and supplies and shall perform all labor required to complete piling work as indicated on the drawings and specified herein. The auger pressure grouted pipes shall be installed to the lengths indicated on the drawings unless pile lengths are adjusted by change order based on the results of pile testing.

Damage to existing structures and underground utilities or facilities shall be prevented during the installation of all CFAs.

1-3. **SUBMITTALS.** All submittals of data and drawings shall be in accordance with the Submittals section, unless otherwise specified herein. The submittals shall include the following:

   a. CFA pile Subcontractor’s project and personnel experience.
   b. Description of pile drilling and pumping equipment to be used, including the cubic feet of grout delivered per grout pump stroke.
   c. Description of automatic measurement and recording equipment for monitoring pile CFA pile installation (i.e., pile installation recorder).
   d. Proposed grout mix design reported in accordance with mix design specified herein.
   e. A pile layout plan referenced to the drawings including a numbering system capable of identifying each individual pile.
   f. Reinforcement drawings and data.
   g. Detail of pile survey point (refer to paragraph of this specification titled, “Pile Locations”).
   h. Drawing indicating installed location of CFA piles.

1-4. **QUALITY ASSURANCE.** In addition to requirements specified in this section, specific testing requirements for installation of the CFA piles shall be as specified in the Augered Pressure Grouted Piles – Load Testing section.
1-4.01. **Subcontractor's Qualifications.** Piles shall be installed by an experienced subcontractor having at least 10 years of experience in the successful installation of CFA piling. The subcontractor's job supervisor (foreman or crew chief) shall have a minimum of 3 years of experience in the installation of CFA piling. Drill equipment operators shall be documented to have a minimum of three years experience installing CFA piles.

1-4.02. **Preinstallation Meeting.** Contractor shall schedule a meeting a minimum of 2 days prior to the installation of piles for coordination of all related activities with the Owner and Engineer. The meeting shall be attended by the Contractor and CFA Subcontractor.

1-4.03. **Tolerances.** Unless otherwise specified, tolerances for grout proportions shall be as stipulated in Article 2.4 of ACI 117. Each pile shall be accurately located, sized, and plumbed. The location of each pile shall be determined by surveying. Locating piles from previously installed piles is not acceptable. The maximum deviation of any pile from its location indicated on the Drawings shall not be more than 3 inches at its top elevation. Vertical piles shall be installed plumb within a tolerance of 2 percent of vertical. Costs of redesign or extra construction caused by incorrectly located piles shall be paid by the Contractor at no additional cost to the Owner.

PART 2 - PRODUCTS

2-1. **MATERIALS.** Materials used in the construction of CFA piles shall conform to the following:

- **Cement**
  - ASTM C150, Type II/V, low alkali and high sulfate resistance.

- **Fly Ash**
  - ASTM C618, Class F, except loss on ignition shall not exceed 4 percent.

- **Fine Aggregate**
  - Clean natural sand, ASTM C33. Artificial or manufactured sand will not be acceptable.

- **Water**
  - Clean and free from deleterious substances.

- **Fluidifier**
  - ASTM C937, except that expansion as described in Section 5.1 shall be limited to 5 percent maximum.
Retarder       ASTM C494, Type F.
Viscosity Modifier       ASTM C494, Type S
Reinforcing Steel
   Bars, Nonweldable       ASTM A615, Grade 60, deformed.
   Threadbar       ASTM A722, 150 ksi.
   Threadbar Couplers       Capable of developing at least 100 percent of the minimum specified ultimate tensile strength of the threadbar.
   Threadbar Bearing Plate       ASTM A36.

2-1.01. Reinforcement. Reinforcements shall be accurately formed and shall be free from loose rust, scale, and contaminants which reduce bond. Unless otherwise indicated on the Drawings or specified herein, the details of fabrication shall conform to ACI 315 and 318.

2-1.01.01. Shop Drawings and Bar Lists. Bar lists, drawings for the fabrication and placing of reinforcements, and details of the bar supports, centering devices, and spacers shall be submitted to the Engineer for review.

2-1.01.02. Splices. Splices shall conform to ACI 318 and the details indicated on the Drawings. Splices at locations other than those indicated on the Drawings shall be acceptable to the Engineer.

Welding or tack welding of reinforcement is prohibited. Reinforcements upon which unauthorized welding has been done shall be removed and replaced at the expense of the Contractor.

2-2. PILE INSTALLATION RECORDS. A numbered pile plan and complete record of all piles installed for the project shall be submitted to the Engineer. The pile installation form shall be acceptable to the Engineer. The form shall contain the pile identification number, elevation of the pile tip, top elevation of the pile, nature and location of any obstructions, pile length, diameter, theoretical volume of grout required, and actual volume of grout pumped in each pile.

The Engineer shall have access to the plan and records at all times during pile installation. Records shall be kept in a systematic manner and shall be up-to-date.

2-3. MIX DESIGN. Using materials acceptable to the Engineer, a tentative grout mix shall be designed and tested. Design quantities and test results of each mix...
shall be submitted for review. All tests and reports required for mix design review shall be made by an independent testing laboratory at the expense of the Contractor. Reports covering the source and quality of materials and the grout proportions proposed for the work shall be submitted to the Engineer for review before work is started. Review of these reports will be for general acceptability only, and continued compliance with all contract provisions will be required.

2-3.01. Grout Testing. Two sets of compression test cylinders, three cylinders per set, shall be made from each proposed grout mix. One set of three cylinders shall be tested at an age of 7 days and the other set shall be tested at an age of 28 days. Grout test specimens shall be made, cured, and stored in conformity with ASTM C192, except molds shall be 3 inch diameter by 6 inches high. Grout test specimens shall be tested in conformity with ASTM C39. The Contractor may substitute strength data based on compression testing of 2 inch cubes, provided the cube test breaks exceed the herein specified 7 and 28 day strengths by 10 percent. Test cubes shall be made, cured, and tested in accordance with ASTM C109.

2-3.02. Report. The report for each tentative grout mix submitted shall contain the following information:

- Total gallons of water per cubic yard.
- Brand, type, composition, and quantity of cement.
- Brand, type, composition, and quantity of fly ash.
- Specific gravity and gradation of aggregate.
- Weight (surface dry) of aggregate per cubic yard.
- Brand, type, ASTM designation, active chemical ingredients, and quantity of each admixture.
- Compressive strength based on 7 day and 28 day compression tests.
- Certification by an Engineer registered in the State of California.

2-4. PROPORTIONING. Grout shall be nonshrinking and shall consist of a mixture of Portland Cement, fine aggregate, water, and fluidifier, and at Contractor’s option, retarder, fluidifier, and fly ash or slag cement. Unless otherwise acceptable to the Engineer, all admixtures shall be from one manufacturer and shall be compatible. The grout shall be proportioned and mixed as recommended by the manufacturer of the admixtures to produce a mixture capable of maintaining the solids in suspension without appreciable water gain; that may be pumped without difficulty; which will fill
the augered hole; and that will produce a hardened grout with a minimum compressive strength of 3,750 psi at 7 days and 5,000 psi at 28 days.

Contractor may substitute fly ash for Portland cement within the range of 15 to 25 percent, on the basis of 1.0 pound of fly ash added for each pound of Portland cement reduction. Contractor may substitute slag cement for Portland cement within the range of 25 to 50 percent on the basis of 1.0 pound of slag cement added for each pound of Portland cement reduction. Mixtures using slag cement in combination with fly ash will not be acceptable.

2-5. BATCHING AND MIXING. Batching and mixing shall be in accordance with ASTM C94. The measurement of sand and cement shall be by weight. Sand weights shall be adjusted for the moisture content.

Each admixture shall be dispensed by a mechanical device that provides accurate and automatic measurement.

The minimum amount of water required to produce the desired flow shall be batched automatically. Additional water that may be required to produce and maintain a uniform flow shall be added manually by the mixer operator. Flows shall be kept uniform.

Grout shall be mixed until all ingredients are uniformly distributed throughout the batch. Mixers shall not be loaded in excess of their rated capacities. Each batch shall be completely discharged before recharging the mixer.

Truck mixers shall be revolving drum type and shall be equipped with a mixing water tank. Only the prescribed amount of mixing water shall be placed in the tank for any one batch unless the tank is equipped with a measuring device that allows verification of the amount of water added to each batch.

A delivery ticket shall be prepared for each load of ready-mixed grout. A copy of each ticket shall be handed to the Engineer by the truck operator at the time of delivery. Tickets shall indicate the mix identification, the number of yards delivered, the quantities of each material in the batch, the outdoor temperature in the shade, the time at which the cement was added, and the numerical sequence of the delivery.

After the addition of water to the cement and aggregates, truck mixers shall discharge within 1-1/2 hours and before the mixing drum makes 300 revolutions. In hot weather, or under conditions contributing to quick stiffening of the grout, a time less than 1-1/2 hours may be required by the Engineer. These limits may be waived by the Engineer or Inspector if the grout mix is visually confirmed to be in a flowable state to allow placement without addition of water to the mix. Grout shall not be placed when its temperature exceeds 100°F. When a truck mixer is
used for the complete mixing of the grout, the mixing operation shall begin within 30 minutes after the cement has been added to the sand.

PART 3 - EXECUTION

3-1. **EQUIPMENT.** Equipment for installing continuous flight auger piles shall conform to the following requirements.

3-1.01. **Drilling Equipment.** The drilling equipment used for CFA pile installation shall sufficient torque capacity and downward thrust capacity for the site conditions and shall meet these minimum requirements:

   a. Either an hydraulic rig with fixed mast drilling platform, with a minimum of 10,000 lbs of equivalent crowd,

   b. Or a crane mounted auger and leads. At ground level, the base of the leads shall be prevented from rotating and moving during drilling by either a stabilizing arm, or by a hydraulic or mechanical spotter, fixed to the crane body.

   c. Have torque (either drill rig or auger drive) of not less than 35,000 feet-pounds and have a torque converter that will ensure full torque at slow rotational speed.

   d. Have the ability to control the rate of auger penetration. The drilling equipment used for the CFA piles shall have the ability to drill at the rate specified in the paragraph of this specification titled, “Drilling.”

3-1.02. **Auger Equipment.** Piles shall be drilled with a continuous hollow flight auger to produce a pile with the minimum diameter shown on the Drawings. Augers shall be designed to drill a straight clean hole and to continuously remove all auger cuttings from the hole. The auger flights shall be continuous from the top of the auger to the bottom tip of the cutting face of the auger, with no gaps or other breaks and shall have a minimum 2-1/2 inch inside diameter stem. Gaps in the flights are allowed only where auger sections are joined and may not exceed 1 in. The length of any auger brought to the project site shall be such that the auger is capable of installing a pile to a depth that is 20% greater than the depth of the pile shown on the approved working drawings.

The flights shall be uniform in diameter throughout the auger length, and the outside diameter of the auger shall be at least 97% of the design diameter of the pile. Only single helix augers shall be used. Auger cutting teeth shall be inspected for wear and shall be replaced if the specified reduction in diameter tolerance is reached. The hollow stem of the auger shall be maintained in a clean condition throughout the construction operation. In order to facilitate inspection,
the drill mast shall be clearly marked every 1 ft along its length so that such marks are visible to the unaided eye from the ground.

The bottom of the auger flights and the cutting teeth shall be constructed geometrically so that the bottom of the pile will be as flat as feasible. The grout or concrete injection port shall be fitted with a means of sealing it against ingress of water and soil during drilling.

The discharge port at the tip of the auger shall be directed straight down or at an angle with the vertical and shall be located at the bottom of the augers, below the cutting teeth. Straight side (horizontal) discharge bits will not be permitted. Bits shall be periodically checked for missing teeth and teeth with excessive wear. Damaged or worn teeth shall be replaced.

3-1.03. Grouting Equipment. The grout pump shall be a positive displacement pump with a known volume per stroke. The grout pressures measured at the pump discharge shall be a minimum of 350 psi. The pump shall be sized appropriately to the pile size such that a smooth, continuous delivery of grout can be maintained while limiting the pressure variations (particularly the pressure drop) at the pile due to the pump strokes. The equipment shall contain pressure gauges that monitor the pressure at the pump discharge and in line as close to the auger head as possible. The pressure gauges shall be in good operating condition and shall be mounted where they can be continuously monitored by the pump operator and the Engineer. One additional pressure gauge shall be located near the pile rig to facilitate pile installation monitoring. The Contractor shall keep a minimum of two spare functional pressure gauges on site during performance of the work. The grout and power unit operators shall have a direct line of sight with the driller. A screen to remove oversize particles shall be placed at the pump inlet.

The Contractor shall submit to the Engineer the value of the volume of grout delivered by each stroke of the pump. The grout pump shall be calibrated prior to installing piles to demonstrate to the Engineer that the actual volume delivered by each stroke of the pump is within 3% of the value submitted. The volume per stroke shall be recalibrated when the Engineer suspects that the grout delivery performance has changed.

Metering equipment for measuring the flow of grout into each hole shall be provided. This equipment shall be directly coupled to the pumping equipment and shall consist of either a functional stroke counter or grout flow meter that has been calibrated for accuracy at the jobsite. The grout pump shall be calibrated at the beginning of the work to determine the volume of grout pumped per stroke. Note this required monitoring equipment shall be independent of the equipment required for the pile installation recorder.
3-1.04. **Automatic Measurement and Recording Equipment.** Each drill rig shall be equipped with automated measuring and recording equipment to provide real time evaluation of each pile installed on the project. The automated measuring and recording equipment shall be a PIR-A pile installation recorder as supplied by Pile Dynamics, Inc. of Cleveland OH, or equal. The PIR-A shall record appropriate information during both the augering phase and the grouting phase of the installation to assure that a minimum grout volume is pumped per unit depth increment, and shall print the results immediately upon completion of each pile.

The PIR-A shall not replace the manual recording of pile installation information by the Contractor, but shall provide an independent means of providing the information. If there are noticeable differences between manually recorded data and that developed using the PIR-A, such differences shall be reconciled by Contractor to the satisfaction of Engineer. Pile installation operations shall be suspended until the differences are reconciled.

As a minimum, the following automatic measurements shall be made and recorded during the drilling operation:

a. Auger rotation rate (in rpm);

b. Depth of the auger injection point;

c. Torque delivered to the auger; and

d. Crowd force (downward thrust on auger).

All measurements shall be referenced to (or plotted against) the depth of the auger injection point. This shall be accomplished with a rotational position indicator on the auger head system and an electronic depth sensor on the boom holding the auger. Torque and thrust load cells shall be positioned on the auger head system.

As a minimum, the following automatic measurements shall be made and recorded during the grouting operation:

a. Volume of grout or concrete;

b. Maximum and minimum grout pressure;

c. Auger rotation rate in rpm (if rotated); and,

d. Depth of the injection point.

All measurements shall be referenced to (or plotted against) the depth of the auger injection point. This shall be accomplished with flow meters and electronic pressure transducers placed in the grout pressure line, an electronic depth sensor on the boom holding the auger, and a rotational position indicator on the auger system.
Calibration shall be made on all measuring and recording equipment at the beginning of the project that will demonstrate that the values indicated by the measuring and recording equipment are within 2% of the values measured. Calibrations shall be performed in accordance with the equipment manufacturer’s specifications. All measuring and recording equipment shall also be recalibrated when the Engineer suspects that the drilling and grouting performance has changed.

The (PIR-A) pile installation recorder shall have the following minimum components:

a. PIR-A Display Unit shall display numerically and/or graphically the information from all sensors, print results on-site, and store information on a memory card. The unit shall have an easy-to-use touch-screen interface and shall provide immediate feedback to the operator, particularly during the critical grouting phase to assure minimum grout volume per depth increment.

b. Depth Sensor shall track the movement of a cable attached to the drill top to measure auger top (and thus auger tip) location at all times during installation. Depth shall be set to zero when the auger tip is touching the ground surface. The maximum pile depth (from ground elevation) shall be recorded.

c. Magnetic Flow Meter (MFM) shall be installed in the grout line to measure grout volume pumped within an accuracy of ±2%.

d. Field Printer shall record a hard copy of results for each pile including auger rotation rate, incremental augering times, incremental grout volumes, and summary grout volumes. Printed results shall be provided to Engineer immediately following completion of each pile installed.

e. Grout Pressure Sensor shall monitor and record grout line pressure. This sensor shall be used to count pump strokes. The MFM total volume and total pump strokes allows computation of volume per pump stroke to evaluate consistency of grout pump performance and alert the field crew if pump maintenance is needed.

f. Torque Pressure Sensor shall monitor torque during augering. This pressure will be maintained below but near the maximum pressure allowed by the drill rig to reduce stalling the drill rig and improve overall drilling and production efficiency.

g. Proximity Switches shall measure auger rotation in rpm.

The auger tip depth (ft), penetration rate (ft/minute), auger rotation rate (rpm) shall be displayed during drilling. The MFM and Depth Sensor information shall be used to determine volume pumped per unit depth increment (which shall be displayed to the drill rig operator graphically as a bar chart with the minimum grout ratio clearly displayed as a guide). The printout shall be inspected prior to moving the rig, and if
the grout pumped falls below the specified allowable minimum grout ratio for any depth increment, the pile hole shall be reaugered to 5 feet past the defect and regrouted while the grout is still fluid.

The Pile Installation Recorder (PIR-A) shall be installed prior to the start of pile construction, and shall be maintained during the installation of all production piles. If the unit is not fully operative, the Contractor shall halt pile installation and shall notify and work with the manufacturer to rectify the situation. Pile installation work shall not resume until the pile installation recorder has been repaired and is functioning properly.

The PIR-A does not replace the good installation techniques by Contractor and manual recording of information but rather assists Contractor during the critical grouting phase by accurately monitoring grout pumped versus depth. Contractor shall still observe and record arrival times of grout trucks, installed pile location versus planned location, grout return depth, time of reinforcement bar placement, excavation and other unusual activities or installation information as required by these specifications. Contractor shall collect PIR-A printouts for each pile installed and transmit them to Engineer daily.

3-2. DRILLING. Heavy concentrated loads from the installation equipment shall be distributed to prevent compressing or shearing of the soil in the area near the top of the piles. Piles disturbed after installation shall be repaired or replaced at no additional cost to the Owner. The earthwork specification contains minimum requirements for reinforcement of the subgrade prior to CFA pile installation. The Contractor is responsible for providing additional subgrade reinforcement or using other methods that may be required to support the pile installation equipment and avoid transfer of damaging lateral soil pressures to the piles. After pile installation, a survey point shall be installed in the top of each pile as specified in paragraph of this specification titled, “Pile Locations”.

When it is necessary to expose and verify the location of existing utilities by excavating, and piles are designated to be installed there, the excavation shall be backfilled with select fill in accordance with the Earthwork section, and piles shall be installed from grade level.

Drilling of a pile shall begin only after an adequate amount of grout is available at the jobsite to complete the pile. The discharge port in the bottom of the auger shall be closed with a suitable plug while the auger is being advanced into the ground.

The proposed drilled piles will extend through cohesionless sands and gravels. The piles may also extend into the Talbert Aquifer. The cohesionless soils have significant potential to slough and cave during pile installations. Potential for heaving and “quick bottom” conditions exist below groundwater level especially when penetrating the Talbert Aquifer. The Contractor shall take appropriate measures to
prevent development of “quick bottom” condition during drilling. The contractor shall anticipate that difficult drilling conditions could be encountered when penetrating the occasional dense soils present above the pile tip.

The drilling shall be performed to avoid weak drilling conditions. Weak drilling is defined as prolonged drilling at one depth or rapid rotation of the auger in cohesionless material or soft cohesive soils that are present below the water table. Weak drilling results in excessive removal of soil that may cause subsidence of the surrounding soil surface, settlements of nearby structures, or disturbance of previously completed piles. The penetration rate of the auger shall be maintained such that the auger advances a depth equal to or greater than the pitch of the auger for each 2.0 to 3.0 revolutions. The same drilling rate used to install the test piles shall be used to install the production piles.

3-2.01. Obstructions. If non-augerable material such as cobbles or boulders or other obstructions are encountered, auger rotation shall be immediately halted, and the pile shall be completed to the depth of the non-augerable material, in accordance with the specifications. Refusal is defined as an auger penetration rate of less than 1 foot per minute using drilling equipment that complies with the requirements specified herein. The length of such short piles shall be included in the total linear feet of pile for payment. If required by the Engineer, additional piles shall be placed and the length of these piles shall also be included in the total linear feet of piles for payment.

3-3. GROUTING. The placement of grout shall begin within 5 minutes after the auger has achieved the planned depth. Grout shall be pumped through the hollow-stem auger with sufficient pressure (as measured at the top of the auger) as the auger is withdrawn to completely form the pile and fill any soft or porous zones surrounding the pile.

At the start of grout pumping, the auger shall be raised from 6 to 12 inches to facilitate removal of the plug in the discharge port. After the grout pressure builds up sufficiently, the auger shall be re-drilled to at least the previously established tip elevation. A minimum 8 foot head of grout shall be maintained above the auger tip during the raising of the auger until reaching near the ground surface. The rate of grout injection and the rate of auger withdrawal from the soil shall be coordinated to maintain this minimum grout head at all times.

The grout shall be supplied to the pile at a rate during auger withdrawal that ensures that a continuous monolithic shaft of at least the full specified cross-section is formed, and is free from soil inclusions or any grout segregation. After grout is flowing at the ground surface from the auger flights, the rate of grout injection and auger withdrawal shall be coordinated so that there is a constant grout flow at the surface. Satisfactory coordination of the auger withdrawal rate with pumping shall be verified with the pile installation recorder. Augers shall be
withdrawn at a smooth steady rate while continuously pumping. If rotation of the auger occurs during auger extraction, it shall be positive, i.e., in the same direction as drilling.

Except during later stages of grouting, if the grout gauge pressure drops below 100 psi (measured at the top of the auger), the auger lift shall be stopped until the pressure is above 150 psi. At that time, the auger lift shall be resumed. If a sudden drop in gauge pressure occurs, the auger shall be lowered to at least 18 inches below the depth where the pressure drop occurred, and grouting shall be resumed. If a sudden vertical auger lift occurs, the auger shall be lowered to at least 18 inches below the depth where the sudden lift occurred. Grouting shall be resumed from that point. During the later stages of grouting, when the pile is nearing completion, continuous grout delivery to pile shall be maintained along with sufficient grout head above the auger tip to ensure that the full specified cross section is installed.

The volume of grout placed as a function of depth shall be measured and recorded at intervals not exceeding 2 ft using the pile installation recorder. The total volume of grout pumped into each pile (grout volume factor) shall be established during the installation of the test pile and test pile reaction piles. The grout volume factor established during the test pile installation shall be maintained during the production pile construction but in no case shall the target grout volume be less than 115 percent. Inadequate volume pumped over a depth interval of 5 ft is a basis for rejection of the pile. Rejected piles shall be re-drilled. If placement of grout is interrupted for any reason, such as equipment failure, the pile shall be re-drilled.

The spoil that accumulates around the auger during injection of the grout shall be promptly cleared away. To prevent distortion of the top of the pile, the auger shall be extracted completely from the ground before moving the drill rig mast or crane leads. Drilling and pressure grouting within a radius of 6 pile diameters of completed piles shall not be performed until those piles are at least 24 hours old, and damage to completed piles is prevented. If grout drop occurs in previously cast adjacent piles, the Contractor shall be required to use a longer delay time before adjacent pile construction.

After installation of the pile, and prior to installation of the reinforcing bar cage, earth clods or other foreign material shall be removed from the upper 3 feet of the pile by using a screen type dipping device.

After completion of grouting, the tops of piles shall be made square with the pile axis at the indicated cut off elevation by removing fresh grout from the top of pile. The top of each pile shall be protected from contamination from earth clods or other debris by using a light gage sheet metal sleeve or other methods acceptable to the Engineer.
Upon removal of the auger, the required steel reinforcing bar cage shall be placed while the grout is still fluid.

3-3.01. Cold Weather Grouting. Except as modified herein, cold weather grouting shall comply with ACI 306. Unless the outdoor temperature (in shade) is at least 40°F and rising, water and/or aggregates shall be heated so that the temperature of the grout, when placed, is not less than 55°F. Provisions shall be made for maintaining the grout at a minimum temperature of not less than 50°F for a period of at least 5 days. Sudden cooling of grout shall not be permitted.

3-3.02. Hot Weather Grouting. Except as modified herein, hot weather grouting shall comply with ACI 305. At air temperatures of 90°F or above, grout shall be kept as cool as possible during placement and curing. The temperature of the grout when placed in the work shall not exceed 90°F.

3-3.03. Grout Settlement. The level of each grout in a shift shall be checked at the end of the shift. If the level of grout has settled, the pile shall be filled with grout and rodded with a 1/2 inch diameter rod to a minimum depth equal to twice the height filled.

3-4. EXCAVATED MATERIALS. Excess grout and excavated materials shall be removed from the construction site and disposed of in accordance with Section 02200 – Earthwork.

3-5. REINFORCEMENTS. Cages of reinforcing steel shall be assembled as indicated on the drawings. Reinforcing cages shall be fabricated so that lifting and handling does not cause permanent distortion or racking. Wire ties shall attach the longitudinal bars at the contact with every tie or spiral. The reinforcing steel shall be free of oil, soil, excessive rust or other deleterious material. At the Contractor’s option, the main reinforcing bars in the bottom 2 feet of a reinforcing bar cage may be tapered to facilitate installation as indicated on the drawings.

The reinforcing steel cage shall be centered in the excavation by means of plastic or concrete spacers (centering guides) placed at sufficient intervals to keep the cage centered and provide the proper alignment and minimize disturbance to the soil. Spacers shall be placed at maximum of 10 feet intervals along the cage and at a minimum of 3 uniformly spaced intervals around the cage. Metallic spacers shall not be permitted, except metal spider type centralizers are permissible for the threadbars. The spacers on threadbars shall be placed at maximum of 20’ centers. Centralizer types and spacing shall be acceptable to the Engineer.

The reinforcing steel shall be free of any permanent distortion, such as bars bent by improper pickup. The reinforcing steel shall not be spliced except at locations that are shown on the plans. If a pile is required by the Engineer to be
lengthened after the steel has been cut and cages have been assembled, the schedule of reinforcing steel (both longitudinal and lateral) shall be extended to the required depth by splicing. Splices should be as close to the bottom of the reinforcing cage as possible. Splicing by welding will not be permitted.

Reinforcing steel shall be placed by lowering the steel into the grout column while it is in a fluid state after screening the grout. The steel may be lowered into the grout by gravity or pushed gently into position by hand. The reinforcing steel shall not be vibrated, driven, or otherwise guided into position by mechanical means.

The reinforcing steel shall be held in position at the ground surface within the fluid grout column by supports appropriate for the reinforcement used, which shall remain in place until the grout reaches its initial set, or 24 hours, whichever is longer.

3-6. **PILE LOCATIONS.** At completion of each pile, a survey point shall be installed at the top center of each pile before the grout has set. The survey point shall be acceptable to the Engineer. Within 24 hours of initial set of the grout, the location and elevation of the survey point shall be determined. The location and elevations shall be recorded on forms acceptable to the Engineer. The forms shall include as a minimum, the pile identification number and the date and time of the survey. The form shall be submitted to the Engineer within 5 days of completion of all piles. Prior to installation of the foundation mat reinforcing steel, the location and elevation of the piles shall be determined again by the Contractor and recorded on the form that contains the initial survey point locations and elevations for each pile. A drawing shall be submitted that indicates the surveyed location of piles after subgrade preparation, relative to the location of the piles that was determined after their installation. Any piles determined to be broken or laterally displaced shall be replaced or repaired at no additional cost to the Owner. The method of repair shall be acceptable to the Engineer. The Engineer may request that that Contractor survey pile locations again prior to foundation mat concrete placement if it is suspected that pile disturbance has occurred during placement of the reinforcing steel.

3-7. **CURING.** After the grout and reinforcing are placed, each pile shall be covered and cured for at least 7 days in accordance with the cast-in-place concrete section.

3-8. **FIELD QUALITY CONTROL.**

3-8.01. **Testing.** Field control tests, including making compression test cylinders, will be performed by the Owners testing laboratory. A minimum of 6 tests shall be made for each 50 cubic yards of grout placed. The Contractor shall provide all facilities and the services of one or more employees as necessary to assist with the
field control testing activities. Tests required during the progress of the work shall be made at the expense of the Owner.

All testing and inspection by the Engineer and Owner’s testing laboratory is for the sole benefit of the Owner and does not relieve the Contractor of the responsibility for providing quality control measures to ensure that the work strictly complies with the Contract.

3-8.02. Installation. All drilling, grouting, and placement of reinforcement work for piles shall proceed only in the presence and under the observation of a representative of PROJECT GEOTECHNICAL ENGINEER.

End of Section
PART 1 – GENERAL

1-1. THE REQUIREMENT.

A. The Work covered under this section consists of furnishing all plant, labor equipment, appliances, design and materials and performing all operations in connection with static load testing of piles. Installation of piles is covered under the Augered Pressure Grouted Piles. Pile load testing shall be designed to verify the required load carrying capacity for the installation of production (permanent) piles.

B. The Contractor shall retain a professional engineer registered in the State of California with experience on at least five similar projects to supervise or perform all functions associated with performing the static pile load tests which shall be observed by the project Geotechnical Engineer. The Contractor’s professional engineer shall evaluate the test results in accordance with these specifications and prepare load test report. The results shall be sealed by the Contractor’s professional engineer and submitted to the Engineer for review and acceptance.

C. Piles required to be tested:

1. Perform Static Compression Load Testing in accordance with Section 3-1 of this Specification on the following piles. The location of test piles shall be acceptable to the Engineer. Reaction piles shall not be used for production piles.
   a. Two (2) piles under the MF Facility: one test pile 35 feet long; one test pile 60 feet long.

2. Test Pile Locations. The Contractor shall select test pile locations. The cutoff and tip elevations for test piles shall be the same as that for the corresponding productions piles.

1-2. RELATED WORK SPECIFIED ELSEWHERE.

A. Augered Pressure Grouted Piles section.

1-3. SUBMITTALS.
A. The Contractor shall submit at least the following to the Engineer in accordance with the GENERAL REQUIREMENTS.
   1. A dimensional sketch of the loading arrangement.
   2. Testing and measuring equipment used in the load test, including jack, deformation dial gages, pressure gauge, and load cell calibrations.
   3. Proposed test pile locations.
   4. Proposed reaction pile locations.
   5. Certifications of applied loads.
   6. Qualifications of professional engineer that will be retained to review load test arrangements, monitor the load tests, and write the load test reports.
   7. Load test records and report sealed by a professional engineer registered in California.

B. Locations of test and reaction piles shall be acceptable to the Engineer.

1-4. REFERENCE SPECIFICATIONS, CODES, AND STANDARDS.

A. Comply with the reference specifications of the GENERAL REQUIREMENTS.

B. Comply with the current provisions of the following Codes and Standards.

   1. Commercial Standards.
      a. ASTM D1143.

PART 2 – PRODUCTS

2-1. STATIC LOAD TESTING.

A. All equipment and materials required for load testing of the test piles shall be furnished by the Contractor. Load test piles shall not be incorporated into the work as production piles. Production piles shall not be used as reaction piles.

B. Load testing shall consist of axial compressive load tests.

C. The load test apparatus shall be capable of sustaining loads at least 40 percent greater than the maximum anticipated load as certified by the
professional engineer that will be performing the load test. The capacity of the loading apparatus shall be sufficient to operate under the anticipated loading without incurring damage or interrupting the load test. A sketch of the proposed method of testing shall be submitted to the Engineer for acceptance before the test piles are installed.

D. The pistons shall have sufficient strokes to accommodate the anticipated test beam deflections and test pile movements. The pressure gauge shall be certified for accuracy by an independent testing laboratory at the expense of the Contractor. The hydraulic jack shall have a capacity sufficient to preclude the use of multiple jacking systems. The applied loads shall be verified and recorded by a calibrated load cell certified for accuracy of at least 2 percent of the applied load by an independent laboratory. Copies of the certifications shall be submitted to the Engineer.

E. The test piles shall be same diameter and have same reinforcing as the production piles and shall be installed at the same cutoff elevation as the production piles.

F. The Contractor shall retain a professional engineer registered in the State of California to review load test arrangement, monitor the load tests and write the load test report. The load test report shall be signed and sealed by a professional engineer registered in the State of California. The independent testing firm shall supply the dial gauges. A minimum of three dial gauges, spaced equally around the circumference of the pile, shall be installed on each test pile. One dial gage shall be installed on each of the reaction piles to monitor deformation during load tests. The Contractor shall supply all other equipment required to perform the tests. The Contractor shall notify the Engineer one week prior to performing the load tests.

2-2. REACTION PILES.

A. The Contractor shall install reaction piles as required around the test piles.

B. Reaction piles shall be abandoned in place after testing and will not be considered part of the permanent structure.

C. The spacing, reinforcing, and number of reaction piles shall be selected by the Contractor to coordinate with the pile testing apparatus and procedures.

D. All information on the reaction piles shall be submitted to the Engineer.
PART 3 – EXECUTION

3-1. STATIC LOAD TESTING.

A. Axial Compressive Load:

1. The axial compressive load test and report of the results shall be conducted and written in accordance with ASTM D1143, except as modified or supplemented by these specifications.

2. Axial compressive load testing shall be conducted in accordance with ASTM D1143, 5.6 – Quick Load Test Method for Individual Piles. Load increments shall be based on the working load carrying capacity (design load) for the pile, and the full test load shall be at least twice the working load carrying capacity.

B. Net Settlement:

1. Net settlement of the test pile shall be recorded as a function of load applied and time. Net settlement shall be defined as the elevation difference of the butt prior to loading and after unloading of the test pile. Measurement of movement shall be in accordance with ASTM D1143, 6.4 – Readings for Quick Load Test Method.

C. Load Test Acceptance:

1. Pile failure shall be defined as a net settlement exceeding 0.01 inch per ton of the test load, but not exceeding 0.5 inches. If any test pile experiences a net settlement in excess of that defined by pile failure at or before the full test load has been attained shall be rejected, the pile load test shall be halted, and the test results submitted in accordance with the load test records paragraph of this specification.

D. Load Test Report:

1. Load test data shall be reduced in both numerical and graphical form. The reduced data shall be submitted to the Engineer for review and acceptance. Six copies of the load test report shall be submitted on forms acceptable to Engineer. In addition to pile installation records required by Augered Pressure Grouted Piles section, test pile data recorded shall include, but not be limited to, the following:

   a. Test pile number and location.
b. Date and time of testing.

c. Load and settlement readings. Both applied loads and loads recorded by the load cell shall be submitted for all settlement readings.

d. Time-load-settlement curve.

2. All data recorded shall be certified as correct.

End of Section
PART 1 - GENERAL

1-1. THE REQUIREMENT.

A. This Specifications section includes requirements for the in-situ soil improvement and related Work indicated on the Drawings using Cement Deep Soil Mixing (CDSM or DSM). The Work consists of furnishing of all plant, labor, tools, equipment, materials, and supplies as required to conduct all necessary soil-cement mixing operations as specified herein.

B. The intent of the CDSM is to improve the soil bearing capacity and shear strength, reduce liquefaction induced settlements and lateral ground movement, and mitigate surface-fault rupture by providing ground improvement under the structures indicated on the Drawings. Surface-fault rupture affects the FE tank foundations only. The CDSM design is intended to meet the project design criteria listed in Section 3-3.

C. Perform all survey layout and utility clearances affecting the soil-cement mixing, and coordinate with local, state, and federal agencies having jurisdiction over the Project.

D. Mobilize and maintain a sufficient number of soil-cement mixing machines, materials, cement grout batching plant, and crews to complete the Work in accordance with Project milestones. Coordinate soil-cement mixing operations will all other aspects of the Work.

E. All spoil return generated by the CDSM operation shall be removed and disposed at an off-site facility. Containment system to be in place during construction to collect and prevent any runoff from the site.

1-2. VALUE ENGINEERING.

A. The requirements set out in this specification and the contract documents are intended to meet the project design objectives and requirements indicated in Section 3-3. Upon review and approval by the Engineer, the contractor may develop and propose modifications or alternatives to the CDSM design, provided the proposed design is supported by detailed design calculations and plans that will be reviewed and approved by the Engineer prior to CDSM production.
1-3. RELATED WORK SPECIFIED ELSEWHERE.

A. The requirements of the following Specifications sections and divisions apply to the Work of this Specifications section. Other sections and divisions of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. 02200B, Earthwork.
2. 02140, Dewatering.
3. Geotechnical Reports. Please see the Project Geotechnical Report for subsurface conditions.
4. CDSM Design Drawings (Plan Sheets 144-SM-010 through -070).

1-4. REFERENCE SPECIFICATIONS, CODES AND STANDARDS.

A. Comply with the applicable reference Specifications sections as specified in the General Requirements and below:

1. ASTM C42/C42M Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
2. ASTM C192. Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
4. ASTM D1632 Standard Practice for Making and Curing Soil-Cement Compression and Flexure Test Specimens in the Laboratory.

1-5. DEFINITIONS.

A. Cement Deep Soil Mixing (CDSM): is a soil improvement technology used to construct cutoff or retaining walls and to treat soils, in-situ. This is accomplished with a series of overlapping stabilized soil columns. The stabilized soil columns are formed by a series of mixing shafts, guided by a crane-supported set of leads. As the mixing shafts are advanced into the soil, cement grout is pumped through the hollow stem of the shaft and injected into the soil at the tip. The auger flights and mixing blades on the shafts blend the soil with grout in pugmill fashion. The mixing shafts are positioned to overlap one another and form a continuously mixed overlapping column. When the design depth is reached, the augers are withdrawn and the mixing process is repeated on the way to the surface.
Left behind are stabilized CDSM columns having the following property: low permeability, improved bearing capacity and shear strength, and able to withstand differential soil and hydrostatic loading.

B. Binder: Chemically reactive material (e.g., cement) that can be used for mixing with in situ soils to strengthen the soils and form DMM columns. Binder slurry is frequently referred to as grout or slurry.

C. Column: Pillar of treated soil produced in situ by a single installation process using a mixing tool, typically a rotating auger, to make a round column. A rectangular barrette produced by twin horizontal mixing shafts is also a column. See “element” and “panel,” which are related geometric terms.

D. Element: This is an inclusive term that refers to a CDSM element produced by a single stroke of the mixing tools at a single equipment location. A column produced by a single-axis machine, a set of overlapping columns produced by a single stroke of a multiple shaft mixing tool, and a rectangular barrette produced by a mixing tool with horizontal axis rotating cutter blades are each considered an element. An element consisting of overlapping columns produced by a single stroke of a multiple-shaft mixing tool is sometimes referred to as a “panel.” A chainsaw-type mixing tool that travels as it mixes produces a continuous wall, which is not an element.

E. Grout: is a stable colloidal mixture of water and Portland cement. Additional materials such as lime, bentonite clay, attapulgite clay, or fly ash may be added.

F. Mix design: Ratios of soil, binder, water, and additive quantities required to meet the design requirements of the project.

G. Mixing tool: Equipment used to disaggregate the soil and distribute and mix the binder with the soil, consisting of one or several rotating units equipped with several blades, arms, and paddles with or without continuous or discontinuous flight augers, horizontal rotating cutter blades, or chainsaw-type cutters.

H. Panel: Group of overlapping elements arranged to form a continuous panel or wall. Continuous walls can also be constructed using a chainsaw-type of mixing device.

I. Soil-cement: Product of CDSM consisting of a mixture of the in-situ soil and binder. Also referred to as treated soil or deep mixed material.
J. Stroke: One complete cycle (penetration and withdrawal) of the mixing process.

K. Volume ratio: Ratio of the volume of slurry injected (in wet mixing) to the volume of soil to be treated.

L. Spoil Return: all materials including, but not limited, to liquids, semi-solids, and solids, which are discharged above the ground surface or mudline, as a result of soil-cement mixing.

1-6. CONTRACTOR SUBMITTALS.

A. Submittals shall be made in accordance with the General Requirements and Section 01300, Submittals. Prior to the beginning the CDSM test section and production CDSM elements, the Contractor shall submit a CDSM Plan describing, as a minimum, the following information:

1. Qualification: Submit evidence that the Contractor is experienced and competent to construct the CDSM treatment. Evidence shall include the successful completion of five similar projects. This provision shall not relieve the Contractor from overall responsibility for the Work of this Specifications section. See additional requirements under Section 1-7, Quality Assurance.

2. Bench-scale testing report: The Contractor must submit results from bench-scale tests conducted. The report should provide all data collected, including, at a minimum, descriptions of sampling techniques used, boring logs, classifications of all major soil strata to be mixed, site groundwater conditions, binder materials used, mixed design proportions, laboratory mixing techniques used, and curing curves for unconfined compressive strength versus time for each major soil type. Discussion of tests results should be provided, including proposed mix designs for use in the field.

3. Test Section: A map indicating where the test section described in the specification will be constructed, as well as the dimensions and layout of the test section and testing plan. See additional requirements in Section 2-2.

4. Submit detailed sketches of intended injection techniques, sequencing, and patterns based on CDSM Design Drawings. Provide necessary calculations and analyses to verify the proposed CDSM pattern will meet project design criteria.

5. Final grout mix design based on the results of the Test Section. The grout mix design shall be reviewed and accepted by an OCSD certified testing lab.
6. Identification of the Contractor’s independent materials testing laboratory that will do the compressive strength testing.

7. Identification of subcontractor that will perform coring.

8. Element Numbering Scheme: An element numbering system and plan to be used in identifying each element.

9. Calibrations: Calibration tests for all metering equipment, including mixing systems, delivery systems, alignment systems, mixing tool rotational and vertical speed, grout injection pressure, and rotation and extraction rates.

10. Sample of the Daily Quality Control Report to be used.

11. Submit a CDSM installation Plan, including a detailed Quality Control/Quality Assurance Program as specified in paragraph entitled “Quality Assurance” in this Specifications section prior to the start of the CDSM operation for Engineer acceptance. The CDSM Plan shall be submitted with the Earthwork, Shoring, and Dewatering Plans. The Contractor shall ensure that the CDSM, earthwork, shoring, and dewatering Plans are compatible.

1-7. QUALITY ASSURANCE.

A. Work required under this Specifications section shall be performed by a Contractor having at least 5 years of experience in the field of CDSM soil stabilization and having successfully completed at least five (5) projects of a similar nature. The contractor must assign a project manager who has had significant experience on at least five CDSM projects. The Contractor’s proposed CDSM operator shall have a minimum of two year of experience with the equipment and CDSM construction.

B. The Contractor certified testing lab shall sample and test the soil-cement mixture as specified in paragraph entitled “Quality Control/CDSM Testing Frequency” of this Specifications section.

C. Coordinate the work operations of this Specifications section with that of other trades involved and with the Engineer to ensure proper sequence of Work, limitation, methods, and time of Work so as to minimize or avoid interferences as well as performance of Work by other trades.

D. Contractor shall develop a detailed Quality Control/Quality Assurance (QC/QA) plan (QCP). The plan shall include:

1. Project Personnel: List of individuals responsible for QC with authority to take corrective action.
2. Materials: Provide a list of all materials including detailed descriptions and sources.

3. Mix Design: provide mix design produced from a mixture of cement and the actual in-situ soils containing the unconfined compressive strength, the total unit weight test results, and linear shrinkage strain behavior of the treated soils.

4. Production: Detailed listing of equipment proposed for the Project and description and plan of the plant layout for the site including material storage facilities, staging area, cement mixing and production areas, spoil containment facilities, and spoil removal and disposal details.

5. QCP: detailed description of the QCP including methods for assuring compliance with Specifications sections requirements, daily production reports, alignment profiles, and other QC forms as required to demonstrate and document conformance.

PART 2 - PRODUCTS

2-1. MATERIALS.

A. Grout, as referred to herein, shall be cement mixture that when mixed with the soil binds together the soil grains for the purpose of increasing the its strength. Cement binder materials should conform to ASTM C150, Low-aaklali Type II PCC.

B. The solidified soil shall have a minimum unconfined compressive strength of 500 pounds per square inch (psi) at twenty-eight (28) Days. The solidified soil shall have a linear shrinkage strain of less than 1 percent at twenty-eight (28) Days.

C. In areas within the CDSM treated zone that will be excavated to construct structures, such as the pump station wetwells, as shown on the plans, the maximum 28-day unconfined compressive strength of the soil cement mixture shall be 100 psi so that it is excavatable.

D. Water used in drilling, mixed cement grout, and other applications shall be potable.

E. The Contractor shall be responsible for formulation of the cement grout.

F. The cement used shall be so proportioned and mixed as to produce a grout that contains no solids in suspension so that it may be pumped without difficulty.
2-2. PRE-PRODUCTION TEST PROGRAM

A. Prior to production, the contractor will construct a test section at the site to verify that the contractor’s proposed equipment, procedures, and mix design can uniformly mix the onsite soils and achieve the product requirements outlined in the acceptance criteria in Section 3-3.

B. Laboratory bench-scale testing should be used to identify initial mix designs for use in the test section. Bulk soil samples from the site should be obtained by the Contractor. A suite of three mix designs is required for each major soil stratum encountered to the expected termination depth of the elements.

C. At least 30 days before the start of field validation program, the contractor should submit a plan drawing showing the locations of the test section elements, descriptions of the construction procedures, equipment, and ancillary equipment to be used for mixing and binder proportioning and injection; and mix design parameters, associated soil, a summary of QC/QA samples to be collected and tested; and examples of the forms that will be used to document the work. The Contractor may construct more than one test section using various mixing designs, if desired.

D. At least three elements should be installed for each proposed mix design. Each element should extend from ground surface to the required tip elevation. The element size and element overlap shall be consistent with the production elements.

E. The Contractor shall record all construction equipment and procedures used and sensor readings during the test section to set the following construction criteria for production CDSM elements:

1. Grout mix design including ratios of all materials mixed to form the grout
2. Grout specific gravity
3. Grout injection rates
4. Mixing tool penetration and withdrawal rates
5. Mixing tool rotation speed
6. Type of equipment
7. Construction procedures and techniques

F. The Contractor shall obtain full-depth core samples from the test elements selected by the Engineer in accordance with the QC/QA requirements outlined in Article 3-2. Test samples shall be submitted to an approved
independent laboratory for testing and submit the test results for review and approval.

G. Construction of production elements may begin only after written acceptance of the test section, quality control program and associated construction parameters described above by the Engineer. If criteria, procedures or equipment are changed following acceptance of the test sections, the Engineer reserves the right to require the Contractor to construct a new test section at no cost to the owner.

2-3. **SOIL MIXING EQUIPMENT.**

A. Soil mixing equipment (machine with a mixing tool that is capable of injecting grout into a soil mass as the soil and grout are mixed) shall meet the following requirements:

1. The mixing tools shall be of sufficient size, capacity, and torque to thoroughly blend the in situ soils and soil-binder mixture into a homogeneous element of soil-cement to the desired depths.

2. The mixing and injection equipment should be sufficient to adequately blend and distribute the binder with the in situ soils to provide the required strength.

3. The mixing tools should be adequately marked to allow the Engineer to confirm the penetration depth to within 1 foot during construction. If rigs with varying mixing tool lengths are used, the shortest tools should extend to the lowest element termination elevations indicated in the plans.

4. The power source for driving the mixing tool shall be sufficient to maintain the required revolutions per minute (RPM) or injection pressure and penetration rate from a stopped position at the maximum depth required as determined from the test section. The Contractor shall consider the range of expected subsurface conditions, indicated by the available boring and cone penetration test logs and other test data included in the geotechnical data report.

5. Electronic sensors, built into the soil mixing equipment, to perform the following:
   a. Determine vertical alignment of the leads in two directions: fore-aft and left-right.
   b. Monitor the mixing tool penetration/withdrawal speed, mixing tool rotation speed, and injection pressure.
c. All output from the sensors shall be routed to a console that is visible to the operator and the Engineer during penetration and withdrawal.

d. The sensors shall be calibrated at the beginning of the project and calibration data transmitted to the Engineer. The calibration shall be repeated at intervals not to exceed two months.

e. An alternative display/monitoring system may be used subject to review and approval by the Engineer prior to use.

f. The Engineer shall have access to the monitoring equipment.

6. All of these monitored functions shall be fully adjustable during operation of the equipment.

2-4. MIXING.

A. All materials shall be accurately measured by weight or volume for mixing. If a variable proportioning pump system is used, positive controls shall be incorporated to ensure accurate proportioning. Care shall be taken not to contaminate mixing vessels with reactive chemicals by spillage, splash, etc.

B. A fast check reaction shall be made with each new primary binder batch. A test sample shall be made of every injection batch. Keep records to establish the point of injection for each sample. This data shall be submitted to the Engineer on a daily basis.

C. If any sample fails to show the proper gelation, the potential area of failure as defined by the Engineer shall be reinjected. The Contractor shall propose method of correction.

PART 3 - EXECUTION

3-1. APPLICATION.

A. The extent of the soil stabilization required is presented in the Area 144 drawings. A ground improvement area replacement ratio of 60 percent shall be used for the FE tanks, and pump station area, and 100 percent for the Metering Box, Diversion Structure, and Weir Box. The 108-inch and 120-inch pipe shall be protected during soil stabilization to a depth of 30 feet below grade.

B. All CDSM columns shall extend to a minimum an elevation of -49 feet within the CDSM improvement area.
C. Bottom of structure elevations.

<table>
<thead>
<tr>
<th>Structure</th>
<th>Bottom of Base Slab Elevation (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tanks</td>
<td>8.6 (Coordinate with tank manuf.)</td>
</tr>
<tr>
<td>Pump Station Wetwell</td>
<td>-22.5</td>
</tr>
<tr>
<td>Pump Station Building</td>
<td>13</td>
</tr>
<tr>
<td>Metering Structure Sump</td>
<td>-5.5</td>
</tr>
<tr>
<td></td>
<td>-11.88</td>
</tr>
<tr>
<td>Diversion Structure</td>
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<tr>
<td>Weir Box</td>
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<tr>
<td>Valve Vault Sump</td>
<td>-5</td>
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<tr>
<td></td>
<td>-9.88</td>
</tr>
</tbody>
</table>

D. The element overlap between any two adjacent circular elements shall be at least 20 percent of the area of a single element at the ground surface. The overlap between adjacent rectangular elements shall be a minimum of 10 inches. The overlap between two elements shall be achieved by cutting into an existing adjacent element with the soil mixing tool while installing the new element.

E. Injection rates and pressures shall be closely controlled to prevent blowout, localized "quick" conditions, and to ensure the proper filling of voids to attain the desired stabilized section.

F. Quantities of grout injected at each point shall be governed by calculated volume, backpressure, or a combination of these two factors. If it appears, at any point, that a large void exists, proper steps shall be taken to ensure permeation of the desired soil section as directed by the Engineer.

G. Excess material or soils generated from the CDSM operations shall be disposed of in accordance with paragraph entitled "Disposal of Excess Excavated Material" of the Specifications Section 02200B, Earthwork.

3-2. QUALITY CONTROL/CDSM TESTING FREQUENCY.

A. Discrete wet-grab sampling shall be performed by the Contractor in the test section and production elements while meeting the following minimum requirements:

1. Samples shall consist of in-situ mixed soil and grout in its "fluid" state retrieved with equipment that can discretely sample at depths specified by the Engineer.
2. Four sample cylinders per depth location are required to perform compressive strength testing at 7, 14, and 28 days with one reserve sample for test at 56 days if the twenty-eight (28) Day result does not meet the required strength.

3. Sufficient sample shall be taken to form the required number of cylinders for compressive strength testing.

4. The samples shall be formed in cylinders 3-inches diameter by 6-inches long in accordance with ASTM C42/C42M.

5. Determine unit weight on each 3-inch cylinder as part of the unconfined compressive strength testing process.

6. Three specimens for linear shrinkage bar tests shall be prepared from the same wet grab samples. One specimen shall be tested at seven (7) Days’ curing and two other specimens shall be tested at fourteen (14) Days’ curing.

B. During production, take wet-grab samples of the soil-cement mixture at the rate of at least one sample for each 600 cubic-yards of soil-cement elements with a minimum of one sample per day.

C. Full-depth continuous sampling shall be performed by the Contractor on the test section and production elements while meeting the following minimum requirements:

1. The Contractor shall determine the time interval between element installation and coring except that the interval shall be no longer than required to conduct the 28-day strength testing.

2. Samples shall be retrieved using triple tube or equivalent continuous coring techniques after the soil-grout mixture has hardened sufficiently.

3. Each core run shall be at least 4 feet in length.

4. Samples shall have a diameter of at least 2.5 inches and a height to diameter ratio of 2.0.

5. Upon retrieval, the samples shall be given to the Engineer for field logging and test specimen selection.

6. Photograph each core run.

7. A minimum core run recovery of 85 percent for each 4-foot-long core run shall be achieved. During coring, the elevation of the bottom of the holes shall be measured after each core run in order that the core recovery for each run can be calculated.

8. Lumps of unimproved soils shall not amount to more than 20 percent of the total volume of any 4-foot section of continuous full-depth core sample. Any individual or aggregation of lumps of unimproved soil shall
not be larger than 12 inches in greatest dimension. For evaluating the
volume of unimproved lumps of soil, all of the unrecovered core length
shall be assumed to be unimproved soil. In addition, within a single
core, the sum length of unmixed or poorly mixed soil regions or lumps
that extend entirely across the diameter of the core sample will be
considered unimproved.

9. Following logging and test specimen selection by the Engineer, the
entire full-depth sample, including the designated test specimens, shall
be immediately sealed in plastic wrap to prevent drying, placed in
suitable core boxes, and transported to the Contractor's independent
materials testing laboratory by the Contractor within 24 hours.

10. The samples should be stored in a moist room in accordance with
ASTM C192 until the test date.

11. All core holes shall be filled with cement grout that will obtain 28-day
strength equal to or greater than the strength of the CDSM.

12. Three samples per depth location are required to perform compressive
strength testing at 28 and 56 days with one reserve sample.

D. During production, take a minimum of 10 (ten) random, continuous core
samples along the full depth of the soil-cement column for uniformity
determination as selected by the Engineer. The core samples shall be
examined by the Engineer for uniformity determination. Test a minimum of
twenty randomly selected specimens from the core samples by the
Engineer for unconfined compressive strength and unit weight
determinations.

E. All specimens shall exhibit unconfined compressive strength values
exceeding those specified in Part 2 paragraph entitled “Materials’ and the
coefficient of variation of all tests shall not be less than 25 percent.

F. The testing frequencies listed above may be increased if determined
necessary by the Engineer based on the evaluation of test results.

3-3. PROJECT DESIGN CRITERIA.

A. Soil Bearing Capacity: the improved soils using CDSM shall have a
minimum net allowable bearing capacity of 5,000 pounds per square foot
for dead and live loads.

B. Settlement: Maximum total settlement of 2 inches and differential
settlement of 1 inch over 50 feet under static and seismic conditions.

C. Lateral Movement: Maximum lateral displacement of 2 inches due to
liquefaction-induced lateral spread.
D. No Collapse due to fault rupture displacement.

3-4. **CLEANUP.**

A. Upon completion of soil stabilization and Work specified herein, dispose of all excess materials off the jobsite and the jobsite shall be left in a clean and orderly condition ready for subsequent Work operations.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing of labor, materials and equipment for the construction of asphaltic concrete base or binding course, bituminous tack coat, and asphaltic concrete surface or wearing course for the roadway, driveways and parking area as indicated on the Drawings.

Subgrade preparation shall be as indicated in the GWRS Earthwork section for work on OCWD property and OCSD Earthwork section for work on OCSD property, unless otherwise specified in the governing standards or herein.

Asphaltic concrete paving shall be constructed to the lines, grades, and cross sections indicated on the drawings. Type of construction shall be as indicated on the Drawings and as specified herein.

1-2. GENERAL.

1-2.01. Governing Standards. Work of this section shall be performed in accordance with the Standard Specifications for Public Works Construction (SSPWC), unless otherwise specified herein. All materials and procedures shall comply with the rules and regulations of the South Coast Air Quality Management District.

1-2.02. Coordination. Contractor shall coordinate the construction of asphaltic concrete paving with the excavation, the construction of concrete curb and gutters and other construction.

1-3. SUBMITTALS. All submittals of design mix reports including design mix test results and other data, shall be in accordance with the Submittals Procedures section.

A. Samples. Prior to the delivery of specified aggregate to the site, the Contractor shall submit samples of the material for the Engineer’s acceptance in accordance with SSPWC Section 4-1.4. Samples shall be typical of materials to be furnished from the proposed source and in conformance with the specified requirements.

B. The Contractor shall formulate a job-mix formula using the Hveem method with the optimum asphalt content determine by California Test 367 in accordance with SSPWC Section 203-6.2 and submit it to the Engineer for approval.
C. Certificates:

1. Twenty days prior to the delivery of aggregates, asphalt materials, and paving mixes to the project site, the Contractor shall submit to the Engineer certificates and test results of compliance of such materials with these Specifications.

2. Where laboratory testing is specified herein, the Contractor shall employ an independent testing laboratory to conduct such tests and submit certificates of the test results.

PART 2 - PRODUCTS

2-1. GENERAL.

A. The Contractor shall make all tests necessary to locate a source of materials that meet the Specifications. Final approval of the aggregate material will be based on tests of material taken by the Contractor from the compacted base course.

2-2. AGGREGATE BASE.

A. Aggregate base shall conform to the provisions of the latest edition of the Standard Specifications for Public Works Construction (SSPWC), Subsection 200-2.2, Crushed Aggregate Base, or Subsection 200-2.4, Crushed Miscellaneous Base. Crushed miscellaneous base shall have only the fine gradation. Aggregate shall be asbestos free.

2-3. ASPHALT CEMENT.

A. Asphalt cement for binder shall be AR-4000 paving asphalt and shall conform to the requirements of SSPWC Section 203-1 Paving Asphalt.

2-4. PRIME COAT.

A. Asphalt to be used for a prime coat shall be liquid asphalt SC-250 and shall conform to the requirements of SSPWC Section 203-2 Liquid Asphalt.

2-5. TACK COAT.

A. Asphalt emulsion shall be CSS1 or CSS-1h and shall conform to the requirements of SSPWC Section 203-3 EMULSIFIED ASPHALT.
2-6. EMULSION-AGGREGATE SLURRY.
   A. Materials for emulsion-aggregate slurry shall be as specified in SSPWC Subsection 203-5.

2-7. ASPHALT CONCRETE.
   A. Asphalt concrete for paving the designated area shall be Class C2-AR-4000 hot-plant mix and shall conform to the requirements of SSPWC Section 203-6 Asphalt Concrete.
   
   B. Asphalt content in the pavement shall be 5.5 percent to 6.0 percent by weight. Asphalt concrete (AC) paving shall conform to III-C2-AR-4000 as defined in SSPWC, Subsection 400-4. Asphalt shall be viscosity grade AR-4000 or AR-8000.

   C. Aggregate shall be in accordance with SSPWC Subsections 400-1.1. Aggregate shall be asbestos free.

   D. Coarse aggregate shall consist of material of which at least 75 percent by weight shall be crushed particles in lieu of the requirements of SSPWC, Subsection 400-4.2.3.

2-8. WEED KILLER.
   A. Weed killer shall be Karmex 80, as manufactured by Dupont Chemical Company, or Diuron 4L, as manufactured by Drexel Chemical Company, or equal.

2-9. DESIGN MIXES. A design mix for the asphalt base course and for the surface course, based upon the aggregates to be furnished, shall be determined by an independent testing laboratory at the expense of Contractor and shall be submitted to Engineer for review.

The design mixes shall be based on the Marshal Test Method, and upon acceptance by Engineer, shall be the basis for the mixes to be used in asphaltic concrete pavement construction. The proposed design mix data submitted for review shall include at least the following:

- Marshall stability, all mixtures
- Density
- Number of compaction blows
- Flow, all mixtures
PART 3 - EXECUTION

3-1. EQUIPMENT.

A. Equipment and facilities for storage, measuring, mixing, heating, transporting, spreading, compacting, and other operations shall be in accordance with the applicable requirements of the governing standards. Improved or modernized equipment which will produce results equal in quality to those which would result from the specified equipment will be considered for use. All equipment and facilities shall be acceptable to the Engineer.

3-2. EXCAVATION AND BACKFILL.

A. Excavation and backfill are specified in the GWRS Earthwork section for work on OCWD property and OCSD Earthwork section for work on OCSD property.

3-3. PREPARATION OF SUBGRADE.

A. Subgrade shall be shaped and compacted in accordance with SSPWC Subsections 300-4.7 to 95 percent relative density.

B. Use of the prepared subgrade for hauling will not be permitted. The Contractor shall protect the prepared subgrade from all traffic.

C. The subgrade shall be maintained in the finished condition until the first succeeding course is placed.

D. Unless specified otherwise on the Contract Documents, the upper 30 inches of subbase, the Street Zone, shall be compacted to not less than 95 percent relative density. Compaction operations shall be in conformance with the GWRS Earthwork section for work on OCWD property and OCSD Earthwork section for work on OCSD property.

3-4. BASE COURSE.

A. Place crushed aggregate base in a uniform layer over the entire area to receive base course, without segregation of size, to such loose depth that when compacted with the power roller, the course shall have the required thickness shown on the Drawings. Compact over the full width until a density of 95 percent as determined by AASHTO T 180 is obtained. Blade the base with a grader and roll, while damp, with the power roller specified above until the course is thoroughly and uniformly compacted and its surface is smooth and conforms to the grade requirements specified. Maintain the surface in its finished condition until the succeeding layer is placed.
3-5. **WEED KILLER.**

A. After the subbase has been prepared, weed killer shall be applied to the entire base. The weed killer shall be applied according to the manufacturer's published instructions.

3-6. **PRIME COAT.**

A. Prime coat is required in this Contract.

B. After treatment with weed killer, the aggregate base course shall be primed prior to application of the asphalt concrete in accordance with SSPWC, Subsection 302-5.3.

C. The prime coat shall be applied only when the base course surface is dry or slightly damp. For extremely dry areas, a light application of water may be required prior to application of the prime coat which will permit uniform distribution and the desired penetration. The prime coat shall not be applied when the ambient atmospheric temperature is below 60°F.

D. The prime coat shall be applied at a temperature of 175°F to 225°F, and at a rate of 0.3 to 0.4 gallons per square yard.

E. Following the application of the prime coat material, the surface shall be allowed to dry for at least 48 hours without being disturbed, or for an additional period of time as may be necessary to attain penetration of the prime material into the base course, and drying out or evaporation of the volatiles in the prime coat material. Traffic shall be kept off the prime coat until it has penetrated the base course and cured. No prime coat drying time limit is imposed on public streets where fast completion is important. The Contractor shall furnish and spread enough imported sand on all areas that show an excess of bituminous material to effectively blot up and cure excess prime coat material.

F. The primed surface shall be maintained by the Contractor until the succeeding layer of pavement has been placed. During this interval, the Contractor shall protect the primed surface against damage and shall repair all broken spots.

3-7. **CONSTRUCTION OF ASPHALT CONCRETE PAVEMENT.**

A. Lay asphalt concrete over the aggregate base in accordance with the SSPWC Section 302-5.5. The method of proportioning, mixing, transporting, laying, processing, rolling the material, and the standards of workmanship shall conform to the applicable requirements of SSPWC Section 302-5 Asphalt Concrete Pavement. At no time shall the coarse
aggregate that has segregated from the mix be scattered across the paved mat.

B. A tack coat of emulsified asphalt shall be applied to the first lift of the pavement prior to placing the second lift. Application shall be in conformance with SSPWC Section 302-5.4.

C. The Engineer will examine the base before the paving has begun. The Contractor will correct any deficiencies before the paving is started. Roll each lift of the asphalt concrete and compact to 95 percent of the density obtained with the California Kneading Compactor per California Test 304. The grade, line, and cross section of the finished surface shall conform to the Drawings.

D. Asphalt concrete pavement shall consist of one or more courses of a mixture of paving asphalt and graded aggregate placed upon a roadbed or base, or over existing pavement, as indicated on the Contract Documents. The mixture shall be placed when it is at a temperature of not less than 250°F nor more than 320°F and shall not be placed onto a wet surface or when the ambient atmospheric temperature is less than 40°F. All paving or resurfacing shall match the appearance of the existing improvements. A 5-inch asphalt concrete course shall be placed over an 9-inch aggregate base course unless otherwise shown on the Contract Documents.

E. When asphalt is to be applied over existing pavement, and local irregularities in the existing surface would result in a course of more than the specified thickness, the surface of the existing pavement shall be brought to uniform contour by patching with asphalt concrete thoroughly tamped or rolled until it conforms with the surrounding surface, and a tack coat applied to the entire surface. Any existing base, surfacing or pavement shall be thoroughly cleaned immediately prior to receiving the plant-mixed surfacing material.

F. Finished pavement, when ready for acceptance, thoroughly compacted and true to cross section, shall not deviate from the designated grade by more than 1/8-inch in 10 feet and shall be free from ruts, depressions and irregularities. The pavement shall be brought to the final grade with a paving machine. The resulting edge of contact between the new and existing pavement shall be a straight, vertical and neat join line parallel to the trench on each side. New pavement shall not lap over the existing pavement.

G. The base asphalt course mixture shall be placed on the prepared subgrade by means of approved spreading devices in accordance with SSPWC, Subsection 302-5.5. Where the finished paving area exceeds 5000 square feet or 9 feet in width, the Contractor shall use only a Barber-
Green type paving machine. For smaller areas, the motor grader method for placing the base course may be used.

H. The final asphalt concrete course surface shall be 1-inch thick with ½ inch maximum aggregate grading. Placing of the final asphalt concrete course shall be done with a Barber-Green type paving machine.

I. Rolling equipment shall conform to the provisions of SSPWC, Subsection 302-5.6.

3-8. PAVEMENT REMOVAL.

A. Pavement removal shall be in accordance with SSPWC Subsection 300-1.3 unless otherwise specified herein.

B. Street pavement or pavement within the treatment plants shall be removed within the limits of all construction excavations prior to excavation. Surplus material shall be removed as specified in the Earthwork section.

C. Prior to removing existing surfacing, pavement cuts shall be made as shown on the Contract Documents and as specified herein. All pavement cuts shall be neat and straight along both sides of the trench or excavation and parallel to its alignment. The strip of existing AC pavement between an excavation and a gutter face or edge of pavement shall be removed and replaced if less than 3 feet in width. Where large irregular surfaces are removed, such trimming or cutting shall be parallel to the roadway centerline or at right angles to the same.

D. After backfilling and compaction, final pavement cuts shall be made by saw cutting (unless permit requirements supersede) to a minimum depth of 2 inches at a point not less than 12 inches outside the limits of excavation.

E. Concrete curbs, cross gutters, sidewalks and driveways shall be saw cut to a minimum depth of 1½ inches and at a point not less than 12 inches outside the limits of the excavation.

3-9. TACK COAT.

A. All vertical or horizontal hard surfaces, which will be in contact with new pavement, shall be tack coated in accordance with SSPWC, Subsection 302-5.4, and at an approximate rate of 0.05 to 0.10 gallons per square yard.
3-10. **SEAL COAT.**

A. The entire asphalt concrete pavement shall be fog sealed with asphalt emulsion prior to final striping. The fog sealer shall be applied within 5 calendar days after final asphalt concrete course, at a temperature of 75°F to 130°F, and at a rate of 0.05 to 0.10 gallons per square yard.

B. Seal coat shall extend over the full width of access road unless otherwise specified.

3-11. **EMULSION-AGGREGATE SLURRY.**

A. Emulsion-aggregate slurry shall be applied in accordance with SSPWC Subsection 302-4.

3-12. **PAVING HEADERS.**

A. All edges of paving adjacent to earth shall be bounded by 2- x 6-inch net, new rough-sawn redwood headers staked with 2- x 2- x 18-inch redwood stakes, 4 feet on centers. The top edge of headers shall be at the grade of the proposed asphalt surface. The top of stakes shall be 1-inch below the top of the header.

3-13. **ASPHALT CURBS.** (Not used)

3-14. **REPAIRS.**

A. Areas of new or existing asphalt concrete requiring repair shall be delineated by saw cutting and the asphalt concrete removed, then prime or tack coated, and paved with hot asphalt as specified herein.

3-15. **TEMPORARY PAVING.**

A. On city streets and where otherwise indicated, pavement removed for trenching operations shall be replaced with 2 inches of temporary asphalt paving mix within one day after compaction is approved by the Engineer. Cross streets are to be paved with temporary pavement on the same day that excavation is made. Temporary pavement shall be maintained so that a smooth traversable surface free from ruts, depressions, holes and loose gravel is available at all times for vehicular traffic.
B. The cost of temporary asphalt paving is considered to be included in the Contract unit prices for the work and no extra compensation will be made to the Contractor.

3-16. **CLEANUP.**

A. Clean all debris and unused materials from the paving operation. Clean all surfaces that have been spattered or defaced as a result of the paving operation. Asphalt or asphalt stains which are noticeable upon surfaces of concrete or materials which will be exposed to view shall be promptly and completely removed. Cleaning shall be done in a manner that will not result in the discharge of contaminated materials into any catch basin or storm drain system.

3-17. **PROTECTION.**

A. In addition to the requirements for protection stipulated in the governing standards, Contractor shall protect all adjacent concrete and masonry so that no damage will occur as the result of subsequent construction operations. All damage or discoloration shall be repaired to the satisfaction of Engineer before final acceptance by Owner.

Special care shall be taken to prevent tack or other asphalt materials from spraying or splashing. Adjacent construction shall be protected by covering with suitable fabric or paper.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers the construction of concrete sidewalks, curb and gutter. This section also covers the reconstruction of concrete sidewalks, curb, and gutter.

Subgrade preparation shall be as indicated in the GWRS Earthwork section for work on OCWD property and OCSD Earthwork section for work on OCSD property, unless otherwise specified in the governing standards or herein.

1-2. GENERAL. All existing sidewalks, and curb and gutters disturbed or damaged during construction of new work, or indicated on the Drawings to be demolished and replaced shall be reconstructed to the lines, grades, and cross sections indicated on the Drawings. Damaged curbs, sidewalks and/or gutters shall be restored to their original locations, cross sections, and style unless indicated otherwise on the Drawings.

Contractor shall be responsible to remove, construct, reconstruct, and adjust as necessary all existing or new manhole tops, curb and gutter, and area drainage structures to match new grades as needed.

1-2.01. Governing Standards. Except as otherwise specified or indicated on the drawings, materials, equipment, details, and construction methods shall comply with the applicable standards of Standard Specifications for Public Works Construction (SSPWC), as required.

1-3. Contractor Submittals. Submittals shall be in accordance with the Submittals section.

PART 2 - PRODUCTS

2-1. MATERIALS. The sources of materials shall be acceptable to Engineer. Except as otherwise modified herein, materials shall conform to the requirements of the governing standards.

Concrete materials shall be as follows:

Forms

SSPWC Section 303-5.2.
Drainage outlet through curb

Sidewalks
  Concrete designation. See Cast-In-Place Concrete section.
  Portland cement designation. See Cast-In-Place Concrete section.
  Aggregate designation. Coarse.

Curbs and Gutters.
  Concrete designation. See Cast-In-Place Concrete section.
  Portland cement designation. See Cast-In-Place Concrete section.
  Aggregate designation. Coarse.
  Reinforcing steel grade. See the Concrete Reinforcement section.
  Membrane curing compound. See the Concrete Finishing, Placing, and Curing section.
  Expansion joint filler  1/2-inch thick, preformed asphalt-impregnated, expansion joint material conforming to ASTM D 994.

2-2. DESIGN MIXTURE DATA. The design mixture shall be as specified in the Cast-In-Place Concrete section.

PART 3 - EXECUTION

3-1. SUBGRADE PREPARATION. As a minimum, the top 6 inches of the subgrade shall be compacted to a 95 percent of standard proctor density at optimum moisture content as determined by governing standards. In addition, the stability of subgrades shall be such that when materials for construction are deposited on the subgrade no rutting or displacement of the subgrade by material hauling vehicles will occur. No materials shall be placed on subgrades which are muddy, frozen, or have frost, snow, or water thereon. Subgrades shall be thoroughly compacted and properly shaped before any surfacing, curb and gutter, or sidewalk materials are placed. All subgrade and surfacing shall be sloped as indicated on the Drawings, and as needed to achieve a uniform slope between new and existing surfaces. Sidewalks shall slope toward one edge.

3-2. CONCRETE SIDEWALKS. Concrete sidewalks damaged or removed by Contractor during performance of work shall be completely reconstructed at their original locations as indicated on the drawings. The width and thickness of reconstructed sidewalks are to be the same as the original sidewalks and shall be verified with Engineer prior to reconstruction.
New concrete sidewalks and handicap ramps shall be as indicated on the Drawings and as required.

Concrete shall be placed, vibrated, and finished as described in the governing standards.

One-half inch expansion joints shall be provided where sidewalks abut a curb, structure, existing sidewalk, at changes in directions, and at intervals of not more than 40 feet. Expansion joints shall be filled to within 3/4 inch of the surface with bituminous expansion joint material, and then filled flush to the surface with self-leveling caulking in accordance with the Joint sealant section. The joint sealing compound shall be finished slightly concave, and shall not be allowed to overflow the joint.

Concrete sidewalks shall be screeded to the proper elevation and contour. All aggregates shall be completely embedded in mortar. Screeded surfaces shall be given an initial float finish as soon as the concrete has stiffened sufficiently for proper working. Any piece of coarse aggregate which is disturbed by the float or which causes a surface irregularity shall be removed and replaced with mortar. Initial floating shall produce a surface of uniform texture and appearance, with no unnecessary working of the surface. A second floating at the time of initial set shall follow initial floating.

Floated surfaces shall be given a light broom finish, using a horsehair broom, to provide a nonslip surface. Brooming shall be at right angles to the length of the curb, walk, or gutter.

New sidewalks shall be edged to match existing sidewalks. Sidewalks shall be edged using a 3 to 4 inch wide edging tool with a 1/8 inch corner radius. Edger lap marks at corners of each slab shall be carefully removed. False joints shall be provided at right angles to the length of the walk, using a grooving tool with 1/8 inch radius and a depth of 1.2 inch. The finished edge on each side of the joint shall be the same width as the edging tool used. False joints shall divide each sidewalk into square sections.

The finished surface of all sidewalks shall be neat in appearance, shall be sloped to drain, and shall not pond water.

The finished concrete shall be cured and protected as stipulated in the governing standards.

3-3. CONCRETE CURB AND GUTTER. New concrete curb and gutter shall be as indicated on the Drawings and specified herein. Existing concrete curb and gutter damaged or removed by Contractor during performance of work shall be completely reconstructed at their original locations to the configuration and the
existing lines and grades. Replacement concrete curb and gutter shall match the existing curb and gutter. Unless otherwise authorized by Engineer, adjacent and enclosed curbs, drainage structures, and gutters shall be placed before placement of pavement sections.

3-3.01. Forms. Forms shall be in conformance with the governing standards. All forms shall be in good condition, with not more than 1/8 inch variation in horizontal and vertical alignment for each 10 feet in length. Side forms shall have a depth at least equal to the edge thickness of the concrete being formed. The forms shall be set true to line and grade and shall be adequately supported to stay in position while depositing and consolidating the concrete. Forms shall be designed and constructed so as to permit their removal without damage to the concrete. Setting forms shall be in conformance with SSPWC Section 303-5.2.1.

3-3.02. Joints. Expansion and contraction joints shall be formed at right angles to the alignment of the curb and gutter and to the depths as specified, as indicated on the Drawings, and in conformance with the governing standards.

a. Expansion Joints. One half inch wide expansion joints shall be placed full depth using a premolded expansion joint material, cut to the configuration of the full size of the Curb and Gutter section, being secured so that they are not moved by depositing and compacting the concrete at these joints. The edges of these joints shall be rounded by an edging tool of 1/8 inch radius.

Expansion joints shall be placed at the beginning and end of radii, where curbs and gutters abut structures, and at intervals of approximately 45 feet. Expansion joints shall be constructed in conformance with SSPWC Section 303-5.4.2.

b. Contraction Joints. Contraction joints shall be a minimum of 3 inches deep on all sides, shall be spaced at approximately 15 foot intervals, and shall be formed by a 1/8 inch thick steel template, cut to the configuration of the Curb section. These templates shall be secured so that they are not moved by depositing and compacting the concrete. Unless otherwise indicated on the Drawings, and as soon as the concrete has hardened sufficiently, the templates shall be removed from all contraction joints. The edges of the joint shall be rounded with an edging tool having a maximum radius of 3/8 inch.

All expansion and contraction joints shall be filled flush to the surface with joint sealing compound. The joint sealing compound shall be finished slightly concave and shall not be allowed to overflow the joint. Weakened plane joints shall be placed in conformance with SSPWC Section 303-5.4.3.
3-3.03. **Finishing.** Curb and gutter shall be finished to the shape indicated on the drawings. After the forms have been removed, all exposed edges shall be rounded, using an edging tool with a 1/8 inch corner radius. Exposed surfaces shall be float finished and given a light broom finish applied at right angles to the curb at the time of initial set, using a horsehair broom. Mortar or dryer shall not be used to remove imperfections. In all cases, the resulting surface shall be smooth and of uniform color with all rough spots, projections, and form stakes removed. No plastering of the concrete will be allowed. The finished curb shall have a true surface, free from sags, twists, or warps; shall have a uniform appearance; and shall be true to the original lines, grades, and configurations indicated on the Drawings. The finished surface of the walk shall be in conformance with SSPWC Section 303-5.5.3. The stripping of front forms and finishing of curb shall be in conformance with SSPWC Section 303-5.5.2. Where the back of new curb is exposed, it shall likewise be finished in conformance with SSPWC Section 303-5.5.2.

3-4. **PROTECTION.** In addition to the requirements for protection set forth in the governing standards, Contractor shall protect all adjacent concrete and masonry so that no damage will occur as the result of subsequent construction operations. All damage or discoloration shall be repaired to the satisfaction of Engineer before final acceptance by Owner.

Special care shall be taken to prevent bituminous materials from spraying or splashing. Adjacent construction shall be protected by covering with suitable fabric or paper.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing and installation of 4 through 36 inch buried polyvinyl chloride (PVC) pressure pipe for potable water service. PVC pressure pipe shall be furnished complete with all fittings, jointing materials, anchors, blocking, encasement, and other necessary appurtenances.

Pressure and leakage tests, cleaning, and disinfection, are covered in other sections. Pipe trenching, bedding, and backfill are covered in the GWRS Trenching and Backfilling section for work on OCWD property and the Earthwork – OCSD section for work on OCSD property.

The following pipe may be permitted as an alternate to PVC pressure pipe:

- Ductile Iron Pipe
- Steel Pipe

Specifications for alternate pipe materials are covered in other sections.

Pipe shall be furnished where indicated in the pipeline schedule or where indicated on the Drawings.

1-2. GOVERNING STANDARDS. Except as modified or supplemented herein, all PVC pressure pipe shall conform to the applicable requirements of ANSI/AWWA C900 and C905.

The supplementary information required in the governing standards is as follows:

- Affidavit of Compliance: Required.
- Plant Inspection: Not required.
- Special Markings: Not required.
- Special Preparation for Shipment: Not required.
- Certification: Required.

1-3. SUBMITTALS. Drawings and data shall be submitted in accordance with the Submittals Procedures section. Drawings and data shall include, but shall not be limited to, the following:
Gasket material.
Pipe length.
Pipe Dimension Ratio.

Manufacturer’s hydrostatic proof test results for each length of pipe in each lot from which pipe shall be provided for the Project, and results from dimension measurements, flattening tests, and extrusion quality tests performed in accordance with the governing standard, for each lot from which pipe is provided for the Project. Test results shall be submitted in Microsoft Excel format on CD, and shall include a summary of the number of lengths in each lot that fail the tests and the total number of lengths in each lot. The submittal shall also include a listing of the number of lengths of pipe provided from each lot.

Affidavit of Compliance (ANSI/AWWA C900, Sec. 6.3).
Affidavit of Compliance (ANSI/AWWA C905, Sec. 6.3).
Certification (ANSI/AWWA C900, Sec. 4.2.4).
Certification (ANSI/AWWA C905, Sec. 4.2.4).
Certificate of Compliance with NSF Standard No. 61 (if applicable).


1-4. MATERIALS TESTING. The Owner shall have the option of performing testing on pipe delivered to the Site. Testing may be performed on a random sample from each lot or on a random selection of samples obtained from the lots of pipe delivered to the Site. Sample lengths are expected to be approximately 4 feet.

The Owner shall reimburse the Contractor for the Contractor’s cost of the sample material plus overhead and profit, for samples that meet expected testing results as defined by the independent testing laboratory. The Contractor shall pay for samples and reimburse the Owner’s cost for sample shipping and for testing laboratory fees, for samples that fail to meet expected testing results.

Tests the Owner may perform are:

Axial Tensile Properties (ASTM D638)
Dimension Measurements (ASTM D2122)
Flattening (ASTM D2412)
Acetone Immersion (ASTM D2152)

The lot of pipe from which a sample fails to meet expected testing results as defined by the independent testing laboratory, will be rejected by the Owner.
Installation of pipe prior to test results being reported to the Owner, shall be at the Contractor’s risk.

The Contractor shall allow a testing period as required by Owner, which will commence from the time the sample(s) are provided to the Owner.

1-5. **DELIVERY, STORAGE AND HANDLING.** Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section.

Pipe, fittings, and accessories shall be handled in accordance with Chapter 6 of AWWA Manual M23, to ensure installation in sound, undamaged condition. Pipe shall not be stored uncovered in direct sunlight.

**PART 2 - PRODUCTS**

2-1. **DIMENSIONS.** The dimension ratios (DRs: outside diameter to wall thickness) of PVC pressure pipe shall be as indicated herein or in the Pipeline Schedule section.

2-2. **MATERIALS.**

<table>
<thead>
<tr>
<th>Component</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe</td>
<td>ANSI/AWWA C900 or C905; cast iron pipe OD, dimension ratio as specified herein.</td>
</tr>
<tr>
<td>Fittings</td>
<td>Ductile iron; ANSI/AWWA C110/A21.10, 250 psi pressure rating, except shorter laying lengths will be acceptable. Tapping saddles/sleeves shall be sized for PVC pipe.</td>
</tr>
<tr>
<td>Joints</td>
<td>PVC to PVC ANSI/AWWA C900 or C905, stab type, with elastomeric synthetic rubber gaskets. Gaskets of natural rubber will not be acceptable.</td>
</tr>
<tr>
<td></td>
<td>PVC to Cast Iron ANSI/AWWA C111/A21.11, except gaskets shall be synthetic rubber. Natural rubber will not be acceptable.</td>
</tr>
<tr>
<td></td>
<td>Tapping Saddles</td>
</tr>
<tr>
<td></td>
<td>Ductile iron, with galvanized steel straps and synthetic rubber sealing gasket, 250 psi pressure rating.</td>
</tr>
</tbody>
</table>
Restrained Joints ASTMF1674, EBAA Iron 2000PV series (4 inch through 20 inch), Sigma “One Lok” SLCE series, or concrete thrust blocking.

Tapping Sleeves Ductile iron, 250 psi pressure rating.

Polyethylene Encasement Tube or sheet, ANSI/AWWA C105/A21.5.

Joint Tape Self-sticking, PVC or polyethylene, 10 mils thick; Chase “Chasekote 750”, Kendall ”Polyken 900”, or 3M ”Scotchrap 50”.

Coal Tar Epoxy High-build coal tar epoxy; Ameron "Amercoat 78HB Coal Tar Epoxy", Carboline "Bitumastic 300 M", Tnemec "46H-413 Hi-Build Tneme-Tar", or Sherwin-Williams "Hi-Mil Sher-Tar Epoxy".

Manufacturing quality control shall be maintained by frequent, regularly scheduled sampling and testing. Testing shall comply with the governing standards.

2-3. SHOP COATING AND LINING. The exterior surfaces of ductile iron fittings shall be coated with a bituminous coating. The interior surfaces of ductile iron fittings shall be lined with cement mortar.

PART 3 – EXECUTION

3-1. INSPECTION. Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation; spigot ends and bells shall be examined with particular care. All defective pipe and fittings shall be removed from the site of the work.

3-2. LAYING PIPE. Pipe shall be protected from lateral displacement by pipe embedment material installed as specified in the GWRS Trenching and Backfilling section for work on OCWD property and the Earthwork - OCSD section for work on OCSD property. Pipe shall not be laid in water or other unsuitable conditions.

Pipe shall be laid with bell ends facing the direction of laying, except when reverse laying is specifically permitted by Engineer.
Foreign matter shall be prevented from entering the pipe during installation.

Whenever pipe laying is stopped, the open end of the line shall be sealed with a watertight plug. All water shall be removed from the trench prior to removing the plug.

3-2.01. **Cleaning.** The interior of all pipe and fittings shall be thoroughly cleaned before installation and shall be kept clean until the work has been accepted.

3-2.02. **Alignment.** Piping shall be laid to the lines and grades indicated on the Drawings. Pipelines or runs intended to be straight shall be laid straight. Deflections from a straight line or grade shall not exceed the maximum deflections specified by the manufacturer.

Unless otherwise specified or indicated on the Drawings, and subject to acceptance by Engineer, either shorter pipe sections or fittings shall be installed as required to maintain the indicated alignment or grade.

3-3. **CUTTING PIPE.** Cutting shall comply with the pipe manufacturer's recommendations and with Chapter 7 of AWWA Manual M23. Cuts shall be smooth, straight, and at right angles to the pipe axis. After cutting, the end of the pipe shall be dressed to remove all roughness and sharp corners and shall be beveled in accordance with the manufacturer's instructions.

3-4. **JOINTS.** Joints shall be gasketed push on type meeting the requirements of ASTM D3139 unless otherwise indicated on the Drawings.

3-4.01. **Gasketed Push-on Type Joints.** Jointing shall conform to the instructions and recommendations of the pipe manufacturer. All surfaces of the spigot end of the gasketed joints shall be lubricated immediately before the joint is completed. Gaskets and lubricants shall be supplied by the pipe manufacturer, shall be suitable for use in potable water, shall be compatible with the pipe materials, shall be stored in closed containers, and shall be kept clean. Each spigot shall be suitably beveled to facilitate assembly.

3-4.02. **Mechanical Joints.** Mechanical joints shall be carefully assembled in accordance with the manufacturer's recommendations. If effective sealing is not obtained, the joint shall be disassembled, thoroughly cleaned, and reassembled. Over-tightening of bolts to compensate for poor installation practice will not be permitted.

3-5. **POLYETHYLENE ENCASEMENT.** All cast iron fittings, tapping saddles, tapping sleeves, valves, or other cast iron accessories shall be provided with polyethylene tube or sheet protection installed in accordance with ANSI/WWA C105/A21.5, Method A or C.
3-6. CONNECTIONS WITH EXISTING PIPING. Connections with existing pipes shall be made using fittings suitable for the conditions encountered. Each connection with an existing pipe shall be made at a time and under conditions which will least interfere with service to customers, and as authorized by Owner. Facilities shall be provided for proper dewatering and for disposal of water removed from the dewatered lines and excavations without damage to adjacent property.

3-7. SERVICE CONNECTIONS. Tapping saddles or tapping sleeves shall be used for all service connections 2 inches and smaller. Direct tapping of PVC pipe will not be permitted. Fittings shall be used for service connections larger than 2 inches.

3-8. CONCRETE ENCASEMENT. Concrete encasement shall be installed as indicated on the Drawings. Concrete and reinforcing steel shall be as specified in the Cast-in-Place Concrete section. All pipe to be encased shall be suitably supported and blocked in proper position and shall be anchored against flotation.

3-9. RESTRAINED JOINTS. All bell-and-spigot or all-bell tees, Y-branches, bends deflecting 11-1/4 degrees or more, valves, and plugs which are installed in piping subjected to internal hydrostatic heads in excess of 30 feet shall be provided with suitable restraint.

Concrete blocking shall extend from the fitting to solid, undisturbed earth and shall be installed so that all joints are accessible for repair. The dimensions of concrete reaction blocking shall be as indicated on the Drawings or as directed by Engineer.

Reaction blocking, anchorages, or other supports for fittings installed in fills or other unstable ground shall be provided as indicated by the Drawings or as directed by Engineer.

All steel clamps, rods, bolts, and other metal accessories used in tapping saddles or reaction anchorages subject to submergence or in contact with earth or other fill material, and not encased in concrete, shall be protected from corrosion by two coats of medium consistency coal tar applied to clean, dry metal surfaces. The first coat shall be dry and hard before the second coat is applied.

3-10. PRESSURE AND LEAKAGE TESTS. After installation, PVC piping shall be hydrostatically tested for defective workmanship and materials as specified in the Pipeline Pressure and Leakage Testing section.

3-11. LEAKAGE. All PVC piping shall be watertight and free from leaks. Each leak which is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of Contractor.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers furnishing and installation of 4 inch through 36 inch buried solid wall high density polyethylene (HDPE) pressure pipe. HDPE pressure pipe shall be furnished and installed complete with all fittings, jointing materials, anchors, blocking, encasement, and other necessary appurtenances.

Pressure and leakage tests and cleaning are covered in other sections. Pipe trenching, bedding, and backfill are covered in the GWRS Trenching and Backfilling section for work on OCWD property and the Earthwork – OCSD section for work on OCSD property.

1-2. GOVERNING STANDARDS. Except as modified or supplemented herein, all HDPE pressure pipe shall conform to the applicable requirements of ANSI/AWWA C906, latest edition.

The supplementary information required in the foreword of the governing standard is as follows:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affidavit of Compliance (Sec. 6.3)</td>
<td>Required</td>
</tr>
<tr>
<td>Plant Inspection by Purchaser (Sec. 5.8)</td>
<td>Not required</td>
</tr>
<tr>
<td>Markings (Sec. 6.1)</td>
<td>Not required</td>
</tr>
<tr>
<td>Shipping (Sec. 6.2)</td>
<td>Not required</td>
</tr>
<tr>
<td>Verification (Sec. 5)</td>
<td>Required</td>
</tr>
</tbody>
</table>

1-3. SUBMITTALS. Drawings and data shall be submitted in accordance with the Submittals Procedures section. Drawings and data shall include, but shall not be limited to, the following:

Details of joints and connections.
Pipe section length.
Pipe Dimension Ratio.
Certification of compliance with NSF Standard No. 61 (for potable water system pipe).
Affidavit of Compliance (ANSI/AWWA C906, Sec. 6.3).
Verification, including Quality Assurance Testing (ANSI/AWWA C906, Sec. 5).
1-4. QUALITY ASSURANCE.

1-4.01. Qualifications. The pipe manufacturer shall provide the services of an experienced, competent, and authorized representative to visit the site of the work to advise and consult with Contractor during joining and installation of the pipe. The manufacturer’s representative shall not directly supervise Contractor's personnel, and Contractor shall remain responsible for the pipeline work.

1-4.02. Fusion. Fusion joints shall be made by qualified fusion technicians who shall demonstrate fusion experience on projects completed within a year of the Bid date which included similar or larger installation lengths, similar pipe sizes (+/- 2 pipe sizes) and similar DRs (+/- 2 DRs).

1-5. STORAGE AND HANDLING. Storage and handling shall meet the requirements of Delivery, Storage and Handling Requirements section, and shall be in accordance with Chapter 7, Transportation, Handling and Storage of Pipe and Fittings of AWWA Manual M55, to ensure installation in sound, undamaged conditions. Pipe shall not be stored uncovered in direct sunlight.

PART 2 - PRODUCTS

2-1. PERFORMANCE AND DESIGN REQUIREMENTS.

2-1.01. Dimensions. Dimensions shall be as specified in the materials paragraph.

The dimension ratios (DRs) of HDPE pressure pipe shall be as indicated in the following table:

<table>
<thead>
<tr>
<th>Location</th>
<th>Nominal Size</th>
<th>DR</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW</td>
<td>4</td>
<td>17</td>
</tr>
<tr>
<td>RW</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>POTW</td>
<td>3-12</td>
<td>11</td>
</tr>
</tbody>
</table>

2-2. MATERIALS.

Pipe: ANSI/ AWWA C906; material designation (ASTM D3350) PE3608 or PE4710, minimum cell Classification 344464C, IPS (Iron Pipe Size).
Pressure class and wall thickness of DR 17. Thermal butt fusion joints, ASTM D3261.

Joints
Butt fusion joints, ASTM D3261; manufactured by injection molding; pressure class of the pipe or greater.

Fittings
Electrofusion Type
ASTM F1055 having pressure class equivalent to the pipe or greater as required.

Molded or Fabricated Type
Meet applicable AWWA C906 requirements; pressure class and cell class equivalent to the pipe or greater as required.

Other Types
Subject to review by the Engineer.

Tapping Saddles
Ductile iron, with galvanized steel straps and synthetic rubber sealing gasket, 250 psi pressure rating.

Tapping Sleeves
Ductile iron, 250 psi pressure rating.

Coal Tar Epoxy
High-build coal tar epoxy; Ameron "Amercoat 78HB Coal Tar Epoxy", Carboline "Bitumastic 300 M", Tнемec "46H-413 Hi-Build Tneme-Tar", or Sherwin-Williams "Hi-Mil Sher-Tar Epoxy".

PART 3 - EXECUTION

3-1. INSPECTION. Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation, with special attention to pipe ends. All defective pipe and fittings shall be removed from the site of the work.

3-2. INSTALLATION.

3-2.01. Laying Pipe. Pipe shall be protected from lateral displacement by pipe embedment material installed as specified in the GWRS Trenching and Backfilling section for work on OCWD property and the Earthwork – OCSD section for work on OCSD property. Pipe shall not be laid in water or under unsuitable weather or trench conditions, and shall be protected against entry of foreign matter.
Whenever pipe laying is stopped, the open end of the line shall be closed with a tight-fitting end board to keep out sand and earth. The end board shall have several perforations near its center to admit water into the pipe, to prevent flotation in the event the trench is flooded. Any standing water shall be removed from the trench before the end board is removed.

Pipe shall be protected from extended exposure to sunlight, shall be kept as cool as possible during installation, and shall be covered with backfill immediately after installation only during the cooler morning hours of the day.

3-2.02. Cleaning. The interior of all pipe and fittings shall be thoroughly cleaned before installation and shall be kept clean until the work has been accepted.

3-2.03. Alignment. Piping shall be laid to the lines and grades indicated on the drawings. Pipelines or runs intended to be straight shall be laid straight. Deflections from a straight line or grade shall not exceed the maximum deflection specified by the manufacturer.

Unless otherwise specified or indicated on the drawings, and subject to acceptance of the Engineer, either shorter pipe sections or fittings shall be installed as required to maintain the indicated pipeline alignment or grade.

3-2.04. Cutting Pipe. Cutting shall be in accordance with the pipe manufacturer’s recommendations. Cuts shall be smooth, straight, and at right angle to the pipe axis. After cutting, the end of the pipe shall be dressed to remove all roughness and sharp corners and shall be beveled in accordance with the manufacturer’s instructions.

3-2.05. Jointing. Jointing of pipe and fittings shall be performed in accordance with the instructions and recommendations of the pipe manufacturer and in accordance with ASTM F2620 and PPI TR 33. Sections of HDPE pipe shall be joined above ground into continuous lengths by the thermal butt fusion method.

Saddle fusion shall be performed in accordance with ASTM F2620 or PPI TR 41 and the fitting manufacturer’s recommendations.

Where required, electrofusion shall be performed in accordance with ASTM F1290, PPI TN 34, and the manufacturer recommended procedure.

Socket fusion and extrusion welding or hot gas welding will not be acceptable.

All joining procedures shall be acceptable to Engineer.

3-2.06. Connections with Existing Piping. Connections between new work and existing piping shall be made using suitable fittings. Each connection with an
existing pipe shall be made at a time and under conditions which will least interfere with service to customers, and as authorized by Owner. Facilities shall be provided for proper dewatering and for disposal of all water removed from the dewatered lines and excavations without damage to adjacent property.

Special care shall be taken to prevent contamination of potable water lines when dewatering, cutting into, and making connections with existing pipe. Trench water, mud, and other contaminating substances shall be kept out of the lines. The interior of all pipe, fittings, and valves installed in connections to existing piping shall be thoroughly cleaned and then swabbed in accordance with the requirements of AWWA C651.

3-2.07. Service Connections. Not used.

3-2.08. Concrete Encasement. Not used.

3-2.09. Reaction Anchorage and Blocking. All tees and plugs installed in piping subject to internal hydrostatic head in excess of 30 feet shall be provided with suitable reaction blocking, anchors, joint harnesses, or other acceptable means of preventing movement of the pipe caused by internal pressure.

Concrete blocking shall extend from the fitting to solid undisturbed earth and shall be installed so that all joints are accessible for repair. The dimensions of concrete reaction blocking shall be as indicated on the drawings or as directed by Engineer.

Reaction blocking, anchorages, or other supports for fittings installed in fill or in other unstable ground shall be provided as indicated on the drawings or as directed by Engineer.

3-2.10. Protective Coating. All steel clamps, rods, bolts, and other metal components of tapping saddles or reaction anchorages subject to submergence or in contact with earth or other fill material, and not encased in concrete, shall be protected from corrosion by two coats of coal tar paint applied to clean, dry surfaces. The first coat shall be dry and hard before the second coat is applied.

3-3. FIELD QUALITY CONTROL.

3-3.01. Hydrostatic Tests. After installation, HDPE piping shall be hydrostatically tested for defective workmanship and materials as specified in the Pipeline Pressure and Leakage Testing section.

3-3.02. Leakage. All HDPE piping shall be watertight and free from leaks. Each leak that is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of Contractor.
3-4. **CLEANING.** After installation, HDPE piping shall be cleaned as specified in the Closeout Procedures section.

End of Section
PART 1 – GENERAL

1-1. SCOPE. This section covers field hydrostatic pressure and leakage testing of piping. The term "piping" shall be used in this section to refer to piping systems, pipelines, or sections thereof.

Testing of other piping is covered in the Miscellaneous Piping and Accessories Installation section. Cleaning and disinfection of piping is covered in the Cleaning and Disinfection of Water Pipelines section.

1-2. GENERAL. Contractor shall coordinate pressure and leakage testing with adjacent work as necessary to preclude work interferences or duplication of effort and to expedite the overall progress of the work.

Contractor shall provide all necessary piping, piping connections, temporary valves, backflow preventers, and all other items of equipment or facilities necessary to complete the pressure and leakage testing.

In all cases where it is necessary to interrupt service, permission of Owner shall be obtained at least two days before the service will be interrupted. In all cases where it is necessary to interrupt service to water customers, permission of the Owner shall be obtained and each customer affected shall be notified of the proposed service interruption and its possible duration in accordance with the Project Requirements section.

Contractor shall notify federal, state, and local regulatory agencies to determine if any special procedures or permits are required for disposal of water used for pressure and leakage testing and to identify acceptable locations for disposal of the water. All requirements and costs associated with notifications and obtaining any discharge permit or approvals shall be responsibility of Contractor.

Engineer or Engineer's representative shall be present during testing and shall be notified of the time and place of testing at least 3 days prior to commencement of testing. All testing shall be performed to the satisfaction of Engineer, and in accordance with all governing standards and regulations.

1-2.01. Testing Schedule and Procedure. A testing schedule and procedure shall be submitted to Engineer for review and acceptance not less than 21 days prior to commencement of testing. The schedule and procedure shall include, but not be limited to the following information for each pipe section to be tested:
limits of each pipe test section;
proposed time and sequence;
physical locations and set positions of all valves;
locations of temporary bulkheads, stops, caps, restraints, supports, and
other temporary equipment needed;
manner of filling and source of water;
method and location of metering volumes;
method and location of gauging pressures; and
method and location of disposal of test water.

1-2.02. Special Testing Requirements. Special testing requirements include the following:

Water for filling the pipeline from the Owner's existing facilities may not be available during the Owner's periods indicated in the Work Restrictions specification.

Unless otherwise acceptable to Engineer, the general sequence of work for each pipeline, or valved or bulkheaded section thereof, shall be as follows:

  Initial cleaning and flushing of pipeline.
  Filling pipeline.
  Hydrostatic pressure and leakage testing.
  Disinfection.
  Final flushing and neutralization of heavily chlorinated water.
  Bacteriological tests.

Unless otherwise acceptable, during testing of the pipeline, all valves, except for auxiliary hydrant valve(s), shall be in the open position.

Unless otherwise acceptable, temporary bulkheads shall be provided during testing so that the test pressure is not applied to existing or new valves and hydrants, or to existing water lines, or to any portion of water lines installed under this Contract that have already been put into service.

Unless otherwise acceptable, a temporary pressure gauge shall be installed at each end of the limits of the pipeline to be tested.

Unless otherwise acceptable, tests shall be conducted before connections are made to existing water lines, or to any portion of water lines installed under this Contract that have already been put into service.

Unless otherwise acceptable, upon completion of testing and disinfection, connections made to existing water lines or to any portion of water lines installed under this Contract that have already been put into service, and any other portion
of the pipeline not subject to the pressure test, shall be visually inspected for
leakage after placing the water line into service and before backfilling the
connection.

If testing is permitted against a valve, the maximum differential test pressure
across the valve seat (gate) in the closed position shall not exceed the drip-tight
rated pressure of the valve.

1-2.03. Water. Water for testing shall be furnished as stipulated in the
Temporary Facilities section. Unless otherwise permitted, the water shall be kept
out of the remainder of the piping. Following completion of testing, the water
shall be disposed of in accordance with the requirements of regulatory agencies
and in a manner acceptable to Engineer.

PART 2 - PRODUCTS

2-1. TEST EQUIPMENT. All necessary connections between the piping to be
tested and the water source, together with pumping equipment, water meter,
pressure gauges, backflow prevention, and all other equipment, materials, and
facilities required to perform the specified tests, shall be provided. All required
blind flanges, valves, bulkheads, bracing, blocking, and other sectionalizing
devices shall also be provided. All temporary sectionalizing devices shall be
removed upon completion of testing. Vents shall be provided in test bulkheads
where necessary to expel air from the piping to be tested.

Test pressure shall be applied by means of a force pump sized to produce and
maintain the required pressure without interruption during the test.

Water meters and pressure gauges shall be accurately calibrated and shall be
subject to review and acceptance by Engineer.

Permanent or temporary gauge connections shall be installed at each location
where test gauges are connected to the piping during the required test. Drilling
and tapping of pipe walls will not be permitted. Upon successful completion of
testing, each permanent gauge connection shall be fitted with an isolation valve
and a permanent gauge, and each temporary gauge connection, if used, shall be
fitted with a permanent sealed plug or cap acceptable to the Engineer.

Permanent or temporary fill and vent connections shall be installed as needed for
the required test. Drilling and tapping of pipe walls will not be permitted. Upon
successful completion of testing, each permanent fill and vent connection shall
be fitted with the permanent fill or vent piping, and each temporary fill and vent
connection, if used, shall be fitted with a permanent sealed plug or cap
acceptable to the Engineer.
PART 3 - EXECUTION

3-1. FILLING AND VENTING. Before filling the piping with water, care shall be taken to ensure that all air release valves and other venting devices are properly installed and operating properly. Hand-operated vent valves shall not be closed until an uninterrupted stream of water is flowing from each valve. The rate of filling the piping with water must not exceed the venting capacity of the installed air vent valves and devices.

3-2. BLOCKING AND BACKFILLING. Piping shall be adequately blocked, anchored, and supported before the test pressure is applied. Underground piping identified in the Pipeline Schedule shall be tested before the joints are covered.

3-3. PRESSURE TESTING. After the piping to be tested has been filled with water, the test pressure shall be applied and maintained without interruption within plus or minus 5 psi of test pressure for 2 hours plus any additional time required for Engineer to examine all piping being tested and for Contractor to locate any defective joints and pipe materials. The test pressure shall be in accordance with the requirements specified for pipeline or plant piping.

3-3.01. Pipeline Test Pressure. Piping shall be subjected to a hydrostatic test pressure as indicated in the Pipeline Test Pressure Schedule.

The test pressure, expressed in feet of water, to be applied at any point in the piping shall be equivalent to the arithmetic difference between the specified test pressure plane elevation and the elevation of the horizontal center line of the piping at the selected location. The value obtained shall be multiplied by 0.433 to obtain psi.

3-3.02. Plant Piping Test Pressure. Piping shall be subjected to the test pressure as indicated in the Pipeline Test Pressure Schedule.

3-3.03. Pressure Testing of Above Ground or Exposed Piping. Maintain the test pressure for a minimum of 24 hours. Examine joints, fittings, valves, and connections for leaks. The piping system shall show zero leakage or weeping. Repair leaks and retest until zero leakage is obtained. Air and vacuum valves shall be in place and operational in case of pipe failure during testing.

3-3.04. Pressure Testing of Buried Piping. Where any section of the piping contains concrete thrust blocks or encasement, do not pressure test until at least 10 days after the concrete has been poured. When testing cement mortar lined piping, fill the pipe to be tested with water and allow to soak for at least 48 hours to absorb water before conducting the pressure test. Contractor shall apply and maintain the test pressure by means of a hydraulic force pump. The test
pressure shall be maintained for the following durations by restoring it whenever it falls an amount of 5 psi:

<table>
<thead>
<tr>
<th>Pipe Diameter (inches)</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 and less</td>
<td>4</td>
</tr>
<tr>
<td>29 to 36</td>
<td>8</td>
</tr>
<tr>
<td>Greater than 36</td>
<td>24</td>
</tr>
</tbody>
</table>

3-4. **PLANT PIPING LEAKAGE TESTING.** All plant piping shall be watertight and free from leaks. Each leak which is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of Contractor.

3-5. **PIPELINE LEAKAGE TESTING.** The pipeline piping shall be subjected to a leakage test. Leakage testing may be conducted concurrently with pressure testing. The duration of the leakage test shall be 2 hours plus the additional time required for Engineer to make an accurate determination of leakage.

3-5.01. **Above Ground and Exposed Piping Leakage.** All above ground and exposed piping shall be watertight and free from leaks. Each leak which is discovered within the correction period stipulated in the General Provisions shall be repaired by and at the expense of the Contractor.

3-5.02. **Zero Leakage Piping.** In addition to the above ground and exposed piping zero leakage allowance, the allowable leakage for welded steel pipe and flanged joints shall be zero gallons. The allowable leakage for buried piping having threaded, braded, or welded (including solvent welded) joints shall be zero gallons.

3-5.03. **Leakage Test Pressure.** The hydrostatic pressure maintained during the leakage test shall be equal to the pressure specified for pressure testing of the piping and shall be maintained within plus or minus 5 psi during the entire time that leakage measurements are being performed.

3-5.04. **Leakage Measurement.** Measurement of leakage shall not be attempted until all trapped air has been vented, absorption of water by the pipe wall or lining has stabilized, and a constant test pressure has been established. After the pressure has stabilized, piping leakage shall be measured with a suitable water meter installed in the pressure piping on the discharge side of the force pump.

3-5.05. **Allowable Leakage.** The term "leakage", as used herein, refers to the total amount of makeup water which must be added into the piping during the test to maintain the test pressure.
No piping will be accepted if and while it exhibits a leakage rate in excess of that determined by the indicated formulas:

\[ Q = 0.0075 \, DLN \] (using inch-pound units)

Where

\[ Q = \text{allowable leakage in gallons per hour} \]
\[ D = \text{nominal diameter of pipe in inches} \]
\[ L = \text{length of section tested in thousand feet} \]
\[ N = \text{square root of average test pressure in pounds per square inch} \]

Whenever the piping to be tested contains pipe of different diameters, the allowable leakage shall be calculated separately for each diameter and the corresponding length of piping. The resulting allowable leakage rates shall be added to obtain the total allowable leakage for the entire piping.

All joints in piping shall be free from visible leaks during the leakage test. Each leak which is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of Contractor regardless of the amount that the total leakage may have been below the specified allowable leakage rate during the leakage test.

If the leakage test indicates a higher than allowable leakage rate, Contractor shall locate and repair leaking joints and other defective work and repeat the test until leakage rate is less than the allowable rate.

End of Section
DIVISION 3 – Concrete
PART 1 - GENERAL

1-1. SCOPE. This section covers formwork for cast-in-place concrete.

1-2. GENERAL. All forms shall be accurately and properly placed so cast-in-place concrete may be placed as indicated on the Drawings and as specified. The forms shall produce a smooth concrete finish free from offsets or irregularities.

1-3. SUBMITTALS. All submittals of catalog data sheets, manufacturers' certificates of compliance and other data shall be in accordance with the Submittals Procedures section.

A manufacturer's certificate of compliance, which includes the name of the project and, when requested, copies of independent test results confirming compliance with specified requirements, shall be submitted to Engineer for the following materials:

- Form Coating
- Form Ties

PART 2 – PRODUCTS

2-1. MATERIALS.

Forms

| Prefabricated | Simplex "Industrial Steel Frame Forms", Symons "Steel Ply", or Universal "Uni-form". |
| Plywood       | Product Standard PS1, waterproof, resin-bonded, exterior type Douglas fir, face adjacent to concrete Grade B or better. |
| Fiberboard    | ANSI/AHA A135.4, Class 1, tempered, water-resistant, concrete form hardboard. |
| Lumber        | Straight, uniform width and thickness, and free from knots, offsets, holes, dents, and other surface defects. |
Chamfer Strips: Clear white pine, surface against concrete planed.

Form Coating: Nonstaining and nontoxic after 30 days. Product shall not exceed VOC limits established by the federal, state, or local regulatory agency having jurisdiction over the project site.

2-2. FORMS. Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions indicated on the Drawings. Forms shall conform to ACI 347R and the following additional requirements.

Stay-in-place metal formwork will not be permitted.

Form-facing materials shall be selected in accordance with ACI 347.3R, based upon the applicable formed concrete surface category. Formed concrete surface categories vary by structure and application, and shall be as indicated in the Concrete Finishing section. Other types of forming materials, such as steel or unlined wood, may be used where plywood or lined forms are not required, and may be used as backing for form linings. Forms for exposed surfaces shall be laid out in a regular and uniform pattern with the long dimension of panels vertical and all joints aligned. The forms shall produce finished surfaces that are free from offsets, ridges, waves, and concave or convex areas, within the tolerances specified herein.

All vertical concrete surfaces above footings shall be formed.

Flat segmented forms not more than 24 inches wide may be used for forming curved surfaces 25 feet in diameter or larger.

2-2.01. Design. Forms shall be substantial and sufficiently tight to prevent leakage of mortar. Forms shall be braced or tied to maintain the desired position, shape, and alignment during and after concrete placement. Walers, studs, internal ties, and other form supports shall be sized and spaced so that permissible working stresses are not exceeded.

Beams and slabs supported by concrete columns shall be formed so that the column forms may be removed without disturbing the supports for the beams or slabs.

Wherever the top of a wall will be exposed to weathering, the forms on at least one side shall not extend above the top of the wall and shall be brought to true line and grade. At other locations, forms shall be brought to a true line and grade, or a wooden guide strip shall be placed at the proper location on the forms so that the concrete surface can be finished with a screed or template to the...
specified elevation, slope, or contour. At horizontal construction joints in walls, the forms on one side shall not extend more than 2 feet above the joint.

Temporary openings shall be provided at the bottom of column and wall forms and at other points where necessary to facilitate cleaning and inspection.

2-2.02. **Form Ties.** Form ties shall have removable end and permanently embedded body, and shall have sufficient strength and rigidity to support and maintain the form in proper position and alignment without the use of auxiliary spreaders. Cones shall be provided on the outer ends of each tie, and the permanently embedded portion shall be at least 1 inch back from the concrete face. Form ties for liquid-containing walls shall be provided with water stop washers located on the permanently embedded portions of the ties at the approximate center of the wall. Permanently embedded portions of form ties without threaded ends shall be constructed so that the removable ends are readily broken off without damage to the concrete. Through-wall tapered removable ties will not be acceptable. The type of form ties used shall be acceptable to Engineer. Stainless steel form ties shall be used in structures for ozone treatment.

Form ties in exposed surfaces shall be uniformly spaced and aligned in horizontal and vertical rows.

2-2.03. **Edges and Corners.** Chamfer strips shall be placed in forms to bevel all salient edges and corners, except the top edges of walls and slabs which are to be tooled and edges which are to be buried. Equipment bases shall have formed beveled salient edges for all vertical and horizontal corners, unless specifically indicated otherwise on the Drawings. Unless otherwise noted, bevels shall be 3/4 inch wide.

2-3. **ARCHITECTURAL CONCRETE.** Forms for architectural concrete shall be as indicated in Section 6 of ACI 301, and to the additional requirements specified herein. Forms shall be fabricated from plastic overlay plywood or fiberglass reinforced plastic. All joints shall be mortar-tight. Forms shall be reinforced, braced, and supported as necessary to obtain the required straightness tolerance.

**PART 3 – EXECUTION**

3-1. **PLACEMENT.** The limits of each concrete pour shall be determined by Contractor and shall be acceptable to Engineer.

Before concrete is placed, forms shall be rigidly secured in proper position; all dirt, mud, water, and debris shall be removed from the space to be occupied by concrete; all surfaces encrusted with dried concrete from previous placements.
shall be cleaned; and the entire installation shall be acceptable to Engineer. Remove all frost, ice, and snow from within the formwork before concrete is placed.

3-2. TOLERANCES. Tolerances for cast-in-place concrete work shall be as indicated in ACI 347.3R, based upon the relevant formed concrete surface category.

3-3. FORM COATING. All concrete forms shall have form release agent applied to them before placement of concrete.

3-4. FORM REMOVAL. Forms shall not be removed from structures until the concrete in the structures has sufficient strength to support the weight of the structure and any superimposed load, including loads from construction operations. Contractor shall be responsible for limiting any applied loadings. There shall be no evidence of damage to concrete and no excessive deflection or distortion of members due either to the removal of forms or to loss of support.

Supporting formwork (sofit material only) for horizontal members shall not be removed until the concrete has attained at least 75 percent of the specified 28 day compressive strength as determined by cylinders made and cured in the field. Shoring systems for horizontal members shall not be removed until the concrete has attained the full specified 28 day compressive strength, but may be temporarily removed for the purpose of removing the sofit material as permitted above. Shoring shall be left in place and reinforced as necessary to carry any construction equipment or materials placed thereon.

When forms are removed before the specified curing is completed, measures shall be taken to immediately continue curing and to provide adequate thermal protection for the concrete.

3-5. PAN-FORMED JOISTS. New or undamaged metal pans shall be used to produce concrete that is smooth and free from waves and irregularities. Adjustable pans without flanges shall be used to provide joist lines which are straight and true. Pans and joist bottom boards shall be carefully removed to avoid damaging the concrete. Exposed surfaces shall be finished by removing fins and repairing honeycomb. Grout cleaning will not be required.

Nail-down flange type forms may be used for pan-formed joists which are located above suspended ceilings or required in connection with roof slabs for covered basins or reservoirs. Pans and joist bottom boards in such locations shall be removed in a careful manner.

End of Section
PART 1 – GENERAL

1-1. SCOPE. This section covers reinforcement for cast-in-place concrete and precast concrete.

1-2. SUBMITTALS.

1-2.01. Drawings and Data. All submittals of drawings, manufacturers' certificates of compliance, certification of reinforcement, reinforcement bar lists, placement drawings, test data, catalog data sheets and other data shall be in accordance with the Submittals Procedures section.

Bar lists and drawings for the fabrication and placing of reinforcement shall be submitted for review and shall have sufficient plans, elevations, and sections to adequately detail and label all reinforcement. The bar lists and drawings shall also include a reference to the structure in which the reinforcement will be installed and to the Drawing showing the reinforcement.

1-2.02. Manufacturer’s Certificate of Compliance. A manufacturer's certificate of compliance, which includes the name of the project and, when requested, copies of independent test results confirming compliance with specified requirements, shall be submitted to Engineer for the following materials:

    Mechanical connectors
    Terminator mechanical anchors

PART 2 – PRODUCTS

2-1. MATERIALS.

    Bars, Except Weldable  ASTM A615, Grade 60, deformed.
    Bars, Weldable  ASTM A706 or A615, Grade 60, deformed, with maximum carbon equivalent of 0.55%.
Ductile Reinforcing Bars  
ASTM A706 or ASTM A615, Grade 60, if the actual yield strength based on mill tests does not exceed the specified yield strength by more than 18,000 psi (retests shall not exceed this value by more than an additional 3,000 psi) and the ratio of the actual ultimate tensile strength to the actual tensile yield strength is not less than 1.25.

Column Spirals  
ASTM A1064, cold drawn wire.

Welded Wire Fabric  
ASTM A1064.

Bar Supports  
CRSI Class 1, plastic protected; or Class 2, stainless steel protected. Precast concrete bricks shall not be used without approval of Engineer.

Bars, Epoxy-Coated  
ASTM A775, Annex A1, using ASTM A615 and A706 bars only, minimum dry film thickness of 7 mils.

Welded Wire Fabric and Steel Wire, Epoxy-Coated  
ASTM A884, minimum dry film thickness of 7 mils.

Patching Material for the Epoxy Coating  
As specified in ASTM A775, Annex A1.

Bar Supports for Epoxy-Coated Reinforcement  
Coated wire bar supports, bar supports made of dielectric material, or other acceptable materials. Wire bar supports shall be coated with dielectric material 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. In walls having epoxy-coated reinforcing bars, spreader bars shall be epoxy-coated. Proprietary combination bar clips and spreaders used in walls with epoxy-coated reinforcing bars shall be made of corrosion-resistant material or coated with dielectric material.
2-2. REINFORCEMENT. Reinforcement shall be accurately formed and shall be free from loose rust, scale, concrete splatter, and contaminants which reduce bond. Unless otherwise indicated on the Drawings or specified herein, the details of fabrication shall conform to ACI SP-66 and ACI 318. Reinforcement shall not be bent in the field without approval of Engineer.

2-2.01. Splices. Splices shall conform to the details indicated on the Drawings. Splices at locations other than those indicated on the Drawings shall be submitted to Engineer for review and concurrence.

2-2.02. Mechanical Connectors. Mechanical connectors shall be used only as indicated on the Drawings. Connections in adjacent bars shall be spaced at least 30 inches apart.

2-2.03. Welding. Except where indicated on the Drawings, welding or tack welding of reinforcement is not permitted. Preheating and welding shall conform to AWS D1.4. Reinforcement which has been welded improperly or without Engineer's concurrence shall be removed and replaced.

PART 3 – EXECUTION

3-1. STORAGE AND HANDLING. Reinforcing steel shall be carefully handled and shall be stored on supports which prevent the steel from touching the ground.

Epoxy-coated reinforcement shall be handled using equipment with protected contact areas. Bundles or stacks of epoxy-coated reinforcement shall be lifted at multiple points to prevent abrasion from sags. Epoxy-coated reinforcement shall not be dropped or dragged and shall be stored on protective cribbing. Faded or chalking coating will not be cause for rejecting epoxy-coated reinforcement.
3-2. **PLACEMENT.** Reinforcement shall be accurately positioned on supports, spacers, hangers, or other reinforcement, and shall be secured in place with wire ties or suitable clips. Tolerances shall be as stipulated in ACI 117 and ACI 318 unless otherwise indicated.

Reinforcement at the bottom of concrete slabs and mats shall not be supported from contact with subgrade by the use of metal supports or bent reinforcement.

Where reinforcement in beams is placed in two or more layers, the bars in the upper layer shall be placed directly above the bars in the lower layer.

Reinforcement for beams or slabs which are supported by concrete columns shall not be installed until after the concrete for the column has been placed.

Before concrete is placed, reinforcement shall be rigidly secured in proper position. All surfaces encrusted with dried concrete from previous placements shall be cleaned and the entire installation shall be acceptable to Engineer. Remove all frost, ice, and snow before concrete is placed.

Epoxy-coated reinforcement shall be fastened with nylon, epoxy, or plastic-coated tie wire.

3-3. **PLACING CONCRETE.** Concrete shall be placed and compacted in wall or column forms before any reinforcement is placed in the system to be supported by such walls or columns.

3-4. **DUCT BANKS.** All reinforcement and other magnetic materials installed in duct banks shall be installed parallel to the individual ducts, unless they enclose all the ducts of the duct bank.

End of Section
PART 1 – GENERAL

1-1. **SCOPE.** This section covers concrete accessories including construction, contraction and expansion joints for cast-in-place concrete.

Dovetail anchor slots shall be as specified in the Masonry section.

1-2. **GENERAL.** All accessories shall be accurately placed and all joints shall be accurately and properly constructed so cast-in-place concrete can be placed as specified and as indicated on the Drawings.

1-3. **DRAWINGS AND DATA.** All submittals of manufacturers' certificates of compliance, test data, reports, catalog data sheets and other data shall be in accordance with the Submittals Procedures section.

PART 2 - PRODUCTS

2-1. **MATERIALS.**

**Metal Waterstops**

Carbon steel  Uncoated, 12 gage minimum thickness, size as indicated on the Drawings.

Stainless steel  ASTM A480/A666, Type 304 or 316, 14 gage minimum thickness, size as indicated on the Drawings.

**PVC Waterstops**

Extruded, virgin, elastomeric, polyvinyl chloride (PVC), white (no pigment), ribbed, 3/8 inch min thick. Reclaimed material will not be acceptable. Provide hog rings or grommets spaced at 12 inches on center entire length.

At construction joints in concrete sections less than 12 inches in thickness  6 inches wide; Greenstreak “679” or Vinylex “R638”.

<table>
<thead>
<tr>
<th>Joint Type</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>At construction joints in concrete sections 12 inches or more in thickness</strong></td>
<td>9 inches wide; Greenstreak “646” or Vinylex “R938”</td>
</tr>
<tr>
<td><strong>At control joints in concrete sections less than 12 inches in thickness</strong></td>
<td>6 inches wide with an &quot;O&quot; bulb closed center section; Greenstreak &quot;732&quot; or Vinylex &quot;RB638H&quot;.</td>
</tr>
<tr>
<td><strong>At control joints in concrete sections 12 inches or more in thickness</strong></td>
<td>9 inches wide with an &quot;O&quot; bulb closed center section; Greenstreak &quot;735&quot; or Vinylex &quot;RB938H&quot;.</td>
</tr>
<tr>
<td><strong>TPV Waterstops</strong></td>
<td>Extruded, virgin, thermoplastic vulcanizate (TPV), black. Ribbed; center bulb. Ozone resistance – no cracking at 450 ppm per ASTM D1171.</td>
</tr>
<tr>
<td><strong>For concrete sections less than 12 inches in thickness</strong></td>
<td>6 inches wide; 3/16 min thick; minimum 0.5 lbs/ft. J.P. Specialties “Earth Shield – Part No. 636&quot; or Westec “Style 619”.</td>
</tr>
<tr>
<td><strong>For concrete sections 12 inches or more in thickness</strong></td>
<td>9 inches wide, 3/16 inches min thick, minimum 0.8 lbs/ft. J.P. Specialties “Earth Shield – Part No. 936&quot; or Westec “Style 620”.</td>
</tr>
<tr>
<td><strong>Expandable Waterstops, permitted only at locations indicated on Drawings</strong></td>
<td>Hydrophilic; bentonite free, chemically modified rubber. Adeka &quot;Ultra Seal MC-2010MN&quot; or Greenstreak &quot;Hydrotite CJ-1020-2K&quot;. Adhesive and sealant as recommended by the manufacturer.</td>
</tr>
<tr>
<td><strong>For other concrete sections</strong></td>
<td>Hydrophilic; chemically modified rubber. Adeka &quot;KBA-1510FP&quot; or Greenstreak &quot;Swellstop&quot;. Adhesive and sealant as recommended by the manufacturer.</td>
</tr>
</tbody>
</table>
Expansion joint materials

- **Filler**: Preformed sponge rubber, ASTM D1752, Type I.
- **Filler adhesive**: As recommended by manufacturer.
- **Sealant**: As specified in the Joint Sealants section.
- **Polyethylene film**: NBS Product Standard PS17 or ASTM D4397, 6 mils or thicker.
- **Bearing pads**: Preformed cotton duck reinforced pads, at least 1/4 inch thick; JVI "Capralon" or Voss Engineering "Sorbtex".
- **Epoxy bonding agent**: As specified in Concrete Placing section.
- **Wedge inserts**: Malleable iron, with galvanized askew-head bolts, nuts, and washers; Hohmann and Barnard "HW", Richmond "Peerless", or Weston "WC50".

**PART 3 - EXECUTION**

3-1. **CONSTRUCTION JOINTS**: Construction joints shall be made at locations indicated on the Drawings or where specified. Construction joints shall not be made at other locations without the concurrence of Engineer.

3-1.01. **Location**: Construction joints shall be located as follows:

a. **In Columns and Walls**: At the underside of beams, girders, haunches, drop panels, and column capitals, and at floor levels. All haunches, drop panels, and column capitals shall be considered part of the
supported floor or roof and shall be placed monolithically therewith. Column bases will not be required to be monolithic with the floor beneath. Walls shall be divided into sections not to exceed 60 feet, except at corners which shall be as indicated on the Drawings. Walls supporting beams shall have pockets blocked out so that the full beam cross section penetrates the full thickness of the wall. Where waterstops are required in the joint, the wall pocket shall be widened and deepened to prevent interference between the waterstop and the beam reinforcement.

b. **In Beams and Girders.** Within the middle third of the span, unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset by twice the width of the beam. Provisions for the transfer of shear and other forces through the construction joint shall be acceptable to Engineer. Members shall be divided into pour sections not greater than 60 feet in length.

c. **In Suspended Slabs.** At or near the center of the span in flat slab or T-beam construction. No joint will be permitted between a slab and a concrete beam or girder unless specifically required by the Drawings. Suspended floor systems shall be divided by construction joints into approximately square sections not to exceed 60 feet in their longest dimension.

d. **In Bottom Slab.** Each bottom slab shall be divided into approximately square sections not to exceed 60 feet in their longest dimension.

Construction joints in beams, girders, joists, and slabs shall be perpendicular to the planes of their surfaces.

3-1.02. **Watertight Joints.** Construction joints in the following locations shall be watertight and shall be provided with continuous waterstops.

a. For liquid-containing structures, provide in slabs below the liquid surface elevation, and in all perimeter walls to their full height.

b. For liquid-containing structures, provide in divider walls where it is possible for one side or “cell” to be out of service while the other remains liquid-containing.

c. For filters and clear water reservoirs, provide in all walls, base slabs, and top slabs.

d. Provide in other locations specifically indicated on the Drawings.
3-2. **EXPANSION AND CONTRACTION JOINTS.** Expansion joint filler shall be firmly bonded to the previously poured joint face with a suitable adhesive, and the new concrete shall be poured directly against the joint filler. Accessible edges of each expansion and contraction joint shall be sealed as specified in the caulking section.

3-3. **WATERSTOPS.**

3-3.01. **Placement.** Each waterstop shall be continuous throughout the length of the joint in which it is installed. Waterstops shall be clean, free from coatings, and shall be maintained in proper position until surrounding concrete has been deposited and compacted. Waterstop embedment shall be equal on both sides of the joint.

Expandable waterstops shall be located as nearly as possible to the center of the joint and shall not be installed when air temperature falls outside the manufacturer’s recommended range.

3-3.02. **Storage and Handling.** Expansion joint filler and elastomeric (PVC or TPV) waterstops shall be stored in a cool place protected from direct sunlight.

Metal waterstops shall be handled, transported, delivered, and stored in a manner which will prevent bends, dents, or corrosion.

3-3.03. **Splices.** Junctions between adjacent sections of metal waterstops shall be lapped 5 inches and securely bolted, screwed, or spot welded together.

Junctions between adjacent sections of elastomeric (PVC or TPV) waterstops shall be spliced in strict conformity with the recommendations of the manufacturer. Directional changes and intersections shall be factory fabricated by the waterstop manufacturer prior to delivery to the Site. Field splices will be acceptable only in straight sections.

Expandable waterstops shall be contact lapped a minimum distance of 8 inches. Voids shall be filled with sealant.

Where an expandable waterstop is used in combination with metal or PVC water stops, the expandable water stop shall be placed in contact and shall overlap a minimum distance of 12 inches. Voids shall be filled with sealant.

3-4. **PLACEMENT.** The limits of each concrete pour shall be determined by Contractor and shall be acceptable to Engineer.

3-5. **EMBEDMENTS.** Anchor bolts, castings, steel shapes, conduits, sleeves, masonry anchors, and other objects that are to be embedded in the concrete shall be accurately positioned in the forms and securely anchored.
Unless installed in pipe sleeves, anchor bolts shall have sufficient threads to permit a nut to be placed on the concrete side of the form or template. A second nut shall be placed on the other side of the form or template, and the two nuts shall be so adjusted that the bolt will be held rigidly in proper position.

3-6. DUCT BANK JOINTS. Hardened surfaces that are to receive additional concrete shall be prepared by removing all loose particles, scum, and laitance so that the aggregate is exposed. The hardened surface shall then be thoroughly wetted and a thin coating of neat cement mortar shall be spread over the entire surface just before the fresh concrete is placed. The fresh concrete shall be puddled and spaded to eliminate any honeycomb or lack of mortar near the joint.

3-7. PLACEMENT AGAINST SUBGRADE. Where concrete is placed against rock, all loose pieces of rock shall be removed and the exposed surface cleaned with a high-pressure water spray.

3-7.01. Polyethylene Film. Where concrete is placed against gravel or crushed rock which does not contain at least 25 percent material passing a No. 4 sieve, such surfaces shall be covered with polyethylene film. Joints in the film shall be lapped at least 6 inches and taped.

3-7.02. Vapor Retarder. Vapor retarder shall be installed at the locations indicated on the Drawings. Installation shall be in accordance with ASTM E1643 and the manufacturer’s recommendations. Joints in the retarder shall be sealed with waterproof sealing tape. Care shall be exercised to avoid tearing or puncturing the retarder. Any damage shall be promptly repaired, and the retarder shall be inspected for damage immediately before the concrete is placed.

3-8. BEARING PADS. Wherever a concrete beam is supported by a concrete bracket, a bearing pad shall be placed in the joint between the beam and the bracket.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers procurement of all cast-in-place concrete, including concrete materials, limiting requirements, mixture design, and performance requirements, and delivery to the Site through discharge at the end of the delivery truck chute.

Work beyond the end of the delivery truck chute is covered in the Concrete Forming, Concrete Joints and Accessories, Concrete Reinforcing, Concrete Placing, Concrete Finishing, and Concrete Curing sections.

1-2. GENERAL. All cast-in-place concrete shall conform to the limiting requirements of this specification including Table 1.

1-2.01. Concrete Classifications. Concrete classifications shall be defined and used as indicated for the following classes:

Concrete Classifications

<table>
<thead>
<tr>
<th>Class</th>
<th>Class Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>Structural Concrete</td>
</tr>
<tr>
<td>A1.</td>
<td>Concrete for Liquid-Containing Structures. Concrete for liquid-containing environmental structures, liquid-containing tanks, interior suspended slabs in high humidity areas, headwalls, chemical storage or containment areas, below grade structures exposed to groundwater under normal conditions, and all other concrete not otherwise indicated.</td>
</tr>
<tr>
<td>A2.</td>
<td>Small Aggregate Concrete; Congested Areas. Structural small aggregate concrete shall be used in all areas (including liquid-containing structures) where the clear distance between reinforcement, conduit, or embedded items is less than the largest dimension of coarse aggregate particles in the structural concrete.</td>
</tr>
<tr>
<td>A3.</td>
<td>Concrete for Non-Liquid-Containing Structures. Concrete for footings, foundations, manholes, catch basins, pan-formed joists, and all other structural concrete other than for liquid-containing structures.</td>
</tr>
</tbody>
</table>
Class | Class Description
--- | ---
A4. | Mortar Puddle. Placed in a lift 2 inches or more deep at the bottom of forms for walls and columns immediately before structural concrete is placed.
A5. | Drilled Pier Concrete. Placed in drilled piers, lined or unlined. Not to be used as grout for pressure-grouted augured piles.
B. | Exterior Flatwork Concrete. Concrete for exterior slabs on grade, plant pavement, sidewalks, curbs and gutters, and small equipment pads.
C. | Architectural Concrete. Concrete whose appearance is of higher importance; which may have coloring or a special surface texture.
D. | Miscellaneous Concrete
D1. | Ductbanks, Pipe Blocking, Concrete Fill, and Pipe Encasement Concrete. Concrete used in ductbanks, pipe blocking, concrete fill and pipe encasements.
D2. | Underwater Concrete. Not Used. Unless otherwise permitted by Engineer, concrete shall not be deposited underwater.
D4. | Pan Stairs Concrete. Not used.
D5. | Wash Water Trough Concrete. Not used.
D6. | Composite Topping Concrete. Not used.
D7. | Lean Concrete. Used as a fill material for over-excavations or for mud slabs below foundations. Controlled Low-Strength Material (CLSM) used as an easily removable fill material is covered in the Excavation and Fill for Structures section.

1-3. **SUBMITTALS.** All data shall be submitted in accordance with the Submittals Procedures section, unless otherwise specified herein.

The required submittal data for each Class of concrete shall be as indicated in Tables 2A, 2B, and 2C.

1-3.01. Preliminary Review of Materials. Reports covering the source and quality of concrete materials proposed for the work shall be submitted to Engineer for review within 30 days after the preconstruction conference.
A manufacturer's certificate of compliance, which includes copies of independent test results confirming compliance with specified requirements, shall be submitted for the following materials:

Cement.
Admixtures.
Fly Ash.
Slag Cement.
Fibers.

1-3.02. **Proposed Mixture Proportions.** Data indicating the proposed material quantities in each Class of concrete shall be submitted to Engineer for review within 30 days after the preconstruction conference.

1-3.03. **Field Test Record Data.** Concrete mixture field test record performance data shall be submitted to Engineer for review and acceptance. Field test record data shall be acceptable only for the Classes of concrete indicated as such in Table 2C.

1-3.04. **Laboratory Trial Mixture Test Results.** Laboratory trial mixture testing shall not begin until materials and proposed mixture proportions have been reviewed and are acceptable to Engineer. Trial mixture testing shall be performed for all Classes of concrete where field test record data is not acceptable as a means of qualifying the mixture.

1-4. **Storage and Handling.** Cement, slag cement and fly ash shall be stored in suitable moistureproof enclosures. Cement, slag cement and fly ash which have become caked or lumpy shall not be used.

Aggregates shall be stored so that segregation and the inclusion of foreign materials are prevented. The bottom 6 inches of aggregate piles in contact with the ground shall not be used.

**PART 2 - PRODUCTS**

2-1. **Limiting Requirements.** Unless otherwise specified, each concrete mixture shall be designed and controlled, within the following limits, to provide a dense, durable concrete suitable for the expected service conditions.

Concrete materials shall be selected and concrete shall be proportioned, batched, mixed, and delivered in a manner that will minimize shrinkage and
cracking as specified herein, and in accordance with Chapters 3 and 8 of ACI 224R. Concrete temperatures shall be controlled before and until delivery at the end of the delivery truck chute to minimize cracking. Any rise in concrete temperature caused by environmental conditions that will be conducive to excessive shrinkage shall be controlled.

For each class of concrete, each concrete mixture shall be designed and concrete shall be controlled within the limits in the specification and in Table 1.

2-1.01. Cementitious Material Content Limits. The minimum quantity of Portland cement in the concrete shall be as indicated in Table 1.

The cementitious material content shall not be increased beyond the Table 1 values more than necessary to achieve the required $f'_{cr}$.

Contractor may substitute fly ash for Portland cement within the percentage ranges indicated in Table 1, on the basis of 1.0 lbs of fly ash added for each lb of Portland cement reduction.

Contractor may substitute slag cement for Portland cement within the percentage ranges indicated in Table 1 on the basis of 1.0 lbs of slag cement added for each lb of Portland cement reduction.

Mixtures using slag cement in combination with fly ash will not be acceptable.

2-1.02. Maximum Water-Cementitious Material Ratio. The maximum water-
cementitious material ratio shall be on a cement mass basis, or, if fly ash or slag cement is used, the combined mass of cement plus fly ash or slag cement shall be used to determine the water-cementitious materials ratio. Limiting maximum water-cementitious material ratios are indicated in Table 1.

2-1.03. Aggregates. Aggregates shall comply with ASTM C33 except as specified herein. Fine aggregate shall be clean natural sand. Artificial or manufactured sand shall not be used unless acceptable to Engineer. Coarse aggregate shall be crushed rock, washed gravel, or other inert granular material, meeting Class 4S requirements, except that clay and shale particles shall not exceed values indicated in Table 1.

Gradation of coarse aggregate shall conform to maximum nominal size grading requirements of ASTM C33. When a combination of two or more sizes is used, the combined gradation shall meet ASTM C33 requirements.

Aggregates used in concrete shall have a combined aggregate distribution similar to the aggregates used in the concrete trial mixtures. Reports of individual aggregates shall include sieve sizes 1-1/2 inch, 1 inch, 3/4 inch, 1/2 inch, 3/8 inch, No. 4, No. 8, No. 16, No. 30, and No. 50 in accordance with ASTM E11.
Specified sand equivalent for fine aggregate shall be not less than indicated in Table 1 for an average of 3 samples tested in accordance with ASTM D2419.

To comply with the specified concrete shrinkage test requirements, the clay and shale content of the aggregates may need to be reduced by washing the aggregate.

2-1.04. Ratio of Fine to Total Aggregates. The ratio of fine to total aggregates, based on solid volumes (not weights), shall be as follows:

<table>
<thead>
<tr>
<th>Maximum Nominal Coarse Aggregate Size</th>
<th>Minimum Ratio</th>
<th>Maximum Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8 inch</td>
<td>0.45</td>
<td>0.60</td>
</tr>
<tr>
<td>1/2 inch</td>
<td>0.40</td>
<td>0.55</td>
</tr>
<tr>
<td>3/4 inch</td>
<td>0.35</td>
<td>0.50</td>
</tr>
<tr>
<td>1 inch</td>
<td>0.30</td>
<td>0.46</td>
</tr>
<tr>
<td>1-1/2 inch</td>
<td>0.25</td>
<td>0.40</td>
</tr>
</tbody>
</table>

2-1.05. Slump. Concrete slump shall be kept as low as possible, consistent with proper handling and thorough consolidation. Prior to the addition of admixtures, slump shall be at least 2 inches and shall not exceed the maximum slump as indicated in Table 1.

When superplasticizer is dispensed at the ready-mix plant, the concrete mixture design shall be based on a maximum slump as indicated in Table 1. When superplasticizer is dispensed at the Site, the slump of the concrete delivered shall not exceed the maximum slump as indicated in Table 1 before superplasticizer is added.

2-1.06. Initial Set. The initial set, as determined by ASTM C403, shall be attained 5-1/2 hours ±1 hour after the water and cementitious materials are added to the aggregates for each concrete mixture. The quantity of retarding admixture shall be adjusted to compensate for variations in temperature and job conditions.

2-1.07. Total Air Content. The total volumetric air content of concrete after placement shall be as indicated in Table 1, and within ±1.5 percent. Air-entraining admixture may be omitted from concrete for interior slabs which are to be steel trowel finished.
2-1.08. **Admixtures.** Only approved or specified admixtures shall be used. Unless otherwise acceptable to Engineer, all admixtures shall be from one manufacturer and shall be compatible. Admixtures that are compatible with other admixtures and concrete materials shall not have an adverse affect on the required properties of the concrete nor the specified limiting requirements. The admixture content, batching method, and time of introduction to the mixture shall comply with these specifications and with the manufacturer's recommendations for minimum shrinkage. The admixture manufacturer shall provide qualified field services as necessary, at no additional cost to Owner.

Admixtures used in the concrete shall be reviewed and accepted by Engineer prior to conducting the laboratory trial mixture testing and the shrinkage testing. No calcium chloride nor admixture containing chloride from sources other than residual impurities in admixture ingredients will be permitted.

Combination of admixtures which cause premature or local dehydration or post-compaction settlement of the concrete surface shall not be used. If any such undesirable characteristics are observed, the use of the mixture shall be discontinued and an alternate mixture design used.

All liquid-containing (Class A1) concrete, and small aggregate (Class A2) concrete that is placed in liquid-containing structures, shall include a high-range water reducing admixture (superplasticizer). Water-reducing admixtures are not required for Classes D1 and D7, but may be included at Contractor's option. For all other non-liquid-containing concrete, a water-reducing admixture shall be used.

Superplasticizer may be dispensed into the concrete at the plant or on the Site and shall be mixed in accordance with the admixture manufacturer's recommendations. Each superplasticizer dose, when dispensed at the Site, shall be easily verifiable and recorded on the delivery ticket. The superplasticizer for each load shall be accurately proportioned into a separate container prior to dispensing the admixture into the concrete. When truck-mounted dispensers are used, the system shall not be flushed or cleaned with water until after the entire load of concrete has been discharged. When permitted by Engineer, redosing of concrete with superplasticizer shall be done only once. Redosing procedures shall be as recommended by the admixture manufacturer.

A shrinkage reducing admixture may be added to Class A1 concrete. It shall replace an equal volume of mixing water or as otherwise recommended by the admixture manufacturer. The quantity of air entrainment admixture shall be adjusted as required by the admixture manufacturer to keep mixture air content within specified limits.
2-1.09. **Fiber Concrete.** Fiber concrete shall be used only where noted on the Drawings. Polypropylene micro fibers shall be added to the concrete materials at the time the materials are batched at the rate of 1.5 lbs/cu yd. Batching and mixing procedures shall be in accordance with the manufacturer’s recommendations. Fibers shall be randomly oriented and uniformly distributed throughout the concrete.

2-1.10. **Strength.** In addition to the other limiting requirements to achieve durability and minimize shrinkage, the minimum acceptable compressive strengths of concrete tested at the end of the delivery truck chute, as determined by ASTM C39, shall be as indicated in Table 1.

Adequate test cylinders taken at the point of placement shall also be made to verify that Contractor's concreting procedures comply with applicable industry standard procedures.

2-1.11. **Pumped Concrete.** Coarse aggregate size for pumped concrete mixtures shall be limited to a nominal maximum of 1-1/2 inch.

The slump of concrete that is discharged into a pump may exceed the specified maximum slump value by the amount of slump loss in the pumping system, up to a maximum of 1 inch. The slump loss shall be determined by tests made at each end of the pumping system, with the pump boom oriented in the expected worst-case position during placement.

2-1.12. **Water-Soluble Chloride.** Maximum water-soluble chloride ion concentrations in hardened concrete at an age of 28 days shall not exceed the limits expressed as a percentage of mass of cementitious materials as indicated in Table 1.

Test results shall be reported as the percentage of water-soluble chloride ions in the concrete and as a percentage of chloride ion relative to the mass of cementitious materials in the concrete.

Testing of the concrete components for water-soluble chloride ions may be done at the discretion of Contractor. Copies of the reports on such tests shall be furnished to Engineer.

The hardened concrete and each gradation of aggregate used in the concrete shall be tested each time a chloride ion test is conducted on a concrete mixture.

2-1.13. **Laboratory Shrinkage Limits.** Based on the modified ASTM C157 test procedures as specified herein, the shrinkage limits of concrete shall be the average drying shrinkage of each set of three test specimens cast in the laboratory from a trial mixture as measured at the 21 days drying age, and shall not exceed the values in Table 1.
2-1.14. **NSF 61 Compliance.** Not used.

2-1.15. **Mineral Colored Concrete.** Mineral colored concrete shall be used where indicated on the Drawings. The color of the concrete shall be as noted on the Drawings. The quantity of mineral coloring admixture added shall be as recommended by the color admixture manufacturer for a deep, intense color tone.

2-1.16. **Cold Weather Concrete.** Except as modified herein, cold weather concrete shall comply with ACI 306.1. The temperature of concrete at the point of delivery at the end of the delivery truck chute shall be not less than that indicated in ACI 306.1 for corresponding outdoor temperature (in shade) at the time of placement.

When delivered, heated concrete shall be not warmer than 80°F.

2-1.17. **Hot Weather Concrete.** Except as modified herein, hot weather concrete shall comply with ACI 305.1. At air temperatures of 90°F or above, concrete shall be kept as cool as possible before and during delivery. The temperature of the concrete at the time of delivery at the end of the delivery truck chute shall not exceed the values indicated in Table 1.

2-2. **MATERIALS.**

<table>
<thead>
<tr>
<th>Material</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement</td>
<td>ASTM C 150, Type V or Type II/V. Low Alkali.</td>
</tr>
<tr>
<td>Fly Ash</td>
<td>ASTM C618, except that loss on ignition shall not exceed 4 percent. Class F or Class C are acceptable, but Class C shall also be qualified for moderate sulfate resistance as described in ASTM C618, Table 3, Procedure A. The test for sulfate resistance shall be in accordance with ASTM C1012.</td>
</tr>
<tr>
<td>Slag Cement</td>
<td>ASTM C989, Grade 100 or Grade 120.</td>
</tr>
<tr>
<td>Aggregates, Fine and Coarse</td>
<td>As specified in Limiting Requirements paragraph.</td>
</tr>
<tr>
<td>Water</td>
<td>Potable. Water from concrete production operations shall not be used.</td>
</tr>
</tbody>
</table>
Admixtures

Water Reducing/Normal Set  ASTM C494, Type A, except as otherwise specified herein.

Water Reducing/Retarding  ASTM C494, Type D, except as otherwise specified herein.

Air-Entraining  ASTM C260.

High Range Water Reducing/Normal Set  ASTM C494, Type F, extended slump life type, except as otherwise specified herein.

High Range Water Reducing/Retarding  ASTM C494, Type G, extended slump life type, except as otherwise specified herein.

Shrinkage Reducing Admixture  GCP Applied Technologies (Grace) “Eclipse 4500”, Euclid “Eucon SRA”, or BASF “MasterLife SRA 035”.

Mineral Coloring  Nonfading mineral coloring unaffected by sunlight or free alkali; Davis Colors "Mix-Ready", L.M. Scofield "Chromix", or Euclid “Super Concentrated Mortar Color”.

Fibers  Collated, fibrillated, polypropylene fibers; Propex “Fibermesh”, Forta “Mighty-Mono”, or GCP Applied Technologies (Grace) “MicroFibe”.

2-3. MIXTURE DESIGN AND TESTING. As stipulated in the Quality Control section, all reports and tests required for preliminary review of materials and for laboratory trial mixtures shall be made by an independent testing laboratory at the expense of Contractor. Mixtures shall be adjusted in the field as necessary, within the limits specified, to meet the requirements of these specifications. If the source of any concrete materials is changed during the contract, concrete work shall pause until the new materials and the new mixture design are tested in accordance with the specified requirements.

2-3.01. Preliminary Review of Materials. The tests and reports required shall be as indicated in Table 2A. Review of these reports shall be for general acceptability only, and continued compliance with all contract provisions shall be required.
Aggregate reports shall be no more than 90 days old at time of submittal.

Alkali-aggregate reactivity potential shall be determined by one of the following procedures. A satisfactory service record evaluation as described in ASTM C33 will not be acceptable.

1. Test fine and coarse aggregates in accordance with ASTM C1260. Aggregates which are classified as innocuous may be used without further testing. Aggregates which are not innocuous shall be further tested in accordance with ASTM C227 or C1105 (as appropriate), using a cement containing less than 0.6 percent alkalis.

2. Test fine and coarse aggregates in accordance with ASTM C1567, using a single aggregate with all cementitious materials selected for the Project. The fine and coarse aggregates shall not be combined and used in a single test. This test may only be used for mixtures that contain slag cement or fly ash, and those products shall not have an alkali content greater than 4.0 percent sodium oxide equivalent. Combinations of cementitious materials and aggregate which do not indicate a potential for alkali reactivity may be used without further testing. Mixture combinations which indicate a potential for alkali reactivity shall have the ingredients and/or proportions modified and then the test shall be repeated.

3. Test fine and coarse aggregates in accordance with ASTM C1293. Concrete mixtures containing only portland cement (without pozzolan or slag cement) shall be tested accordingly and have a measured expansion of 0.04 percent or less at one year duration. Concrete mixtures containing pozzolan or slag cement shall be tested with those ingredients in proportions matching that of the proposed mixture, and shall have a measured expansion of 0.04 percent or less at two years duration.

At the discretion of Engineer, testing in addition to that indicated herein or in Appendix X1 of ASTM C33 may be performed on potentially reactive aggregates. Nonreactive aggregates shall be imported if, in the opinion of Engineer, local aggregates exhibit unacceptable potential reactivity.

2-3.02. Proposed Mixture Proportions. Proposed proportions for each Class of concrete shall meet the limiting requirements indicated herein.

2-3.03. Mixture Testing. Test results on each Class of concrete shall be submitted for review and shall be acceptable to Engineer before concrete work is started. The reports shall include the information indicated in Table 2C.
2-3.03.01. **Field Test Record Data.** If indicated as acceptable in Table 2C, concrete mixtures may be qualified based upon field test record performance data in lieu of laboratory trial mixtures. Field test data records shall be from the production facility being used on the current Project and shall have been performed in the past 12 months. Field test records shall represent a single group of at least 10 consecutive strength tests for one mixture, using the same materials, under the same conditions, and encompassing a period of not less than 45 days.

2-3.03.02. **Laboratory Trial Mixture Testing.** Trial mixtures shall be tested in the laboratory for each size and combined gradation of aggregates and for each consistency as indicated and intended for use on the work and as specified.

Concrete proportions shall be established based on laboratory trial mixtures that meet the following requirements:

a. The combination of materials shall be as proposed for use in the work.

b. Mixtures shall conform with the limiting requirements specified herein.

c. The required average compressive strength, $f'_{cr}$, of the trial mixture shall exceed the specified minimum acceptable compressive strength, $f'_{cr}$, as required in Table 1.

d. Trial mixtures of the proportions and consistencies specified for the work shall be prepared. When a three point curve is required by Table 2C, the three concrete trial mixtures shall reflect the cement content proposed for the Project and for the indicated concrete class at three water-cementitious material ratio contents at or lower than indicated in Table 1. The compressive strength of the cylinders made from the three trial mixtures shall produce a range of compressive strengths exceeding or encompassing the $f'_{cr}$ required for the work.

e. For each proposed concrete mixture that is required to be tested as indicated in Table 2C, compressive strength test cylinders shall be made for each testing age. Each change in the water-cementitious materials ratio shall be considered a new concrete mixture. Each mixture shall be tested at the ages of 7 days and 28 days.

f. When a three point curve is required in Table 2C, the results of the cylinder tests for each water-cementitious materials ratio at each age shall be plotted as a curve showing the relationship between compressive strength (along y-axis) and the water-cementitious materials ratio (along x-axis). The water-cementitious materials ratio and the associated average compressive strength for the Project concrete mixture shall be selected from the 28 day curve. The maximum water-cementitious materials ratio specified in the limiting
requirements shall still apply even if the curve indicates that the concrete strength would be adequate at a higher ratio. The cement content and mixture proportions to be used shall be such that the selected water-cementitious materials ratio will not be exceeded at specified maximum slump. These concrete mixture proportions shall be submitted for review in accordance with the Submittals Procedures section.

g. When a shrinkage reducing admixture is proposed, trial mixtures shall be prepared with and without the shrinkage reducing admixture.

2-3.03.03. Testing Procedures. Concrete mixture testing procedures shall be as specifier herein, and reports for these tests shall be prepared specifically for this Project.

Aggregates shall be sampled and tested in accordance with ASTM C33. The bulk specific gravity of each aggregate shall be determined in accordance with ASTM C127 and ASTM C128.

Slump shall be determined in accordance with ASTM C143. Unit weight (mass) shall be determined in accordance with ASTM C138. Total air content shall be determined in accordance with ASTM C231 and verified in accordance with ASTM C138. Concrete temperature shall be determined in accordance with ASTM C1064.

Initial set tests shall be made at ambient temperatures of 70°F and 90°F to determine compliance with the specified time for initial set. The test at 70°F shall be made using concrete containing the specified normal set/water-reducing admixture and, when required, air-entraining admixture. The test at 90°F shall be made using concrete containing the specified retarding/water-reducing admixture and, when required, air-entraining admixture. Initial set shall be determined in accordance with ASTM C403.

Concrete test specimens shall be made, cured, and stored in accordance with ASTM C192 and tested in accordance with ASTM C39.

Cylinders shall be 6 inches diameter by 12 inches high for concrete mixes using a maximum nominal aggregate size of 1 inch or larger. Cylinders may be either 6 inches diameter by 12 inches high, or 4 inches diameter by 8 inches high for concrete mixes using a maximum nominal aggregate size of less than 1 inch. The average compressive strength shall be determined from the results of at least three cylinders when using 4 inch diameter cylinders, and at least two cylinders when using 6 inch diameter cylinders. All tests for a particular class of concrete shall be performed using the same sized cylinders for the duration of the work.
Water-soluble chloride ion shall be determined in accordance with ASTM C1218.

A drying shrinkage test shall be conducted on the trial mixture with the maximum water-cementitious materials ratio used to qualify each proposed concrete mixture design using the concrete materials, including admixtures, that are proposed for the Project. Three test specimens shall be prepared for each test. Drying shrinkage specimens shall be 4 inch by 4 inch by 11 inch prisms with an effective gauge length of 10 inches, fabricated, cured, dried, and measured in accordance with ASTM C157 except with the following modifications:

Specimens shall be removed from the molds at an age of 23 hours ±1 hour after batching, shall be placed immediately in water at 73°F ±3°F for at least 30 minutes, and shall be measured within 30 minutes thereafter to determine original length and then submerged in lime-saturated water as specified in ASTM C157. Measurement to determine expansion expressed as a percentage of original length shall be taken at age 7 days. The length at 7 days shall be the base length for drying shrinkage calculations ("zero" days drying age). Specimens then shall be stored immediately in a humidity controlled room maintained at 73°F ±3°F and 50 percent ±4 percent relative humidity for the remainder of the test. Measurements to determine shrinkage expressed as a percentage of the base length shall be reported separately for 7, 14, and 21 days ±4 hours of drying from "zero" days after 7 days of moist curing for a total of 28 days from the date of casting.

Drying shrinkage deformation for each specimen shall be computed as the difference between the base length (at "zero" days drying age) and the length after drying at each test age. Results of the shrinkage test shall be reported to the nearest 0.001 percent. If drying shrinkage of any specimen deviates from the average for that test age by more than 0.004 percent, the results for that specimen shall be disregarded.

The average drying shrinkage of each set of 4 inch by 4 inch by 11 inch test specimens made in the laboratory from a trial mixture shall not exceed the values required in Table 1.

2-4. ARCHITECTURAL CONCRETE. Architectural concrete shall be used only where indicated on the drawings, and shall conform to the applicable requirements of Section 6 of ACI 301. The architectural concrete shall match the color, finish, texture, and detailing of the existing Architectural Concrete in place on the existing buildings being added onto.
PART 3 – EXECUTION

3-1. **BATCHING, MIXING, AND DELIVERY.** Concrete shall be furnished by an acceptable ready-mixed concrete supplier, and shall conform to ASTM C94 except as indicated otherwise in this specification.

3-1.01. **Delivery Tickets.** A delivery ticket shall be prepared for each load of ready-mixed concrete and a copy of the ticket shall be handed to Engineer by the truck operator at the time of delivery. Tickets shall indicate the name and location of Contractor, the project name, the mixture identification, the quantity of concrete delivered, the quantity of each material in the batch, the outdoor temperature in the shade, the time at which the cementitious materials were added, and the numerical sequence of the delivery.

3-1.02. **Mixing Water.** Mixing water shall not be added in transit. Any amount of water withheld from the truck mixer shall be clearly indicated on the delivery ticket. Water added at the site shall not exceed the amount withheld, and shall not be added without oversight by Owner’s on site inspector.

3-1.03. **Consistency.** The consistency of concrete shall be suitable for the placement conditions. Aggregates shall flow uniformly throughout the mass, and the concrete shall flow sluggishly when vibrated or spaded. The slump shall be kept uniform.

3-2. **CONTRACTOR’S ON GOING MATERIAL CONTROL TESTING.** The following tests and test reports are required during the progress of the work and shall be made at the expense of Contractor. The frequency specified herein for each field control test is approximate and subject to change as determined by Engineer.

3-2.01. **Aggregate Gradation.** Each 200 tons of fine aggregate and each 400 tons of coarse aggregate shall be sampled and tested in accordance with ASTM D75 and C136, for verification that the gradations continue to meet ASTM C33 requirements. If lesser quantities of aggregates are used, the sampling and testing shall occur at least once every 6 months.

3-2.02. **Sand Equivalent.** The sand equivalent test shall be conducted each time the sand gradation tests are conducted.

3-2.03. **Fly Ash.** Each 400 tons of fly ash shall be sampled and tested in accordance with ASTM C618 and C311. Contractor shall supply Engineer with certified copies of supplier's (source) test reports showing chemical composition and physical analysis for each shipment delivered to Contractor and certifying that the fly ash complies with the specifications. The certificate shall be signed by the fly ash supplier.
3-2.04. **Cement.** Each 1500 tons of cement shall be sampled and tested in accordance with ASTM C150. Contractor shall supply Engineer with certified copies of supplier’s (source) test reports showing chemical composition and physical analysis, and certifying that the cement complies with ASTM C150 and these specifications. The certificate shall be signed by the cement manufacturer.

3-2.05. **Slag Cement.** Each 800 tons of slag cement shall be sampled and tested in accordance with ASTM C989. Contractor shall supply Engineer with certified copies of supplier’s (source) test reports showing chemical composition and physical analysis, and certifying that the slag cement complies with ASTM C989 and these specifications. The certificate shall be signed by the slag cement manufacturer.

3-3. **OWNER’S FIELD CONTROL TESTING.** Field control tests, including slump, air content, and making compression test cylinders, shall be performed by Engineer or Owner’s testing laboratory personnel, at the expense of Owner. Contractor shall provide access to all facilities and the services of one or more employees as necessary to assist with the field control testing.

The frequency specified herein for each field control test is approximate and subject to change as determined by Engineer.

Engineer may require field testing prior to the addition of superplasticizer at the Site to determine compliance with the specifications. Field testing after the addition of superplasticizer shall be conducted as specified and as needed to determine that the concrete is in compliance with the specifications. Air content tests shall be conducted whenever field tests are conducted.

3-3.01. **Slump.** A slump test shall be made for each 100 cubic yards of concrete. Slump shall be determined in accordance with ASTM C143.

3-3.02. **Air Content.** An air content test shall be made on concrete from one of the first three batches mixed each day and on concrete from each batch of concrete from which concrete compression test cylinders are made. Air content shall be determined in accordance with ASTM C231 and verified in accordance with ASTM C138.

3-3.03. **Unit Weight.** A unit weight test shall be made on concrete from each batch of concrete from which concrete compression test cylinders are made. Unit weight shall be determined in accordance with ASTM C138.

3-3.04. **Concrete Temperature.** A concrete temperature test shall be made on concrete from the first batch of concrete mixed each day and on concrete from each batch of concrete from which concrete compression test cylinders are made. During hot or cold weather concreting operations, temperature shall be
checked not less than once per hour. Concrete temperature shall be determined in accordance with ASTM C1064.

3-3.05. **Water-Soluble Chloride Ion.** Water-soluble chloride ion testing shall be performed once for each 1,000 cubic yards of concrete in accordance with ASTM C1218.

3-3.06. **Compression Tests.** One set of concrete compression test cylinders shall be made not less than once each day concrete is placed, not less than once for each 100 cubic yards of each class of concrete, and not less than once for each 5000 square feet of surface area for slabs or walls. Half of the cylinders of each set shall be tested at an age of 7 days and the remaining cylinders shall be tested at an age of 28 days.

Test cylinders shall be made, cured, stored, and delivered to the laboratory in accordance with ASTM C31 and tested in accordance with ASTM C39.

Cylinders shall be 6 inches diameter by 12 inches high for concrete mixes using a maximum nominal aggregate size of 1 inch or larger. Cylinders may be either 6 inches diameter by 12 inches high, or 4 inches diameter by 8 inches high for concrete mixes using a maximum nominal aggregate size of less than 1 inch. The average compressive strength shall be determined from the results of at least three cylinders when using 4 inch diameter cylinders, and at least two cylinders when using 6 inch diameter cylinders. All tests for a particular mixture class shall be performed using the same sized cylinders for the duration of the work and shall match the cylinder size used for the trial mixtures.

Each set of compression test cylinders shall be marked or tagged with the date and time of day the cylinders were made, the location in the work where the concrete represented by the cylinders was placed, the number of the delivery truck or batch, the air content, the slump, the unit weight, and the concrete temperature.

3-3.07. **Shrinkage Tests.** Concrete shrinkage tests shall be performed once for each 1,000 cubic yards of concrete with controlled shrinkage that is placed and shall be made on concrete from a batch of concrete from which concrete compression test cylinders are made. Shrinkage testing shall be conducted as specified for the preliminary trial mixtures.

The average drying shrinkage of each set of test specimens cast in the field from concrete delivered to the Site and sampled at the end of the delivery truck chute, as measured at the 21 days drying age, shall not exceed the values indicated in Table 1.
3-3.08. Test Reports. Five copies of each test report shall be prepared and distributed by the testing laboratory to the Owner, Resident Project Representative (two copies), Engineer, and Contractor, in accordance with the Quality Control section.

3-4. EVALUATION AND ACCEPTANCE OF CONCRETE. Concrete will be evaluated for compliance with all requirements of the specifications. Concrete strength will be only one of the criteria used for evaluation and acceptance of the concrete. The results of all tests performed on the concrete and other data and information concerning the procedures for handling, placing, and curing concrete will be used to evaluate the concrete for compliance with the specified requirements.

Compression tests will be evaluated in accordance with ACI 318 and as specified herein. A strength test shall be the average of the compressive strengths of two 6 inch diameter cylinders or three 4 inch diameter cylinders, made from the same concrete sample tested at 28 days.

3-4.01. Compression Test Evaluation. Compressive strength test results will be evaluated for compliance with the specified strength requirements. The strength level of the concrete will be considered satisfactory when the averages of all sets of three consecutive strength tests equal or exceed the specified compressive strength, $f'_c$, and no individual strength test result falls below the specified compressive strength by more than 500 psi.

3-4.02. Inspection of Concrete Supplier. Both scheduled and unscheduled visits by inspectors on days of concrete pours shall be accommodated. Inspectors shall be allowed access to delivery tickets and mixture proportions.
# TABLE 1 – LIMITING REQUIREMENTS

<table>
<thead>
<tr>
<th>Concrete Class</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
<th>A5</th>
<th>B</th>
<th>C</th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
<th>D4</th>
<th>D5</th>
<th>D6</th>
<th>D7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Minimum Cement Content, lbs/cubic yard; based on maximum slump and maximum water-cementitious material ratio.</td>
<td></td>
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</tr>
<tr>
<td>Maximum Nominal Aggregate Size, ASTM C33 aggregate</td>
<td>---</td>
<td>---</td>
<td>489</td>
<td>---</td>
<td>440</td>
<td>464</td>
<td>---</td>
<td>---</td>
<td>600*</td>
<td>**</td>
<td>---</td>
<td>---</td>
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<td>380</td>
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<tr>
<td>Size No. 467 (1-1/2&quot;)</td>
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<td>514</td>
<td>---</td>
<td>460</td>
<td>489</td>
<td>514</td>
<td>460</td>
<td>620*</td>
<td>**</td>
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<td>Size No. 57 (1&quot;)</td>
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<td>526</td>
<td>480</td>
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<td>680*</td>
<td>**</td>
<td>636</td>
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<tr>
<td>Fine Aggregate, (Sand)</td>
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<tr>
<td>2. Compressive Strength, minimum; psi</td>
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9 Testing limits

| Sand equivalent, min. percent | 75 | 75 | 75 | 75 | 75 | 75 | ---| 75 | **| 75 | 75 | 75 | ---|
| Chloride ion, max. percent    | 0.10 | 0.10 | 0.15 | 0.10 | 0.30 | 0.15 | 0.10 | 0.30 | **| ---| 0.15 | 0.15 | ---|

Shrinkage, max. percent; based 4 x 4 x 11 inch specimen

| Laboratory | 0.036 | 0.036 | 0.048 | --- | --- | 0.048 | 0.048 | --- | 0.048 | **| ---| ---| 0.048 | ---|
| Field      | 0.048 | 0.048 | 0.064 | --- | --- | 0.064 | 0.064 | --- | 0.064 | **| ---| ---| 0.064 | ---|

Coarse Aggregate:
- Clay and shale combined particles shall not exceed, max. percent

| 1 | 1 | 1 | 1 | 1 | 3 | 2 | 10 | 1 | **| 3 | 1 | 2 | 3 |

10 Concrete temperature at time of delivery and placement, max. °F

| 85 | 85 | 90 | 85 | 90 | 95 | 85 | 95 | 95 | **| 90 | 85 | 85 | 95 |

NOTES:

* "D2" (Underwater concrete) - Limit aggregate to 3/4" for reinforced concrete, up to 1-1/2" for unreinforced concrete.
** "D3" (Mass Concrete) limiting requirements shall be as indicated in the Mass Concrete section.
ª "D5" Wash water trough top edge water-cementitious ratio, 100 percent sand passing No. 8 sieve.
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TABLE 2B – SUBMITTAL REQUIREMENTS (PROPOSED MIXTURE PROPORTIONS)

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TABLE 2C – SUBMITTAL REQUIREMENTS (MIXTURE TESTING)

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<td>**</td>
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<td>Drying shrinkage</td>
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### TABLE 2C – SUBMITTAL REQUIREMENTS (MIXTURE TESTING)

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<tr>
<th>Concrete Class</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
<th>A5</th>
<th>B</th>
<th>C</th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
<th>D4</th>
<th>D5</th>
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<tr>
<td>NSF 61 compliance evaluations</td>
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</table>

**NOTE:**

**“D3” (Mass Concrete) submittal requirements shall be as indicated in the Mass Concrete section.**

End of Section
PART 1 – GENERAL

1-1. SCOPE. This section covers curing of cast-in-place concrete.

1-2. GENERAL. All cast-in-place concrete shall be properly cured as indicated on the Drawings and as specified herein.

1-3. SUBMITTALS.

1-3.01. Drawings and Data. All submittals of test data, manufacturers' certificates of compliance, reports, catalog data sheets and other data shall be in accordance with the Submittals Procedures section.

1-3.02. Manufacturer's Certificate of Compliance. A manufacturer's certificate of compliance, which includes the name of the project and, when requested, copies of independent test results confirming compliance with specified requirements, shall be submitted to Engineer for the following materials:

- Membrane curing compound.
- Epoxy Bonding Agent.

PART 2 - PRODUCTS

2-1. LIMITING REQUIREMENTS. Concrete shall be cured in a manner that will minimize shrinkage and cracking as specified herein, and in accordance with Chapters 3 and 8 of ACI 224R. Concrete temperatures shall be controlled both before and after placement to minimize cracking. Any rise in concrete temperature caused by environmental conditions that will be conducive to excessive shrinkage shall be controlled with blankets or other acceptable means of insulation.

2-2. MATERIALS.

| Concrete Surface Coloring/Hardener | Dry-shake colored hardener for concrete flatwork; Davis Colors "Color-Shake", L.M. Scofield "Lithchrome", Master Builders "Colorcron", Euclid "Surflex", or Dayton Superior “Quartz Tuff. |
Pre-Cure Finishing Aid  Burke "Finishing Aid Concentrate", Euclid "Eucobar", L&M Chemical "E-Con", Master Builders "Confilm", or Sika "Sikafilm".

Nonslip Aggregate  Aluminum oxide aggregate; L&M Chemical "Grip It" BASF "MasterTop 120SR", or Dayton Superior "Emery Non-Slip".

Epoxy Bonding Agent  ASTM C881, Type V, moisture insensitive, 100 percent solids; Master Builders "Concrese Paste LPL", Euclid "Euco #352 or #452" or Prime Resins "Prime Bond".

Membrane Curing Compound/Sealer  ASTM C1315, Type I, Class A, minimum 25 percent solids, acrylic, non-yellowing, unit moisture loss 0.40 kg/m² maximum in 72 hours. Product shall not exceed VOC limits established by the federal, state, or local regulatory agency having jurisdiction over the project site; L&M Chemical "Lumiseal Plus", Sonneborn "Kure-N-Seal 30", or Euclid Chemical "Super Diamond Clear".

Evaporation Reducer  Dayton Superior "AquaFilm Concentrate J74", Euclid "Eucobar", L&M Chemical "E-Con", BASF "MasterKure ER50", or Sika "Sikafilm".

2-3. ARCHITECTURAL CONCRETE. Architectural concrete shall conform to the applicable requirements of Section 6 of ACI 301.

PART 3 - EXECUTION

3-1. GENERAL.

3-1.01. RECEIVING. Contractor shall check each delivery ticket to verify the concrete class delivered to the jobsite is in compliance with the concrete requested and is suitable for Contractor’s handling, placing, finishing, and curing procedures. Engineer shall collect the delivery tickets from the truck operator.
3-2. **PLACEMENT.** The limits of each concrete pour shall be determined by Contractor and shall be acceptable to Engineer. All concrete within the predetermined limits shall be placed in one continuous operation.

Before concrete is placed, forms, reinforcement, water stops, anchor bolts, and embedments shall be rigidly secured in proper position; all dirt, mud, water, and debris shall be removed from the space to be occupied by concrete; all surfaces encrusted with dried concrete from previous placements shall be cleaned; and the entire installation shall be acceptable to Engineer. Remove all frost, ice, and snow from within the formwork before concrete is placed.

Contractor shall inform Engineer at least 24 hours in advance of the times and places at which he intends to place concrete.

3-2.01. **Bonding to Hardened Concrete.** The surface of hardened concrete upon which fresh concrete is to be placed shall be rough, clean, sound, and damp. Before placement of plastic concrete, the hardened surface shall be cleaned of all laitance and foreign substances (including curing compound), washed with clean water, wetted thoroughly, and the surface made free of standing water. Surface profile of the hardened concrete after surface preparation shall be as required for good bond.

Coarse aggregate shall be omitted from the first batch or batches of concrete placed on hardened concrete in wall or column forms. The mortar puddle, Class A4 concrete, shall cover the hardened concrete by at least 2 inches at every point.

3-2.02. **Conveying Concrete.** Methods of conveying concrete to the point of final deposit shall prevent segregation or loss of ingredients. After placement in the forms, concrete shall not be moved laterally more than 5 feet. Concrete's free fall should not exceed 4 feet.

3-2.03. **Pumping Concrete.** The slump of concrete, with or without a superplasticizer, that is discharged into the pump may exceed the specified maximum slump value by the amount of slump loss in the pumping system, up to a maximum of 1 inch. The slump loss shall be determined by tests made at each end of the pumping system. If tests indicate a slump loss greater than 1 inch in the pumping system, Contractor shall modify the pumping system as required to reduce the slump loss to 1 inch or less.

3-2.04. **Placing Concrete.** For proper compaction, concrete shall be placed in approximately horizontal layers not to exceed 24 inches. Each layer of concrete shall be plastic when covered with the following layer, and the rate of vertical rise of the concrete in the forms shall be not less than 24 inches per hour. Vertical
construction joints shall be provided as necessary to comply with these requirements.

Concrete shall be placed and compacted in wall or column forms before any reinforcement is placed in the system to be supported by such walls or columns. The height of any portion of a wall or column placed monolithically with a floor or roof slab shall not exceed 6 feet. Concrete in walls or columns shall settle at least 2 hours before concrete is placed in the structural systems to be supported by such walls or columns.

Concrete shall be thoroughly settled before top finishing. All laitance, debris, and surplus water shall be removed from concrete surfaces at tops of forms by screeding, scraping, or other effective means. Wherever the top of a wall will be exposed to weathering, the forms shall be overfilled and after the concrete has settled, the excess shall be screeded off.

Concrete for piers or caissons shall be carefully deposited to avoid contact with forms, reinforcement, and earth sides until completion of the drop. Necessary precautions shall be taken during concrete placement to prevent earth or other material from falling into excavations and to avoid dislocation of reinforcement. Concrete shall be placed continuously to the top of each pier or caisson at a rate of not less than 2 feet of vertical rise per hour. Forms above grade shall be of cylindrical steel or fiber acceptable to Engineer.

3-2.05. Compaction. During and immediately after placement, wet concrete shall be thoroughly compacted and worked around all reinforcement and embedments and into the corners of the forms. Mechanical vibrators shall maintain at least 14,000 cycles per minute when immersed in the concrete. The number and type of vibrators shall be acceptable to Engineer. The use of "jitterbug" tampers to compact concrete flatwork will not be permitted.

3-2.06. Cold Weather Concreting. Except as modified herein, cold weather concreting shall comply with ACI 306.1.

The concrete surface shall be maintained at a temperature of at least 50°F for 5 days or 70°F for 3 days, after placement. Concrete temperature shall be recorded at least six times for each 24 hour period. Concrete and adjacent form surfaces shall be kept continuously moist. Sudden cooling of concrete shall not be permitted.

3-2.07. Hot Weather Concreting. Except as modified herein, hot weather concreting shall comply with ACI 305.1.

At air temperatures of 90°F or above, concrete shall be kept as cool as practicable during curing.
Plastic shrinkage cracking due to rapid evaporation of moisture shall be prevented.

3-2.08. **Placement Sequence.** To minimize the effect of shrinkage in producing cracks, concrete shall be placed as follows:

a. **Bottom Slab.** Each bottom slab shall be divided into sections by the construction joints indicated on the drawings and, when not indicated on the drawings, into approximately square sections not greater than 60 feet in their longest dimension. Bottom slabs with radial and circumferential reinforcement patterns may be divided into pie-shaped segments with the longest dimension not greater than 60 feet. A section near the center of each structure shall be placed first. Sections shall be placed alternately, first on one side and then on the other side of previously placed sections. Placement shall be scheduled so that two adjacent sides of each section are free, except at closures.

b. **Walls.** Walls shall be divided into sections by the construction joints indicated on the drawings and, when not indicated on the drawings, into sections not greater than 60 feet in length. A section near the center of each wall shall be placed first. Sections shall be placed alternately, first on one side and then on the other side of the previously placed section. Placement shall be scheduled so that one end of each section is free, except at corner closures.

c. **Top Slab.** Each top slab shall be placed in the manner described for the bottom slab.

No two abutting sections shall be placed prior to a minimum curing period of 7 days and 14 days curing for the 2 adjacent wall panels at corner sections of vertical walls, unless otherwise authorized by Engineer.

3-2.09. **Protection.** Loads, including but not limited to earth loads, loads exerted from shoring or bracing, wind loads, hydraulic loads, equipment or vehicle loads or loads from stacked materials shall not be permitted until concrete has obtained its specified 28-day strength.

Contractor shall protect all concrete against damage until final acceptance from the DISTRICT. New concrete shall be protected from deleterious effects from weather and construction activities during its minimum curing period.

3-2.10. **Duct Banks.** Duct bank concrete shall be compacted by rodding or spading only. Mechanical vibrators shall not be used. Concrete shall be worked around reinforcement and embedments and into the corners of the forms.
3-2.11. **Underwater Concrete.** Underwater (tremie) concrete, if used, shall be deposited underwater within the construction limits indicated on the drawings. Concrete shall not be deposited underwater without the concurrence of Engineer.

Underwater concrete shall be placed in accordance with ACI 304R through tremies having hoppers at the upper end.

The water shall be quiescent when concrete is deposited. Velocity of flow within the space where the concrete is placed shall not exceed 2 feet per minute in any direction. After concrete is placed, the water level in the space shall be kept static until the concrete has hardened.

3-3. **FINISHING UNFORMED SURFACES.** Buried and permanently submerged concrete blocking and encasement will require no finishing except as necessary to obtain the required surface elevations or contours. The unformed surfaces of all other concrete shall be screeded and given an initial float finish followed by additional floating, and troweling where required.

3-3.01. **Screeding.** Screeding shall produce a concrete surface conforming to the proper elevation and contour, with all aggregates completely embedded in mortar.

3-3.02. **Application of Evaporation Reducer.** Concrete flatwork subject to rapid evaporation due to hot weather, drying winds, and sunlight shall be protected with a pre-cure finishing aid. The finishing aid shall form a monomolecular film on the surface of fresh, plastic concrete to retard evaporation.

Immediately following screeding, pre-cure finishing aid shall be sprayed over the entire surface of fresh, plastic concrete flatwork at a rate of not less than 200 square feet per gallon, in accordance with the manufacturer's recommendations. The spray equipment shall have sufficient capacity to continuously spray finishing aid at approximately 40 psi with a suitable nozzle as recommended by the manufacturer.

The sprayable solution shall be prepared as recommended by the manufacturer.

Under severe drying conditions, additional applications of finishing aid may be required following each floating or troweling, except the last finishing operation.

3-3.03. **Floating.** Screeded surfaces shall be given an initial float finish as soon as the concrete has stiffened sufficiently for proper working. Any piece of coarse aggregate which is disturbed by the float or which causes a surface irregularity shall be removed and replaced with mortar. Initial floating shall produce a surface of uniform texture and appearance, with no unnecessary working of the surface.
Initial floating shall be followed by a second floating at the time of initial set. The second floating shall produce a finish of uniform texture and color, and unless additional finishing is specifically required, shall produce the completed finish for unformed surfaces.

Floating shall be done with hand floats or suitable mechanical compactor-floats.

3-3.04. **Finishing Surfaces for Bonding.** All surfaces to be covered with concrete or topping shall be float finished. All laitance, surface mortar, and unsound material shall be removed by brushing or air blasting at the time of initial set. Surfaces shall be rough, clean, and sound. Floors and other flat surfaces to receive composite topping (Class D6) shall be given a broom finish or raked finish with at least a 1/4 inch profile.

3-3.05. **Troweling.** Interior floor surfaces which will be exposed after construction is completed; surfaces to be covered with resilient floor coverings, thinset terrazzo, or seamless floor covering; exposed top surfaces of equipment bases and interior curbs; and other surfaces designated on the drawings shall be steel trowel finished. Surfaces to be covered with elastomeric deck covering shall be lightly troweled but not burnished. Trowel finishing will not be required for floors which are normally submerged. Troweling shall be performed after the second floating when the surface has hardened sufficiently to prevent an excess of fines being drawn to the surface. Troweling shall produce a dense, smooth, uniform surface free from blemishes and trowel marks.

3-3.06. **Edging.** Unless specified to be beveled, exposed edges of floated or troweled surfaces shall be edged with a tool having at least a 1/8 inch corner radius.

3-3.07. **Broom Finish.** Where required, concrete surfaces shall be given a light broom finish to produce a nonslip surface. Brooming shall be done after the second floating and at right angles to the normal direction of traffic.

Broom finish shall be provided at the following locations:

a. exterior docks and slabs
b. exterior stairs

3-3.08. **Nonslip Aggregate Finish.** Tread surfaces of exterior stairs shall be surfaced with nonslip aluminum oxide aggregate. Aggregate shall be uniformly distributed during steel troweling at the rate of 1/4 lb per square foot, in accordance with the manufacturer's recommendations and as acceptable to Engineer.
3-3.09. **Pavement Finishing.** The surface of pavements shall not vary more than 1/8 inch under a 10 foot straightedge placed parallel to the center line.

Following placement and consolidation, and the disappearance of bleed water, the concrete surface shall be drag finished, using a seamless strip of damp burlap over the full width of the surface. The burlap drag shall consist of sufficient layers of burlap and shall have sufficient length in contact with the concrete to slightly groove the surface. The drag shall be moved forward with a minimum bow of the lead edge. The drag shall be kept damp, clean, and free of particles of hardened concrete. When acceptable to Engineer, carpet, artificial turf, or cotton fabric may also be used.

3-3.10. **Curb and Gutter Finishing.** Curb and gutter shall be finished to the shape indicated on the drawings. After the forms have been removed, all exposed edges shall be rounded, using an edging tool with at least a 1/8 inch corner radius. Exposed surfaces shall be float finished and given a light broom finish applied at right angles to the curb at the time of initial set, using a horsehair type broom.

3-3.11. **Sidewalk Finishing.** Concrete surfaces shall be screeded to the proper elevation and contour. All aggregates shall be completely embedded in mortar. Screeded surfaces shall be given an initial float finish as soon as the concrete has stiffened sufficiently for proper working. Any piece of coarse aggregate which is disturbed by the float or which causes a surface irregularity shall be removed and replaced with mortar. Initial floating shall produce a surface of uniform texture and appearance, with no unnecessary working of the surface. Initial floating shall be followed by a second floating at the time of initial set.

Floated surfaces shall be given a light broom finish, using a horsehair broom, to provide a nonslip surface. Brooming shall be done at right angles to the length of the walk.

Sidewalks shall be edged using a 3 or 4 inch wide edging tool with a 1/8 inch corner radius. Edger lap marks at corners of each slab shall be carefully removed. False joints shall be provided at right angles to the length of the walk, using a grooving tool with 1/8 inch radius. The finished edge on each side of the joint shall be the same width as the edging tool used. False joints shall divide each sidewalk into square sections.

The finished surface of all sidewalks shall be neat in appearance, shall be sloped to drain, and shall not pond water.

3-4. **CONCRETE SURFACE COLORING/HARDENER.** Where concrete surface coloring/hardener is required, a dry-shake coloring material shall be worked into the freshly screeded concrete surface.
3-4.01. **Duct Bank Finishing.** After screeding and before final floating, a red concrete surface coloring shall be dusted onto the fresh concrete surface at the rate recommended by the manufacturer.

3-4.02. **Floor Finishing.** Where concrete surface coloring/hardener is required on the Drawings, the coloring material shall be applied at the rate of 50 lbs per 100 square feet in strict accordance with the manufacturer's recommendations. The color of the concrete surface shall be as required on the Drawings.

Concrete floors with surface coloring shall be protected from damage until acceptance by Engineer. Areas which are subject to traffic or over which equipment or materials are to be moved shall be covered with hardboard or plywood. Just before final inspection, the colored floors shall be thoroughly cleaned and then waxed with colored wax furnished by the manufacturer of the coloring material.

3-5. **FLOOR SEALER.** All concrete floors in interior locations which are to remain as exposed concrete or will be covered with carpet shall be given two coats of clear floor sealer in addition to any which may have been applied as a membrane curing compound. Floor sealer shall not be applied to concrete floors that are to be stained or etched, covered with chemical resistant linings, covered with additional concrete, or indicated in the Architectural drawings to be covered with a finish flooring material. Prior to application of each coat of sealer, the floor shall be thoroughly cleaned of dirt, grease, and other foreign matter. The first coat shall be applied at the end of the curing period and before any traffic is permitted on the floor. The second coat shall be applied in preparation for substantial completion of the work. Floor sealer shall be applied in accordance with the manufacturer's recommendations.

3-6. **FINISHING FORMED SURFACES.** Formed concrete surfaces shall meet all criteria of the relevant formed concrete surface category (CSC), as defined in ACI 347.3R, except as indicated otherwise herein. Surfaces shall be assigned to CSC's as indicated.

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<tr>
<th>Formed Concrete Surface Category</th>
<th>Applicable Surfaces</th>
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<tbody>
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<td>CSC1</td>
<td>Formed concrete surfaces that will be in permanent contact with earth backfill.</td>
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<tr>
<td>CSC2</td>
<td>All other formed concrete surfaces not designated otherwise.</td>
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<td>CSC3</td>
<td>None.</td>
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<tr>
<td>CSC4</td>
<td>None.</td>
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3-6.01. **Tie Holes.** All tie holes in formed surfaces, regardless of the relevant CSC, shall be cleaned, wetted, and filled with patching mortar. The patches shall be finished flush and cured and shall match the texture and color of the adjacent concrete.

3-6.02. **Mockups.** Mockups shall be used to validate the means and methods to be used by Contractor, and to provide Owner a sample of the specified concrete surface. The use of a reference area within an existing structure shall not be acceptable as a mockup.

Mockups shall incorporate the structure geometries; reinforcing bar size, spacing, arrangement, and cover; inserts; the approved concrete mixture; sample tie hole patching, and other likely required repair procedures. Contractor shall confirm in writing that the mockup quality represents work than can be accomplished in the actual structure.

3-6.03. **Grout Cleaning.** The surfaces noted on the Drawings shall be finished by grout cleaning.

Grout-cleaned finish shall conform to Paragraph 5.3.3.4.b of ACI 301. Grout cleaning shall not result in an overall plastering of the concrete surfaces, but shall produce a smooth, uniform surface free of marks, voids, surface glaze, and cement dust.

3-7. **TOLERANCES.** Tolerances for cast-in-place concrete work shall be as stipulated in ACI 117, unless otherwise indicated.

3-8. **CLEANING EMBEDMENTS.** After placement of concrete, surfaces of embedments not in contact with concrete shall be cleaned of concrete spatter and other foreign substances.

3-9. **CURING.** Concrete shall be protected from loss of moisture for at least 7 days after placement unless indicated otherwise. Curing of concrete shall be done by methods which will keep the concrete surfaces adequately wet for the specified curing period.

3-9.01. **Water Curing.** Water curing shall be performed for concrete in liquid-containing structures and for all concrete containing slag cement. Other forms of curing will not be acceptable in these applications. Water curing shall be in accordance with ACI 308.1 except as modified herein.

Water saturation of concrete surfaces shall begin as soon as possible after initial set. The rate of water application shall be regulated to provide complete surface coverage with a minimum of runoff. The application of water to walls may be interrupted for grout cleaning only over the areas being cleaned at the time, and
the concrete surface shall not be permitted to become dry during such interruption.

Water curing shall continue for 14 days for concrete containing slag cement, and for 7 days for other types of concrete. However, when concrete is being protected from low temperatures, the duration of water curing may be shortened to 1 day less than the duration of cold weather protection.

When forms are removed before the specified curing duration is completed, measures shall be taken to immediately continue water curing and to provide adequate thermal protection for the concrete.

3-9.02. Membrane Curing. Unless otherwise specified, membrane curing compound may be used instead of water curing on concrete in non-liquid-containing structures which will not be stained or etched, covered with chemical resistant linings, covered with additional concrete, or indicated in the Architectural drawings to be covered with a finish flooring material.

Membrane curing compound shall be evenly sprayed at a coverage rate of not more than 300 square feet per gallon. The spray equipment shall have sufficient capacity to continuously spray curing compound at approximately 40 psi with a suitable nozzle as recommended by the manufacturer. Unformed surfaces shall be covered with the first coat of curing compound within 30 minutes after final finishing. A second coat of curing compound shall be applied when the first coat has become tacky to the touch and shall be applied at right angles to the first coat.

Concrete surfaces shall be covered with white polyethylene sheeting immediately after the curing compound has become dry to the touch. White polyethylene sheeting shall completely cover the surfaces and shall overlap the edges for proper sealing and anchorage. Joints between sheets shall be sealed. All tears, holes, and other damage shall be promptly repaired. Covering shall be anchored continuously at edges, and shall be anchored as necessary to prevent billowing on the surface.

Curing compound shall be suitably protected against abrasion during the curing period.

3-9.03. Film Curing. Unless otherwise specified, film curing with white polyethylene sheeting may be used instead of water curing on concrete in nonliquid-containing structures which will be covered later with mortar or additional concrete, or which will otherwise not be exposed to view.

Film curing shall begin as soon as possible after initial set of the concrete. The concrete surfaces shall be completely covered with polyethylene sheeting.
Sheeting shall overlap the edges of the concrete for proper sealing and anchorage, and joints between sheets shall be sealed. All tears, holes, and other damage shall be promptly repaired. Covering shall be anchored continuously at edges and as necessary to prevent billowing on the surface.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers procurement and installation of grout. Unless otherwise specified, only nonshrink grout shall be furnished.

Epoxy grouting of anchor bolts, threaded rod anchors, and reinforcing bars is covered in the anchorage in concrete and masonry section. Grouting of masonry is covered in the building masonry section.

1-2. SUBMITTALS. A letter of certification indicating the types of grout to be supplied and the intended use of each type shall be submitted in accordance with the Submittals Procedures section.

1-3. DELIVERY, STORAGE, AND HANDLING. Materials shall be handled, transported, and delivered in a manner which will prevent damage of any kind. Materials shall be protected from moisture.

PART 2 - PRODUCTS

2-1. MATERIALS.

| Nonshrink Grout for Equipment and pump base installation | Precision cementitious grout with demonstrated non-shrinking properties, minimum 28 day compressive strength of 9000 psi; L&M "Crystex", BASF "Masterflow 928", Sika "SikaGrout 328", or Dayton Superior "Sure-Grip High Performance Grout". |
| Water | Clean and free from deleterious substances. |

2-2. CEMENTITIOUS GROUT. Cementitious grout shall be furnished factory premixed so that only water is added at the jobsite.

2-3. EPOXY GROUT. Epoxy grout shall be used in lieu of cementitious grout when required by the equipment manufacturer for performance or warranty requirements. Epoxy grout products and installation procedures shall be submitted to Engineer for approval.
PART 3 - EXECUTION

3-1. **PREPARATION.** The concrete foundation to receive nonshrink grout shall be saturated with water for at least 12 hours preceding grouting unless additional time is required by the grout manufacturer.

3-2. **INSTALLATION.**

3-2.01. **Mixing.** Grout shall be mixed in a mechanical mixer. No more water shall be used than is necessary to produce a flowable grout.

3-2.02. **Placement.** Unless otherwise specified or indicated on the Drawings, grout under baseplates shall be 1-1/2 inches thick. Grout shall be placed in strict accordance with the directions of the manufacturer so that all spaces and cavities below the baseplates are completely filled without voids. Forms shall be provided where structural components of baseplates will not confine the grout.

3-2.03. **Edge Finishing.** In all locations where the edge of the grout will be exposed to view, the grout shall be finished smooth after it has reached its initial set. Except where shown to be finished on a slope, the edges of grout shall be cut off flush at the baseplate.

3-2.04. **Curing.** Nonshrink grout shall be protected against rapid loss of moisture by covering with wet cloths or polyethylene sheets. After edge finishing is completed, the grout shall be wet cured for at least 3 days and then an acceptable membrane curing compound shall be applied.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers the repair of concrete and shotcrete cracks and joints.

1-1.01. General Crack Repair. General crack repair is applicable only to new construction, and shall include the following:

   a. Sealing of all cracks and crack networks that are wider than 10 mils (0.01 inch) as measured at the exposed surface.
   b. All necessary repairs to structures that have failed a tightness test, including sealing of construction joints. Repairs shall include all repairs necessary to achieve an acceptable leakage test.
   c. All defective work as identified by the District and Engineer.
   d. Existing concrete to include areas adjacent required demolition as shown on plans.
   e. Sealing of construction and movement joints that require repair.

All costs for general crack repair shall be included in the Contract Price. General crack repair work is expected to be necessary due to cracks that commonly develop during concrete construction.

1-1.02. Engineer-Directed Crack Repair. Engineer-directed crack repair is applicable only to new construction, and shall only be performed when instructed by Engineer. The work shall include, but is not limited to, the following:

   a. Sealing of construction joints that are not otherwise required to be sealed as the result of a failure of a leakage test.
   b. Sealing of cracks and crack networks with a width of 10 mils (0.01 inch) or less as measured at the exposed surface.

1-1.03. Pre-Defined Crack Repair. Pre-defined crack repair is applicable only to existing structures, and the extent of this type of repair is indicated on the Drawings.

Prior to beginning the repair work Contractor shall field verify and provide clear bright colored marking to the cracks to be repaired. Crack repair work shall not begin until marking is complete and has been approved by Engineer.
Concrete work includes expansion of existing water-containing basins with requirements on the preparation and attachment to the existing concrete surface in Section 3-2.04.

1-2. **SUBMITTALS.** Specifications and data covering physical properties, mixtures, application procedures, and curing procedures of the materials proposed shall be submitted in accordance with the Submittals Procedures section. Submittals shall include the approvals from the material manufacturer.

1-3. **QUALITY ASSURANCE.**

1-3.01. **Manufacturer’s Field Services.** The material manufacturer shall provide engineering field services to review the Work and the material application prior to any preparation; to approve the applicator, the material used, and the procedure to be used; to observe surface preparation; to approve surface preparation; and to observe application. The field representative of the material manufacturer shall submit, in writing through Contractor, approvals of proposed material, application procedures, applicator, and surface preparation. The field representative shall be an employee of the material manufacturer.

   a. Minimum of ten years work experience using specific products and their application shall be shown. To include ongoing training programs, certifying and technically supporting Contractors’ personnel

1-3.02. **Applicator.** The applicator shall submit through Contractor a satisfactory experience record including references from previous application of the specified materials to structures of similar design and complexity.

1-3.03. **Pre-Construction Meeting.** At least 30 days prior to concrete crack repairs, Contractor shall conduct a meeting to review the detailed requirements for rehabilitation work. Site conditions, surface preparation, proposed equipment, procedures, material mixing, placing procedures, and curing methods shall be discussed and approved by Engineer and by the manufacturer’s field representative. Contractor shall require the attendance of all involved parties, including but not limited to Contractor’s superintendent, repair contractor, manufacturer’s field representative and proposed equipment supplier representative. Minutes of the meeting shall be recorded, typed and printed by Contractor and distributed to all parties within 5 days after the meeting.

1-3.04. **Quality Assurance Certification.** Material manufacturers shall be ISO 9001/9002 registered or shall provide proof of documented quality assurance. The documented quality assurance system shall be obtained through an independent auditing registrar.
1-4. **DELIVERY, STORAGE, AND HANDLING.** Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance manufacturers’ recommendations. Material shall be package in new containers. Each container to be clearly labeled with the following information:

- Manufacturer name.
- Product name, lot number, and expiration date.
- ANSI Hazard Classification and appropriate recommended ANSI precautions for handling.
- Mix ratio by volume.

**PART 2 - PRODUCTS**

2-1. **PERFORMANCE AND DESIGN REQUIREMENTS.** Unless otherwise specified or authorized, repairs shall conform to the requirements specified herein. Types of repairs not specified herein shall be as specified in other sections, as indicated on the Drawings, or, in the absence of any definite requirement, as recommended by the manufacturer's representative and subject to acceptance by Engineer. The following types of repairs shall be performed as required.

2-1.01. **Pressure-Injected Epoxy Resin.** Unless indicated otherwise on the drawings, pressure-injected epoxy resin shall be used to seal joints and cracks that are not intended to permit movement.

2-1.02. **Pressure-Injected Foam Resin.** Unless indicated otherwise on the drawings, pressure-injected foam resin shall be used to seal joints that are intended to permit movement.

2-1.03. **Crack Sealant.** Crack sealant shall be used to seal cracks in structures prior to pressure injection of resin.

2-1.04. Repair mortar to be used to repair defective concrete to include, but not limited to rock pockets, honeycombed or unconsolidated areas.

2-1.05. Bonding Agent To be used to structurally bond existing concrete to new concrete as indicated on plans.

2-2. **ACCEPTABLE PRODUCTS.** Repair products/materials shall be as specified herein. Equivalent products of other manufacturers regularly producing high quality concrete crack repair products/materials, providing engineering field
services, and meeting the specified quality assurance requirements may be furnished subject to review and acceptance by Engineer.

2-3. **MATERIALS.** Materials shall be approved by the manufacturer for the type of application, including temperature and moisture conditions encountered.

<table>
<thead>
<tr>
<th>Material</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure-Injected Epoxy Resin</td>
<td>ASTM C881, Type I or Type IV, moisture tolerant or moisture insensitive.</td>
</tr>
<tr>
<td>Crack Sealant</td>
<td>As recommended by the manufacturer of the pressure-injected epoxy resin product.</td>
</tr>
<tr>
<td>Pressure-Injected Foam Resin</td>
<td>Hydrophilic polyurethane foam; Prime Resins &quot;Prime-Flex 900 XLV&quot;, DeNeef &quot;Sealfoam PURe&quot;, or Avanti “AV-333 Injectaflex”.</td>
</tr>
<tr>
<td>Foam Resin Accelerator</td>
<td>As recommended by foam resin manufacturer.</td>
</tr>
<tr>
<td>Adhesive Anchor System</td>
<td>As specified in the Anchorage in Concrete and Masonry section</td>
</tr>
<tr>
<td>Water</td>
<td>Clean and free from deleterious substances.</td>
</tr>
</tbody>
</table>

**PART 3 - EXECUTION**

3-1. **INSPECTION.** Prior to the placement of the repair materials, the crack to be repaired shall be inspected by the material manufacturer to assure that preparation and conditions are correct for the type of repair and the product/material being used as specified herein.

3-2. **PREPARATION.** All cracks and surfaces around the cracks shall be free of objectionable substances and shall conform to the requirements of the material manufacturer. Concrete and shotcrete to be repaired shall be cleaned by...
methods acceptable to the material manufacturer so that the cracks are free of
dirt, oil, grease, laitance, and other foreign matter. All loose and deteriorated
existing concrete and shotcrete shall be removed down to sound materials. All
concrete and shotcrete surfaces shall be checked for delamination to ensure that
all surfaces are sound. All edges shall be square cut to avoid feather edges.

Any other preparation recommended by the material manufacturer shall be
brought to Engineer's attention and may be incorporated into the work if
acceptable to Engineer.

Concrete and shotcrete surfaces in the area of a crack to be repaired shall be
cleaned by wire brushing, blasting, or other acceptable methods.

Wall surfaces shall be sandblasted clean to expose crack networks and
construction joints. If there is active water seepage in the repair area, the
seepage shall be stopped as recommended by the injection material
manufacturer and as acceptable to Engineer. Injection ports shall be installed,
when recommended by the injection material manufacturer.

3-2.01. Injected Epoxy Resin. Preparation for injected epoxy resin shall include
sealing the surface at the crack, on both sides when possible, with crack sealant
as recommended by the material manufacturer and as acceptable to Engineer for
the pressure injection work. Injection ports for epoxy resin shall penetrate
through the crack sealant into the cracks at spacings recommended by the
material manufacturer.

3-2.02. Injected Foam Resin. Preparation for injected foam resin shall include
drilling offset injection holes at an angle that will intersect the crack, joint, or crack
network at approximately one-half the thickness of the concrete or shotcrete up
to a thickness of 36 inches. Spacing of injection ports shall be determined as
recommended by the injection material manufacturer and as acceptable to
Engineer. When the injection material manufacturer certifies, in writing, that
spacing of injection ports and installation procedures are acceptable, the injection
ports may be installed directly into the crack, subject to review by Engineer.

3-2.03. Structural Concrete Repair. All defective and damaged concrete shall be
removed and replaced with structural repair mortar. The Contractor shall be
responsible for preparing the surfaces of damaged concrete in accordance with
the repair adhesive manufacturer's recommendations. The area shall be chipped
to remove all loose materials and expose sound concrete. A minimum ½ inch
deep sawcut joint shall be made around the repair area to provide a vertical joint
to terminal the repair mortar. Bonding agent shall be applied to prepared area as
required by Engineer.
3-2.04. Connection Surface Treatment. The following are specific concrete surface preparation methods to be used where indicated on the Plans or required by the Engineer.

a. **Method A**: After existing concrete surface at connection has been roughened a minimum ¼ inch amplitude and cleaned, thoroughly saturate with water. Brush on a 1/16 inch layer of cement and water paste mixed to a heavy consistency. Place new concrete immediately after application of paste as shown on the Drawings.

b. **Method B**: After existing concrete surface at connection has been roughened to a minimum ¼ inch amplitude and cleaned, thoroughly saturate with water. Brush on a 1/16 inch layer of cement and water paste mixed to a heavy consistency. Place new concrete immediately after application of paste as shown on the Drawings.

c. **Method C**: Drill a hole ¼ inch larger in diameter than diameter of bolt or dowel. The hole shall be brushed clean and blown clear of loose particles and dust prior to installing epoxy. Follow installation recommendations as provided by the epoxy adhesive manufacturer from the Anchorage In Concrete and Masonry section. Unless note otherwise on the Plans, set dowels in drilled hole depth of minimum 10 bar diameters.

d. **Method D**: Combination of Method B & C.

3-3. **APPLICATION**. Concrete and shotcrete repair work shall be performed in accordance with the following requirements.

3-3.01. **Crack Sealant**. Crack sealant shall be trowel-applied to a minimum dried thickness of 1/8 inch, or thicker if directed by manufacturer’s literature. The concrete surface where the sealant is applied shall be smooth, uniform, and free from irregularities. Crack sealant shall be removed after the injection of resin is completed, except for portions of wall faces that will be at least 12 inches below the finished grade.

3-3.02. **Pressure-Injected Resin**. The injected areas shall be prepared as specified and as recommended by the manufacturer. Pressure-injected resin shall be suitable for penetration of joints, cracks, and crack networks 2 mils (0.002 inch) wide and larger.

After the joints and cracks are prepared and before the injection of the resin, the joints shall be flushed with water. The water flush shall be terminated when the turbidity of the expelled water is equal to that of the flush water. Unless otherwise acceptable to resin manufacturer and Engineer, cracks shall be dry prior to injecting resin.
The pumping equipment used for the pressure injection of resin shall have pressure metering. Written procedures for use and quality control of the injection equipment shall be furnished to Engineer for review and acceptance. The pump shall be electric. The material and process used for the pressure injection of the resin shall have been in use a minimum of 5 years.

The joints and crack networks shall have a minimum of 90 percent penetration of resin into the joint or crack network. Core samples may be taken at Engineer's discretion.

3-3.02.01. Epoxy Resin. Epoxy resin shall be injected into the structure in accordance with the material manufacturer's recommendations and as acceptable to Engineer. Epoxy resin shall be injected until the resin appears at the next injection port.

3-3.02.02. Foam Resin. Foam resin shall be premixed and injected into the structure in accordance with the material manufacturer's recommendations and as acceptable to Engineer. Foam resin shall be injected into the structure until the resin appears at the next injection port.

Surfaces of cracks and joints may need to be sealed with crack sealant.

3-3.02.03. Structural Concrete Repair. Repair mortar shall be applied in strict conformance with manufacturer's instructions. Acceptable application methods include trowel or form-and-place with each method using the appropriate product. Bonding agent shall be applied to prepared area as required by Engineer.

3-3.02.04. Connection Surface Treatment. Drilling holes for dowels shall be performed without damage to surrounding concrete and rebar. Bonding agent shall be applied in strict conformance with manufacturer's instructions.

3-3.02.05. Removal of Existing. Concrete designated to be removed to specific limits on Drawings or directed by the Engineer, shall be done by line drilling at limits of removal followed by chipping or jack-hammering as appropriate. Sawcutting at limits of concrete to be removed shall only be done as indicated on the Drawings, or by written approval form the Engineer. Remove concrete in such a manner that surrounding concrete and existing reinforcement to remain in place are not damaged.

3-3.02.05.01. At locations where existing reinforcement is exposed from sawcutting/core drilling and no new material is to be placed on the cut surface, a coating or surface treatment of epoxy adhesive shall be applied to the entire cut face to a minimum thickness of ½”.
3-3.02.05.02. Existing concrete that is specified to remain in place, if damaged shall be repaired by appropriate means.

3-3.03. Cold Weather. When ambient temperatures below 40°F are expected during the curing period, the repair materials shall be maintained at a temperature of at least 50°F for 14 days or 75°F for 7 days after placement. Sudden cooling of the repair materials shall not be permitted.

3-4. PROTECTION. Post-placement curing and protection shall be as specified herein and in accordance with the manufacturer's recommendations.

3-5. CLEANING. Work areas shall be cleaned each day in accordance with the Project Requirements section. Upon completion of the final cleanup, Contractor shall restore all areas affected by the grouting procedures to their original condition, leaving no trace of material piles or other wasted materials.

End of Section
DIVISION 4 – Masonry
PART 1 - GENERAL

1-1. THE REQUIREMENT.

A. The Contractor shall furnish all tools, equipment, materials, and supplies and shall perform all labor required to complete the reinforced hollow unit masonry work as indicated on the Drawings and specified herein.

B. All work shall be in accordance with ACI 530.1 except as modified herein.

1-2. RELATED WORK SPECIFIED ELSEWHERE.

A. Concrete Reinforcement section.

B. Grout section.

C. Masonry Water Repellent Coating section.

1-3. REFERENCE SPECIFICATIONS, CODES AND STANDARDS.

A. Comply with the reference specifications of the General Requirements.

B. Comply with the current provisions of the following Codes and Standards.

- ASTM C 33 Standard Specification for Concrete Aggregates
- ASTM C 90 Standard Specification for Loadbearing Concrete Units
- ASTM C 140 Standard Test Methods for Sampling and Testing Concrete Masonry Units
- ASTM C 144 Standard Specification for Aggregate for Masonry Mortar
- ASTM C 207 Standard Specification for Hydrated Lime for Masonry Purposes
- ASTM C 331 Standard Specification for Lightweight Aggregates for Concrete Masonry Units
- ASTM C 404 Standard Specification for Aggregates for Masonry Grout
- ASTM C 476 Standard Specification for Grout for Masonry
- CBC Chapter 21 – Masonry Construction
1. Standard Specifications:
   a. SSPWC Sections 202-2; 303-4.1 - Concrete Block and Masonry.

1-4. CONTRACTOR SUBMITTALS.

A. Submittals shall be made in accordance with the General Requirements.

B. The following submittals and specific information shall be provided.

1. Manufacturer's Literature: Submit information illustrating the horizontal joint reinforcement and preformed control joint materials proposed for use.

2. Samples: Before starting work, samples of blocks to be used shall be submitted to the Engineer for approval. Materials used on the project shall conform to approved samples.

3. Sample Panel: Lay up a sample panel for each type of masonry at the site to show the approved bond and method of finishing joints. Sample panels shall be at least 4-feet high and at least 4-feet long, and shall remain intact after approval until acceptance of the permanent masonry work and then shall be removed by the Contractor. The accepted sample panels shall serve as a basis of color, texture, and workmanship for acceptance of the permanent construction. The sample panel shall demonstrate the ability to receive insulation and/or grout in certain cells in any sequence of placement and demonstrate that the materials will be restricted to the cells and bond beams intended to receive each material. The sample panel construction shall show all areas required to receive mortar, including the webs on each side of each cell to prevent insulation from entering cells to receive grout or to prevent grout from entering cells to receive insulation. Where bond beams are to be used, the sample panel shall demonstrate the proper placement of both insulation and grout to the bond beam level and the proper placement of the bond beam prior to placement of the insulation and grout above the bond beam level. The sample panel shall demonstrate the proper use of running bond or stacked bond meeting the requirements hereinafter specified.

4. Manufacturer's Certificate: Provide manufacturer's certificate(s) for the masonry units specified herein.

1-5. QUALITY ASSURANCE.

A. The Contractor shall hire an independent test laboratory to visit the jobsite to sample and test the masonry units, to make samples of grout and mortar, and to cure and test these samples as herein specified. A copy of all testing reports shall be furnished to the Engineer within 5 days of the tests.
B. After delivery to the jobsite, the masonry units will be sampled and tested in accordance with ASTM C 140 and ASTM C 426 for Class 2 masonry units. Masonry construction shall not proceed until test results are known and the masonry units are certified by an approved testing agency as complying with ASTM C 90 and this Specification.

C. Grout and mortar samples for strength testing shall be taken at the beginning of the masonry work and thereafter at the discretion of the Engineer. The samples shall be taken as hereinafter specified.

1. **Field Compressive Test Specimen for Grout:** On a flat nonabsorbent base, form a space approximately 3-inches by 3-inches by 6-inches high, i.e., twice as high as it is wide, using masonry units having the same moisture conditions as those being laid. Line the space with a permeable paper or porous separator so that water may pass through the liner into the masonry units. Thoroughly mix or agitate grout to obtain a fully representative mix and place into molds in two layers, and puddle each layer with a 1-inch by 2-inch puddling stick to eliminate air bubbles. Level off and immediately cover molds and keep them damp until taken to the laboratory. After 48 hours set, carefully remove masonry units and transport and place grout samples in a fog room until tested.

2. **Field Compressive Test Specimen for Mortar:** Spread mortar on the masonry units 1/2-inch to 5/8-inch thick, and allow to stand for 1 minute, then remove mortar and place in a 2-inch by 4-inch cylinder in two layers, compressing the mortar into the cylinder using a flat end stick or fingers. Lightly tap mold on opposite sides, level off and immediately cover molds and keep them damp until taken to the laboratory. After 48 hours set, have the laboratory remove molds and place them in the fog room until tested in the damp condition.

3. Requirements:
   a. Each such mortar test specimen shall exhibit a minimum ultimate compressive strength of 3750 pounds per square inch.
   b. Each such grout test specimen shall exhibit a minimum ultimate compressive strength of 2,500 pounds per square inch.
   c. The design compressive strength of the CMU assembly is 2500 psi.
   d. CMU construction shall not begin prior to Engineer has reviewed the applicable submittals for strength of mason units, grout and mortar.
PART 2 - PRODUCTS

2-1. MASONRY UNITS.

A. General:

1. Units shall be of size shown. Provide or cut special shapes for corners, jambs, lintels, and other areas shown or required. Unless otherwise required by the wall configuration, provide concrete masonry units with one open end to facilitate placement around vertical reinforcing steel. Special units shall match color and texture of standard units. Where masonry units are placed so that the end of a unit is exposed, such as at a corner or intersection, the exposed end surface shall match the color and texture of the exposed unit sides.

2. Units shall be sound, dry, clean, free of cracks, and shall have reached the specified moisture content and compressive strength prior to placing in the structure.

3. Vertical cells to be grouted in all units covered under this Specification shall have vertical alignment sufficient to maintain a clear, unobstructed continuous vertical cell measuring not less than 2-inch by 3-inch.

4. The color of the units for exterior walls shall be white and the surface texture shall be smooth on all exposed surfaces or split face as indicated on the drawings.
   a. Smooth Face Type Block with a single score line shall be comparable to ORCO Block Company, Precision finish, white in color, and with integral moisture proofing admixture.
   b. Split Face Type Block shall be comparable to ORCO Block Company, b. Split Face finish, white in color, and with integral moisture proofing admixture.

5. The color of the units for interior walls shall be grey and the surface texture shall be smooth on all exposed surfaces.

B. Hollow Concrete Units (CMU):

1. Hollow concrete masonry units (CMU) shall be Class 2 (medium weight), in accordance with ASTM C 90.

2. Tests for conforming to the above specifications shall be made in accordance with ASTM C 140, "Sampling and Testing Concrete Masonry Units".

3. Blocks shall have dense faces suitable for painting.

4. The manufacturer shall certify that the masonry units meet all requirements of ASTM C 90 including the moisture content and linear shrinkage requirements for intermediate conditions.
5. Minimum compressive strength of CMU unit shall be 3250 psi.

C. Hollow Brick Units:

1. Hollow brick units shall be Grade SW, Type HBX and shall conform to ASTM C 652. Units shall be manufactured by extrusion method and shall not be Drypress units.

2. Color and texture of hollow brick units shall be as scheduled and shall match the approved samples as submitted by the Contractor.

2-2. CEMENT.

A. Portland Cement: All cement to be used or furnished shall be Type II low alkali portland cement conforming to ASTM C 150, or Type IP (MS) Portland-pozzolan cement conforming to ASTM C 595, unless otherwise specified. Either cement shall conform to the low alkali requirements of Table IA of ASTM C 150. Type IP (MS) cement shall contain no more than 20 percent pozzolan, which shall be inter-ground with the clinker.

1. The Contractor shall furnish a Certificate of Compliance signed by the manufacturer identifying the cement and stating that the cement complies with these requirements. Supporting test data shall be furnished when requested by the Engineer.

2. Whenever suitable facilities accepted by the Engineer are available for handling and weighing bulk cement, such facilities shall be used. Otherwise, the cement shall be delivered in original unopened sacks that have been filled by the manufacturer. They shall be plainly marked with the manufacturer’s name or brand, cement type and weight.

3. Cement shall be stored in such a manner as to permit ready access for the purpose of inspection and sampling, and suitably protected against contamination or moisture. Should any cement delivered show evidence of contamination or be otherwise unsuitable, the Engineer may reject it and require that it be removed from the site.

4. All portland cement used in concrete for any individual structure shall be of the same brand and type unless otherwise accepted by the Engineer.

2-3. LIME.

A. Lime putty shall be made from Type S hydrated lime and shall conform to ASTM C 207. Lime shall be kept dry.

2-4. AGGREGATES.

A. Hollow Concrete Units: Aggregates for hollow concrete units shall conform to ASTM C 33 and ASTM C 331 or shall be blended from aggregates conforming to these Specifications. Use the same type or types of
aggregate throughout the project unless otherwise indicated or written permission is received from the Engineer. Aggregates used for the project shall produce concrete units with a dry density of 105 to 125 pounds per cubic foot.

B. **Mortar**: Aggregate for mortar shall conform to ASTM C 144.

C. **Grout**: Aggregate for grout shall conform to ASTM C 404.

2-5. **WATER**.

A. Water used for concrete shall not contain deleterious substances. Water shall not contain an amount of impurities that will cause a change in the time of setting of portland cement of more than 25 percent nor a reduction in relative mortar strength at 7 and 28 days of more than 10 percent compared to results obtained with distilled water.

B. In conventionally reinforced concrete work, water shall not contain more than 1,000 ppm of chlorides calculated as Cl, nor more than 1,000 ppm of sulfates calculated as SO₄.

C. In prestressed concrete work, water shall not contain more than 650 ppm of chlorides calculated as Cl, nor more than 800 ppm of sulfates calculated as SO₄.

D. In nonreinforced concrete work, water shall not contain more than 2,000 ppm of chlorides calculated as Cl, nor more than 1,500 ppm of sulfates calculated as SO₄.

2-6. **MORTAR**.

A. Mortar shall conform to ASTM C270, Type S. Mortar shall attain a minimum compressive strength of 1,800 psi in 28 days. Test results verifying the compressive strength shall be submitted to the Engineer.

2-7. **MORTAR ADMIXTURE**.

A. Water repellent admixture shall be added to all mortar in the quantity recommended by the manufacturer. Water repellent admixture shall be Hydrophobe 31, manufactured by W. R. Grace and Company; Sika Red Label, manufactured by Sika Chemical Corporation; Omicron Mortar Proofing, Master Builders Corporation; or equal.

B. Inert coloring pigments may be added but not to exceed 6 percent by weight of the cement. Color shall be as selected by Engineer.

C. Quantity of admixture per mortar batch shall be in accordance with manufacturer’s recommendations.
2-8. **GROUT.**

   A. Conform to ASTM C 476 except as hereinafter specified.

   B. **General:** Grout shall be sufficiently fluid to ensure complete filling of all sections of masonry requiring grout, but not so thin as to allow separation of aggregate.

   C. **Proportions:**

      1. Grout for pumping shall be of fluid consistency and shall have not less than seven sacks of cement in each cubic yard of grout. The mix design shall be approved by the Engineer.

      2. Fluid consistency shall mean a fluid suitable for pouring without segregation.

      3. Grout for use in spaces less than 4-inches clear in any dimension, grout proportioned by volume shall be 1 part portland cement and 2-1/4 to 3 parts sand. For spaces 4-inches or larger in all horizontal directions, grout shall be 1 part portland cement, 2 to 3 parts sand and 1-1/4 to 2 parts No. 4 concrete aggregate.

   D. **Grout Admixture:** Grout admixture shall be Sika Grout Aid, Type II, manufactured by Sika Chemical Corporation; Grout Aid GA-II, manufactured by Concrete Emulsions; or equal. Amount of admixture and method of introducing admixture shall be in accordance with manufacturer's recommendations.

   E. **Compressive Strength:** The average 28-day compressive strength of the grout samples for each grout pour tested shall not be less than 2,500 psi. Test results verifying the compressive strength shall be submitted to the Engineer.

2-9. **HORIZONTAL JOINT REINFORCEMENT.**

   A. Two parallel No. 9 wires, uncoated, weld connected to No. 9 perpendicular cross wire at 15-inches on center. Special manufactured corner and wall intersection pieces shall be used at these locations. Horizontal joint reinforcement shall be ladder type masonry wall reinforcement, manufactured by Dur-O-Wall National, Inc., Cedar Rapids, IA; AA Wire Products Company, Chicago, IL; or equal.

2-10. **PREFORMED CONTROL JOINT.**

   A. Joint material shall be a solid rubber extrusion such as regular Rapid Control Joint, manufactured by Dur-O-Wall National Company, Cedar Rapids, IA; Sonneborn Control Joint.
B. Manufactured by Sonneborn-Contech Company, Oakland, CA; or equal.

PART 3 - EXECUTION

3-1. GENERAL.

A. All work shall be performed in a workmanlike manner and in full compliance with the applicable building ordinances.

B. The foundation on which a masonry wall is to be built shall have a clean, smooth surface with aggregate exposed. Sandblasting shall be done if the surface has laitance or other foreign material lodged in the pores of the foundation surface.

C. All masonry walls shall be laid true, level, and plumb in accordance with Subsection 3.4 and the Drawings.

D. Masonry units shall be cured, dry and surfaces shall be clean when laid in the walls.

E. During construction, all partially laid walls as well as units in storage shall be protected from moisture. All concrete blocks units and any partially laid walls which become wet during the construction shall be permitted to dry for at least 1 week, or longer if required by weather conditions, before recommencing work.

F. Proper masonry units shall be used to provide for all windows, doors, bond beams, lintels, pilasters, etc. with a minimum of unit cutting. Where masonry unit cutting is necessary, all cuts shall be neat and regular and edges exposed in the finished work shall be cut with a power-driven abrasive saw.

G. Where no bond pattern is shown, the wall shall be laid up in straight uniform course with regular running bond with alternate header joints in vertical alignment.

H. Intersecting masonry walls and partitions shall be bonded by the use of 1/4-inch minimum diameter steel ties at 24-inches on centers (maximum) unless a control joint is indicated on the drawings.

I. Where stack bond is indicated on the Plans, approved metal ties shall be provided horizontally at 24-inches on centers (maximum).

J. Mortar joints shall be straight, clean, and uniform in thickness. Unless otherwise specified or detailed on the Plans, horizontal and vertical joints shall be approximately 3/8-inch thick with full mortar coverage on the face.
shells and on the webs surrounding cells to be filled. Units shall be laid with "push joints". No slushing or grouting of a joint will be permitted, nor shall a joint be made by working in mortar after the units have been laid. The scored “false” joints in the smooth face block shall be mortared to match the color of the mortar in typical mortar joints.

K. Exposed walls shall have joints tooled with a round bar (or V-shaped bar) to produce a dense, slightly concave surface well-bonded to the block at the edges. Tooling shall be done when the mortar is partially set but still sufficiently plastic to bond. All tooling shall be done with a tool which compacts the mortar, pressing the excess mortar out of the joint rather than dragging it out.

L. If it is necessary to move a block so as to open a joint, the block shall be removed from the wall, cleaned, and set in fresh mortar.

3-2. WEATHER CONDITIONS.

A. Protect the tops of walls at all times. Cover the tops of walls with waterproof paper when rain is imminent and work is discontinued.

B. Protect masonry construction from loss of moisture during the curing period when ambient air temperature of 90 degrees F (37 degrees C) or greater exists and when relative humidity is less than 50 percent. Use light fog spray nozzles to cure the mortar when these conditions exist. Provide a demonstration of the fog spray nozzles prior to starting the work.

3-3. BONDING WALL UNITS.

A. Foundation:

1. The foundation shall be prepared for the initial mortar placement by one of the following methods:
   a. Sandblasting the foundation and reinforcing dowels after the concrete has fully cured to remove all laitance and spillage and to expose sound aggregate.
   b. Water blasting the foundation and reinforcing dowels after the concrete has partially cured to remove all laitance and spillage and to expose sound aggregate.
   c. Green cutting fresh concrete with high pressure water and hand tools to remove all laitance and spillage from the foundation and the reinforcing dowels and to expose sound aggregate.

2. The foundation shall be cleaned of all loose material prior to the initial mortar placement.
B. Corners: Unless a control joint is indicated on the drawings, corners shall have a standard masonry bond for overlapping units and shall be grouted solid. Reinforcement shall be as shown.

C. Intersections: Unless a control joint is indicated on the drawings, intersecting walls shall be bonded with reinforcement as shown. The abutting wall shall not have a masonry bond with the straight wall.

3-4. LAYING REINFORCED MASONRY UNITS.

A. General:

1. Masonry construction shall conform to the applicable sections of the Uniform Building Code, latest edition, and as supplemented by these Specifications. Do not start laying masonry units if the foundation horizontal or vertical alignment does not satisfy the Tolerance Specification specified in Section 03301 Cast-In-Place Concrete.

2. The maximum permissible variation from plumb of the wall or of a line of joints in the wall shall be 1/16-inch per foot of height, and 1/4-inch in the total height of the wall. The maximum permissible variation from a horizontal line along the base of the wall or for lines of horizontal joints shall be 1/16-inch per block, 1/4-inch per 50-feet of wall with proportionately greater tolerance for longer walls up to 1/2-inch in the total length of wall. Interior surfaces shall be maintained in the plane described above and the dimension tolerances of the units shall be taken up on exterior surfaces.

3. Units with chipped edges or corners within permissible ASTM limits shall be placed in the wall such that the chipped area is not exposed to view.

B. Wall Units:

1. General:
   a. If it is necessary to move a unit after it has been once set in place, the unit shall be removed from the wall, cleaned, and set in fresh mortar.
   b. Toothing of masonry units will not be permitted unless acceptance is given by the Engineer.
   c. All masonry work shall be protected from damage until final acceptance of the work. Damaged units will not be accepted.

2. Running Bond: Unless otherwise shown, walls shall be laid up in straight, uniform courses using a running bond pattern. The running bond pattern shall guarantee continuous vertical cells meeting the requirements of this Specification with mortar joints as required to prevent the different materials such as grout or poured insulation from
escaping from the cell being filled to adjacent cells where the material is not intended to be placed.

3. Stack Bond:
   a. Where shown, walls shall be laid up in straight, uniform courses using a stack bond pattern.
   b. Horizontal mortar joint reinforcement shall be provided in addition to the typical wall reinforcing steel. Joint reinforcement shall be spaced not more than 16-inches apart, vertically. Ends of joint reinforcement shall lap 6-inches minimum, except at control joints where the joint reinforcement shall be discontinuous.

4. Special Shapes: Provide and place such special units as corner block, door jamb block, lintel block fillers, and similar blocks as may be required. Use the required shapes and sizes to work to corners and openings maintaining a proper bond throughout the wall.

3-5. BUILT-IN ITEMS.
   A. Door frames, windows, vents, and other items required to be built in the wall shall be in position and the wall constructed around them. Standard masonry anchors shall be used to secure the items to the wall. All spaces around the items shall be filled with mortar or grout.

3-6. EMBEDDED CONDUITS.
   A. Electrical, instrumentation, or water conduits shall not be placed in a cell containing reinforcement unless accepted by the Engineer.

3-7. MORTAR PREPARATION.
   A. Mortar shall be mixed by placing 1/2 the water and aggregate in the operating mixer. Add cement. Add the remaining aggregate and water, and mix for at least 2 minutes. Add lime and continue mixing as long as needed to secure a uniform mass, but no less than 3 minutes after the addition of lime. The addition of the admixture shall be timed in strict accordance with the manufacturer's instructions and the procedure used for adding it to the mix shall provide good dispersion.

   B. The mortar shall be machine mixed in approved mixers. Mixer drums shall be kept clean and free of debris and dried mortar. The mortar shall be in place before the initial setting of the cement has taken place. Re-tempering of mortar in which the cement has started to set will not be permitted.
3-8. **MORTAR JOINTS.**

A. General:

1. Mortar joints shall be straight, clean, and uniform in thickness, and shall be tooled as shown on the Contract Documents. Where no joint detail is shown and the wall is not to be coated or painted, exposed walls shall have joints tooled with a round bar to produce a dense, slightly concave surface well bonded to the masonry units at the edges. Tooling shall be done when the mortar is partially set but still sufficiently plastic to bond. All tooling shall be done with a tool that compacts the mortar, pressing the excess mortar out of the joint rather than dragging it out. Where certain joints are to be concealed under paint, these joints shall be filled flush and then rubbed with burlap to produce a dense surface without sheen.

2. Horizontal and vertical mortar joints shall be straight, clean, and shall have a uniform thickness of 3/8-inch.

3. The horizontal and vertical mortar joints shall have full mortar coverage on the face shells.

4. Vertical head joints shall be buttered well on each unit for a width equal to the face shell of the unit, and these joints shall be shoved tightly so that the mortar bonds well to both units. Joints shall be solidly filled from the face of the block to at least the depth of the face shell, pointing where necessary to completely and compactly fill the joints. Furrowing of the mortar will not be permitted.

5. All excess mortar shall be removed from the grout space of the cells to be filled as the units are being laid.

B. Exposed Joints:

1. Joints that will be exposed to view after final construction shall be tooled unless otherwise noted or shown. Joints shall be cut flush and, as mortar takes its initial set, shall be tooled to provide a concave joint. Tooling shall be done when the mortar is partially set but still sufficiently plastic to bond. All tooling shall be done with a tool which compacts the mortar, pressing the excess mortar out rather than dragging it out. Joints which are not tight at the time of tooling shall be raked out, pointed, and then tooled.

2. Joints at split face surfaces, interior and exterior, shall be raked and tooled.

C. Concealed Joints: Joints that are not exposed shall be struck flush with no further treatment required.
3-9. **CONTROL JOINTS.**

A. Preformed Control Joints: The mortar shall be omitted from the vertical joints. Place the rubber control joint material as the wall is built. After the wall is grouted, cured, and cleaned, install the backing rod and flexible sealant. Place and tool sealant to match depth of typical joint.

3-10. **REINFORCING.**

A. General:

1. Reinforcing bars shall be straight except for bends around corners or where bends or hooks are detailed on the Contract Documents. Vertical bars shall be fixed in the position and at the interval shown on the Contract Documents at each end of the bar.

2. All steel reinforcing bars shall be as shown on the plans or as specified in Reinforcement section.

3. Reinforcing steel shall be placed as indicated on the Plans. Splices shall be lapped a distance sufficient to develop the yield stress in the bar, with a minimum requirement of 40 diameters. Dowels other than column dowels need to be lapped only 30 diameters. Column dowels shall lap 50 diameters.

4. Outside horizontal steel shall lap around corners 40 diameters and be carried through columns unless otherwise shown on the Plans. Inside horizontal steel shall extend as far as possible and bend into corner core. A dowel shall be provided in the foundation for each vertical bar.

5. Where horizontal courses are to be filled, metal stops shall be used. Use of paper stops will not be permitted. All horizontal reinforcing steel shall be laid in a course of bond beam blocks filled with grout.

6. Vertical cores containing steel shall be filled solid with grout, and thoroughly rodded.

7. Where knockout blocks are used, steel shall be erected and wired in place before three courses have been laid. Vertical cores at steel locations shall be filled as construction progresses.

8. Where knockout blocks are not used, vertical cores at steel locations shall be filled in lifts of not more than 4-feet. The maximum height of pour shall be 8-feet. Cores shall be cleaned of debris and mortar and shall have reinforcing steel held straight and in place. If ordered by the Engineer, inspection and cleanout holes shall be provided at the bottom of each core to be filled.

9. Reinforcing steel shall be inspected prior to placing grout.
B. Foundation Dowels:

1. The size, number, and location of the foundation dowels shall match the vertical wall reinforcing unless otherwise noted.

2. When a foundation dowel does not line up as intended, with a vertical core, it shall not be sloped more than 1 horizontal to 6 vertical to bring it into alignment.

3. Dowels shall be accurately placed to match reinforcing in filled cells.

C. Vertical Reinforcing: Vertical reinforcing steel shall be held in position near the ends of the bars by wire ties to dowels and/or by reinforcing positioners. The bars shall be held in position at intervals not exceeding 160 bar-diameters by reinforcing positioners.

D. Horizontal Reinforcing: Horizontal bars shall be laid on the webs of bond beam units, and shall be placed as the wall is built.

3-11. GROUTING.

A. Grout Preparation: Grout shall be mixed as specified hereinbefore for mortar preparation if onsite mixing is performed. Transit-mixed grout shall meet the requirements of ASTM C 476. The grout admixture shall be added at the site. In accordance with the specified grout admixture manufacturer’s recommendations, the admixture shall be premixed with water and the resulting solution shall be added to the grout mix and thoroughly mixed. Do not exceed quantity of admixture recommended by the manufacturer.

B. General:

1. All debris and projecting mortar shall be cleaned out before pouring grout.

2. Grout pour shall be stopped 1-1/2 inches below the top of a course to form a key at pour joints.

3. Grout shall not be mixed, conveyed, or placed with equipment constructed of aluminum.

4. All vertical and horizontal reinforcement, ties, bolts, anchors, and other required embedments shall be secured in place, inspected, and approved before grouting starts.

5. Grouting of beams over openings shall be done in one continuous operation.

6. Vertical cells to be filled shall have vertical alignment sufficient to maintain a clear, unobstructed, continuous vertical cell measuring not less than 2-inch by 3-inch.
7. Grout shall be poured as soon as possible after the mortar has cured to reduce shrinkage and cracking of the vertical joints. Immediately after the grouting has been completed, the scum and stains on the masonry shall be washed off using clean water and fiber brushes. Grout and mortar stains shall not be allowed to dry on the face of the exposed masonry.

8. Vertical reinforcement may be placed initially and the wall built up around it providing the reinforcing steel is first wire tied to the foundation dowels. Reinforcing positioners and/or approved cross bracing must be provided to secure the top of the steel in place. The vertical steel will not be permitted to be dropped in after the block is laid unless reinforcing positioners are provided in the course above the previously grouted course.

C. Grouting Requirements:

1. Solid Grouting Requirements: All walls shall be grouted solid. Walls shall have vertical grout barriers spaced not more than 30-feet apart, which extend the full height of the wall.

D. Low-lift Grouting Requirements:

1. Unless otherwise accepted by the Engineer prior to the start of the masonry work, all grouting shall be low-lift grouting.

2. When grouting is stopped for 1 hour or longer, horizontal construction joints shall be formed by stopping the pour of grout 1 1/2-inches below the top of the uppermost unit. Horizontal steel shall be fully embedded by grout in an uninterrupted pour.

3. Grout pour shall be limited to a maximum height of 4-feet. The wall shall not be constructed more than one course above the top of the grout pour prior to placing the grout.

4. The grout shall be thoroughly consolidated with an internal "pencil" type vibrator operating at 5,000 RPM, to consolidate and reduce the amount of air voids. After waiting sufficient time to permit the grout to become plastic, but before it has taken any set, the grout shall be reconsolidated. The waiting period will vary depending upon weather conditions and block absorption rates, but under "normal" weather conditions with average masonry units, the waiting period should be between 30 to 60 minutes.

E. High-Lift Grouting Requirements:

1. Walls built with open-end units as shown shall not be grouted using the high-lift method. Standard construction masonry may be high-lift grouted if accepted by the Engineer.
2. Cleanouts of sufficient size to permit cleaning of the cell, positioning of the reinforcing and inspection shall be provided at the bottom of every vertical cell containing reinforcing. The location of the cleanout shall be such that it is not exposed to view after final construction unless otherwise accepted by the Engineer.

3. After the wall has been inspected and approved and prior to grouting, all cleanouts shall be capped in a manner that will seal them from grout leakage and provide a flush finish.

4. Grout pours shall be limited to 12-foot heights, with lifts not exceeding 4-feet. Each lift shall be thoroughly consolidated with an internal "pencil" type vibrator. Succeeding lifts shall not be placed until the previous lift has become plastic. Succeeding lifts shall be vibrated into the previous lift.

5. The last grout pour on a wall shall be reconsolidated as specified for low-lift grouting.

3-12. CURING.

A. Masonry and mortar joints shall be wetted frequently for at least 3 days to ensure proper curing of mortar.

3-13. CLEANING.

A. Clean all surfaces of excess mortar, grout spillage, dirt, and other foreign substances.

B. Walls not requiring painting or sealing shall be cleaned such that there are no visible stains.

C. No construction supports shall be attached to the wall except where specifically permitted by the Engineer.

D. Concrete and grout spilled on the wall shall be washed off before it can set up. At the conclusion of the masonry work, the Contractor shall clean down all masonry walls, remove any scaffolding and equipment used in the work, clean up all debris, refuse and surplus material, and remove it from the premises.

E. Surfaces requiring painting or sealing shall be prepared in accordance with Architectural Paint Finishes section.

3-14. PROTECTION.

A. At the end of each day's work, tops of walls shall be covered with building paper or by other means that will protect the walls from becoming excessively wet.
3-15. **TEMPORARY BRACING.**

A. The Contractor shall adequately brace all walls until the walls and roof are completed. Bracing shall be sufficient to protect the walls against damage from the elements, including wind.

3-16. **SEALING.** Not Applicable.

End of Section
DIVISION 5 – Metals
PART 1 - GENERAL

1-1. SCOPE. This section covers design, fabrication, and erection of joists, joist girders, bridging and bracing, and other accessories and appurtenances as required or indicated on the Drawings.

1-2. GENERAL. Unless otherwise noted, all materials, design, fabrication, erection, and end anchorage of open web steel joists shall conform to applicable provisions of the Steel Joist Institute (SJI) specifications.

1-3. SUBMITTALS. All submittals shall be submitted in accordance with the Submittals Procedures section.

Submit written confirmation from the Authority Having Jurisdiction (AHJ) that the manufacturing plant qualifies as an approved fabricator that does not require in-plant special inspection, as indicated in the International Building Code (IBC) Chapter 17, and in the Code Required Special Inspections and Procedures section.

Submit detailed steel joist placement plans, which shall be independently checked by both the joist manufacturer and Contractor. Any drawings submitted without evidence of checks by both parties will be returned without review. Placement plans shall include the following as a minimum.

- Listing of all applicable loads used in the design of the steel joists and joist girders.
- Profiles for non-standard joist and joist girder configurations.
- Connection requirements for joist and joist girder supports, field splices, and bridging attachments.
- Deflection criteria for live load and total loads for non-SJI standard joists.
- Size, location, and connections for all bridging.
- Joist headers.
- Mark numbers, type, sizes and locations of joists, and joist girders.

At completion of manufacture, submit a certificate of compliance in accordance with the Code Required Special Inspections and Procedures section. The statement shall certify that the work was performed in accordance with the...
Drawings, this specification section, and SJI standard specifications. Copies of the certificate shall be provided to Owner, Engineer, and the AHJ.

Submit the following items bearing the seal of an engineer registered in the state of the project.

- Joist calculations.
- Non-SJI standard bridging details (e.g. for cantilevered conditions, net uplift, etc.).
- Connection details for non-SJI standard connections (e.g. flush-framed or framed connections).
- Connection details for field splices.
- Connection details for joist headers.

1-4. DELIVERY, STORAGE, AND HANDLING. Materials shall be handled, transported, and delivered in a manner which will prevent bends, dents, scratches, or damage of any kind. Damaged units shall be promptly replaced. Materials shall be stored off the ground, with one end elevated to provide drainage. Stored materials shall be protected with a waterproof covering and ventilated to prevent condensation.

PART 2 - PRODUCTS

2-1. PERFORMANCE AND DESIGN REQUIREMENTS.

2-1.01. Design Criteria. Joists, joist girders, and appurtenant materials shall be designed and fabricated in accordance with the applicable requirements of the SJI specifications, except as otherwise specified or indicated on the Drawings.

All welds, welding, and related operations for steel joists shall be in conformity with the SJI requirements for welding steel joists.

All welding operators shall be qualified by an independent testing laboratory in accordance with the applicable provisions of the Structural Welding Code as issued by the American Welding Society (AWS). Qualification shall be in written form and shall be submitted to Engineer for review if requested.

Joists and joist girders shall be designed for the loadings indicated on the drawings, using the load combinations indicated in the applicable building code. The joist manufacturer shall check the joist and joist girder sizes indicated on the drawings, and shall modify the selections when appropriate. The indicated joist or joist girder depth shall not be changed without prior approval of Engineer. If web clearance diagrams for ductwork and other utilities are indicated on the
Drawings, the web member locations shall be adjusted as needed from the standards.

2-1.02. **Defective Material and Improper Workmanship.** Any defective joist material or improper workmanship, wherever found, at the mill, shop, or Site, at any time, will be rejected regardless of all previous inspection and regardless of load tests. Contractor shall remove and replace rejected steel joist and joist girder material at no additional cost to Owner and pay all expense because of delay caused by such rejections and replacements.

2-1.03. **Fabricator Approval.** All fabricating plants providing steel joists and joist girders shall be qualified by the SJI plant certification program.

2-2. **MATERIALS.** Materials used in the manufacture and installation of steel joists and joist girders shall be as follows:

<table>
<thead>
<tr>
<th>Material</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
<td>Comply with SJI specifications.</td>
</tr>
<tr>
<td>Unfinished Threaded</td>
<td>ASTM A307, Grade A, regular Hexagon type, low carbon steel.</td>
</tr>
<tr>
<td>Fasteners</td>
<td></td>
</tr>
<tr>
<td>Prime Paint</td>
<td>Comply with SJI specifications.</td>
</tr>
</tbody>
</table>

2-3. **ACCESSORIES.**

2-3.01. **Sloped End Bearing.** Sloped end bearing of joists shall be provided where indicated, complying with manufacturer's standards and requirements of applicable SJI specifications.

2-3.02. **Extended Ends.** Extended ends of joists shall be provided where indicated, complying with manufacturer's standards and requirements of applicable SJI specifications.

2-3.03. **End Anchorages.** End anchorage of joists to the adjacent construction shall be in accordance with the Drawings and applicable SJI specifications, unless otherwise noted.

2-3.04. **Bridging and Bracing.** Horizontal or diagonal type bridging shall be provided for joists, and bracing shall be provided for joist girders, complying with manufacturer’s standards, SJI specifications, and as indicated on the Drawings.

Horizontal bridging for joists shall consist of two continuous steel members, one of which is attached to the top chord and the other attached to the bottom chord. The bottom chord bridging for the joists shall be of sufficient strength to properly resist any lateral force exerted by the bottom chord of the joist.
Diagonal cross type bridging for joists shall be provided when required by the manufacturer’s standard or the SJI specifications.

Bracing shall be provided for joist girder bottom chords when girder is designed for uplift, as indicated in the SJI specifications.

2-3.05. **Headers.** Headers shall be provided where indicated or required, complying with manufacturer’s standard and SJI specifications. Headers are not allowed for LH Series (longspan) and DLH Series (deep longspan) joists.

2-4. **PAINTING.** Loose scale, heavy rust, and other foreign materials shall be removed from fabricated joists, joist girders and accessories before application of shop paint.

One shop coat of primer paint shall be applied to steel joists, joist girders and accessories by spraying, dipping, or other method to provide a continuous dry paint film thickness of not less than 0.50 mil.

PART 3 - EXECUTION

3-1. **GENERAL.** Steel joists and joist girders shall be installed in accordance with the recommendations of the manufacturer.

3-2. **INSTALLATION.**

3-2.01. **Placing Steel Joists and Joist Girders.** Placing of steel joists and joist girders shall not begin until supporting work is in place and secured. Joists and joist girders shall be placed on the support work, and shall be adjusted and aligned in accurate locations and spacing before permanently fastening.

3-2.02. **Bridging and Bracing.** Bridging and bracing shall be installed simultaneously with joists and joist girders before construction loads are applied. Anchor ends of bridging and bracing lines where terminating at walls or beams.

3-2.03. **Field Welding.** Joists and joist girders shall be welded to supporting steel framework as indicated on the Drawings and in accordance with SJI specifications for type of joists and joist girders used. Welding sequence and procedure shall be coordinated with placing of joists and joist girders. Shop paint shall be removed from the joists in the vicinity of field welding prior to the weld being performed.

3-2.04. **Touchup Painting.** Damaged or inadequate paint films of shop-primed steel joists and joist girders, all accessible surfaces of field welds, and ungalvanized field connection bolts shall be cleaned and touchup painted using the same materials as used for shop painting.
3-2.05. **Joist Girders, Longspan Joists and Deep Longspan Joists.** The installation of joist girders, longspan joists and deep longspan joists shall strictly conform with manufacturer's recommendations and SJI specifications.

End of Section
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

   1. Roof deck.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:

   1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Evaluation reports.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel".

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members".
2.2 ROOF DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Canam Steel Corporation; Canam Group, Inc.
2. Nucor Corp.
3. Or Equal

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck", in SDI Publication No. 31, and with the following:

1. Prime-Painted Steel Sheet: ASTM A1008, Structural Steel (SS), Grade 33 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
2. Galvanized-Steel Sheet: ASTM A653, Structural Steel (SS), Grade 33, zinc coating, thickness as indicated on the drawings.
3. Deck Profile: As indicated on the drawings.
4. Profile Depth: As indicated on the drawings.
5. Design Uncoated-Steel Thickness: As indicated on the drawings.

2.3 NONCOMPOSITE FORM DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Canam Steel Corporation; Canam Group, Inc.
2. Nucor Corp.
3. Or Equal.

B. Noncomposite Form Deck: Fabricate ribbed-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:

1. Prime-Painted Steel Sheet: ASTM A1008, Structural Steel (SS), Grade 33 minimum, with underside surface shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
2. Galvanized-Steel Sheet: ASTM A653, Structural Steel (SS), Grade 33, zinc coating thickness as indicated on the drawings.
3. Profile Depth: As indicated on the drawings.
4. Design Uncoated-Steel Thickness: As indicated on the drawings.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Fasteners: Fastener type for each deck system shall be as indicated on the drawings. Requirements for the various fastener types are as follows:
2. Power-actuated fasteners: knurled shank, minimum 1/2 inch diameter steel washer. Pin diameter and length to suit deck type and flange thickness of steel support member. ITW Buildex “Buildex BX14”, Hilti “ENP Series”.
3. Punched connections: Verco “PunchLok” system. VSC2 sidelap connections shall be made using the PunchLok tool.

C. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

E. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

F. Galvanizing Repair Paint: ASTM A780, with dry film containing a minimum of 94 percent zinc dust by weight.

G. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
B. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

C. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

D. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

E. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

F. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

G. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches apart with at least one fastener at each corner.
   1. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten.

H. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Mechanically fasten to substrate to provide a complete deck installation.
   1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

I. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

J. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.2 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field welds will be subject to inspection.
3.3 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

End of Section
Section 05400

COLD-FORMED (LIGHT) METAL FRAMING

PART 1 - GENERAL

1-1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Physical and structural properties representing materials and systems shall be in compliance with American Iron and Steel Institute (AISI S100) “Specification and Design of Cold-Formed Steel Structural Members”, CBC 2016 and any other standard in this Section.

C. Structural steel framing components shall have current approval of the ICC and valid ICC-ES report equivalent to ESR-3064P.

1-2. SUMMARY

A. Section Includes:
   1. Load-bearing wall framing.
   2. Exterior non-load-bearing wall framing.
   4. Ceiling joist framing.
   5. Soffit framing.

B. Related Requirements:
   1. Section 055000 "Miscellaneous Metals" for miscellaneous steel shapes, and connections used with cold-formed metal framing.
   2. Section 09250 "Gypsum WallBoard" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies, with height limitations.

1-3. PREINSTALLATION MEETINGS

1-4. **ACTION SUBMITTALS**

A. **Product Data:** For each type of product.

B. **Sustainable Design Submittals:**
   1. Not used.

C. **Shop Drawings:**
   1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
   2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

D. **Delegated-Design Submittal:** For cold-formed steel framing as indicated on Drawings.

1-5. **INFORMATIONAL SUBMITTALS**

A. **Qualification Data:** For testing agency.

B. **Welding certificates.**

C. **Product Certificates:** For each type of code-compliance certification for studs and tracks.

D. **Product Test Reports:** For each listed product, for tests performed by a qualified testing agency.
   1. Steel sheet.
   2. Expansion anchors.
   4. Mechanical fasteners.
   5. Vertical deflection clips.
   6. Miscellaneous structural clips and accessories.

E. **Evaluation Reports:** For nonstandard cold-formed steel framing post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
1-6. **QUALITY ASSURANCE**

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Stud Manufacturers Association.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel".
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel".

**PART 2 - PRODUCTS**

2-1. **MANUFACTURERS**

A. The following Manufacturers are capable of producing equipment and products which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular Manufacturer or product, nor shall it be construed that a named Manufacturer’s standard product will comply with the requirements of this Section.

B. Candidate steel stud Manufacturers: The Steel Network, Inc; Dale Industries; Bostwick Steel Lath Co.; Rolled Steel Products, Inc.; Studco Corp.; U.S. Gypsum; U.S. Steel Corp.; Western Metal Lath Div.; United Metals Products, INC; or Approved Equal.

C. The Manufacturer shall have ten (10) years of experience manufacturing and installing cold-formed metal framing in similar sized projects.
2-2. PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, registered in the State of the project, to design cold-formed steel framing where framing sizes and details are not indicated on Drawings.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
   1. Design Loads: As indicated on Drawings
   2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
      a. Exterior Load-Bearing Wall Framing: Horizontal deflection of 1/240 of the wall height.
      b. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft.
      c. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft.
      d. Ceiling Joist Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.
   3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
   4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
      a. Upward and downward movement of 1/2 inch.
   5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:
   2. Wall Studs: AISI S211.
   3. Headers: AISI S212.

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2-3. COLD-FORMED STEEL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: ST50H.
2. Coating: G90 or equivalent.

B. Steel Sheet for attachment Clips: ASTM A653, structural steel, zinc coated, of grade and coating as follows:

1. Grade 50, Class 1.
2. Coating: G90.

2-4. LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.
2. Flange Width: 1-1/2 inches.

C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.
2-5. EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer’s standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428 inch.

B. Steel Track: Manufacturer’s standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: Matching steel studs.

C. Single Deflection Track: Manufacturer’s single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428 inch.
   2. Flange Width: 1 inch plus the design gap for one-story structures.

D. Drift Clips: Manufacturer’s standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2-6. INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer’s standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0329 inch.

B. Steel Track: Manufacturer’s standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: Matching steel studs.

C. Single Deflection Track: Manufacturer’s single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support...
horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.
2. Flange Width: 1 inch plus the design gap for one-story structures.

D. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2-7. **CEILING JOIST FRAMING**

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch.

2-8. **SOFFIT FRAMING**

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch.

2-9. **FRAMING ACCESSORIES**

A. Fabricate steel-framing accessories from ASTM A1003, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer’s standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
9. Joist hangers and end closures.

2-10. ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36, zinc coated by hot-dip process according to ASTM A123.

B. Anchor Bolts: As indicated in the Anchorage in Concrete and Masonry section.

C. Post-Installed Anchors: As indicated in the Anchorage in Concrete and Masonry section.
   1. Uses: Securing cold-formed steel framing to structure.
   2. Type: Expansion or adhesive anchors.
   3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.

D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
   1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2-11. MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780 or SSPC-Paint 20.
B. Cement Grout: Portland cement, ASTM C150, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: As indicated in the Grouting section, and with a fluid consistency and 30-minute working time.

D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2-12. FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

   1. Fabricate framing assemblies using jigs or templates.
   2. Cut framing members by sawing or shearing; do not torch cut.
   3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

   4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:
1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3-1. EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Product shall be shipped and stored prior to installation in accordance with Section 01614 “Handling and Storage”.

3-2. PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3-3. INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
   1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
   1. Cut framing members by sawing or shearing; do not torch cut.
   2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
3-4. **LOAD-BEARING WALL INSTALLATION**

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

1. Anchor Spacing: 24 inches.

B. Squarely seat studs against top and bottom tracks, with gap not exceeding 1/8 inch between the end of wall-framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:

1. Stud Spacing: 16 inches

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.

2. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in
each case, considering weight or load resulting from item supported.

I. Install horizontal bridging in stud system, spaced vertically 48 inches. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.

2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.

3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

J. Install steel sheet diagonal bracing straps to both stud flanges; terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3-5. EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:


C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.

2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to infill studs and anchor to building structure.

4. Connect drift clips to cold-formed steel framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at not greater than 96-inch centers.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3-6. INTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:


C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
1. Install single deep-leg deflection tracks and anchor to building structure.

2. Connect vertical deflection clips to studs and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows not more than 48 inches apart. Fasten at each stud intersection.

   1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

   2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

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   1. Install solid blocking at not greater than 96-inch centers.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3-7. ERECTION TOLERANCES

   A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

   1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3-8. FIELD QUALITY CONTROL

   A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

   B. Field and shop welds will be subject to testing and inspecting.
C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3-9. REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

End of Section
HANDRAILING, GUARDRAILING, AND LADDERS

PART 1 - GENERAL

1-1. SCOPE. This section covers the design, fabrication and installation of handrailing, guardrailing, and ladders fabricated from metal or fiberglass shapes. Ornamental railing systems, metal stairs, concrete and masonry anchorage systems, and structural and miscellaneous metals are covered in other sections.

For handrailing, guardrailing, and ladders for the Diversion Structure and Weir Box see Section 05521.

1-2. GENERAL. Fabricated items which are indicated on the Drawings but not mentioned specifically herein shall be fabricated in accordance with the applicable requirements of this section.

1-3. SUBMITTALS. Complete data, detailed drawings, and setting or erection drawings covering all materials shall be submitted in accordance with the Submittals Procedures section. Each separate piece shall be marked.

Data shall be submitted to certify that all railings and ladders meet all applicable requirements of the codes as specified herein and the Specifications and Drawings. Engineer may request copies of all supporting calculations.

1-3.01. Samples. Samples shall be submitted to indicate finishes. Samples of each type of fitting required to complete the installation shall also be submitted.

1-3.02. Colors. Where color selections are required, color charts shall be submitted showing the full range of available colors. Procedures for selecting colors shall be as indicated in the Submittals Procedures section.

1-4. DELIVERY, STORAGE, AND HANDLING. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section.

PART 2 - PRODUCTS

2-1. GENERAL. Railing systems and ladders shall be designed and fabricated by companies normally engaged in the manufacture of such systems. Railing products of like materials shall be from a single supplier and the installed systems shall have a uniform appearance throughout the project. Ladders may
be from another supplier. Unless indicated otherwise on the Drawings, ladders in proximity with guardrailing shall be of the same material, style, and finish as the guardrailing.

For metal railing systems, at Contractor's option, handrailing and guardrailing shall be either shop fabricated welded systems or prefabricated nonwelded systems designed for field assembly. Welded railing systems shall be fabricated from pipe and accessories by metal fabricators experienced in designing and fabricating welded railing.

2-2. PERFORMANCE AND DESIGN REQUIREMENTS.

2-2.01. Railing System Design Criteria. All railing systems shall be designed and fabricated in compliance with the most stringent requirements of the applicable local building code, OSHA 29 CFR Part 1926 Subpart R, and all other pertinent OSHA regulations and local safety regulations. Handrails for handicapped accessible areas, if required, shall comply with the requirements of the local building code, ANSI 117.1 Uniform Federal Accessibility Standards, and the accessibility standards of the Americans with Disabilities Act. In case of conflicting requirements, the more stringent requirements shall be applicable.

At a minimum, guardrailing and handrailing shall be designed to withstand a uniform load of 50 lbs per foot applied in any direction at the top, and a concentrated load of 200 lbs applied in any direction at any point along the top. The uniform load and the concentrated load need not be assumed to act concurrently. The design load shall be transferred through the entire railing system and its support to the structure.

Intermediate rails, including balusters on picket-type systems, shall be designed to withstand a horizontally applied normal load of 50 lb on an area not to exceed 12 inches by 12 inches including openings and space between rails. The load shall be located so as to produce the maximum effects. Reactions due to this loading are not required to be superimposed with the loads specified for the top rail and handrail in the preceding paragraph.

An allowable stress increase of 1/3 shall not be incorporated into the design of any part of the railing system.

Maximum spacing for railing posts shall be 6 feet.

2-2.02. Steel Rails. Handrails and guardrails shall be fabricated from 1-1/2 inch ID steel pipe. Pickets shall be fabricated from 3/4 inch ID steel pipe.
2-2.03. **Aluminum Rails.** Handrails and guardrails shall be fabricated from 1-1/2 inch ID aluminum pipe. Pickets shall be fabricated from 3/4 inch ID aluminum pipe.

2-2.04. **Fiberglass Rails.** Handrails shall be fabricated from 1 -1/2 inch minimum fiberglass reinforced pultruded square tube. Guardrails shall be fabricated from 1-3/4 inch minimum fiberglass reinforced pultruded square tube.

2-2.05. **Kickplate.** Kickplates shall be 4 inches high and shall be fabricated from similar materials as the railing. Kickplates shall clear the walking surface by 1/4 inch.

2-2.06. **Fasteners.** Unless noted otherwise, all fasteners shall be stainless steel. Where galvanized bolts are indicated on the Drawings or specified, the use of zinc-plated bolts will not be acceptable. Metal railings shall be fastened to fittings with through bolts or flush set screws; glued or pop riveted connections are not permitted. Fiberglass railings shall be connected with epoxy bonded connections in accordance with the manufacturer's standard details. Fastener details shall be indicated on the submittal drawings.

2-2.07. **Guarding of Openings.** Openings in railing shall be guarded by self-closing gates in accordance with OSHA 1910.23.

2-2.08. **Removable Guardrail.** Removable guardrail sections shall be designed so that each section has at least two, but not more than three posts.

2-2.09. **Expansion Control.** Guardrailing in outdoor locations shall have slip joints at least every 60 feet and at all concrete expansion joints to permit expansion and contraction. The gap at each slip joint shall be not less than 1/4 inch.

2-2.10. **Mounting to Structure.** Handrailing and guardrailing shall be mounted to structures as indicated on the Drawings. If mounting details are not indicated, railing posts shall be surface mounted with base flanges or side mount brackets secured to concrete by stainless steel adhesive anchors. Bolt sizes and pattern shall be as needed for the mounting device.

2-2.11. **Ladders.** Ladders shall be designed to meet the requirements of OSHA Section 1910.27 and ANSI-A14.3. Ladders with climbing heights greater than 20 feet or where the length of climb is less than 20 feet but the top of the ladder is more than 20 feet above the ground, floor, or roof level, shall be provided with fall prevention devices as indicated on the Drawings. Rest platforms shall be provided to limit straight climbs to maximum 30 feet.
Ladders shall be mounted to structures as indicated on the Drawings. If mounting details are not indicated, bracket connectors shall be stainless steel bolts when attached to structural steel or stainless steel adhesive anchors when attached to concrete or masonry.

Ladders exiting through hatchways shall be furnished with extending ladder safety posts.

2-3. ACCEPTABLE MANUFACTURERS. Metal railing shall be Universal “Uni-Rail”, “TUF Rail System”, Blum & Co “Connectorail”, equal.

Fiberglass rail and ladder shall be Fibergrate Composite Structures "Dynarail", Strongwell “Safrail”, or equal.

Metal ladders shall be Alaco “Series 500”, Thompson “TUFLadder” equal.

2-4. MATERIALS.

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<th>Aluminum Systems</th>
<th>Pipe</th>
<th>Shapes and Plates</th>
<th>Fittings, Welded</th>
<th>Fittings, Non-welded</th>
<th>Assembly Bolts, Nuts, Washers, and Fasteners</th>
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<tbody>
<tr>
<td></td>
<td>Galvanized Steel Systems</td>
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<tr>
<td>Pipe</td>
<td>ASTM A 500 Grade B, Schedule 40 minimum thickness, galvanized after fabrication.</td>
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<tr>
<td>Category</td>
<td>Description</td>
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<tr>
<td>Fittings, Welded</td>
<td>Angles, offsets, tees, ells, crosses, and caps shall be made with formed, welding ells and welding connectors. Material to match railings. Galvanized.</td>
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<tr>
<td>Fittings, Non-Welded</td>
<td>Manufacturer standard component fittings, material to match railings. Galvanized.</td>
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<tr>
<td>Assembly Bolts, Nuts, Washers, and Fasteners</td>
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<td>Painted Steel Systems</td>
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<td>Pipe</td>
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<tr>
<td>Fittings, Welded</td>
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<tr>
<td>Fittings, Non-welded</td>
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<tr>
<td>Fiberglass Systems</td>
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<td>Tube</td>
<td>Fiberglass reinforced pultruded square tube with surfacing veil and UV inhibitors in vinyl ester resin, ASTM E-84 flame spread of 25 or less.</td>
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<td>Kickplate</td>
<td>Fiberglass reinforced pultruded corrugated plate with surfacing veil and UV inhibitors in vinyl ester resin, ASTM E-84 flame spread of 25 or less.</td>
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<td>Hardware</td>
<td>Manufacturer’s standard, AISI Type 316 stainless steel.</td>
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<td>UV Protective Coating</td>
<td>Manufacturer’s standard, polyurethane.</td>
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<tr>
<td>Steel Pipe Sleeves</td>
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<tr>
<td>Outer Sleeves</td>
<td>Black steel pipe, Schedule 40. Hot-dip galvanized after fabrication.</td>
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<tr>
<td>Removable Post Inner Sleeves</td>
<td>PVC tube, Schedule 40.</td>
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<td>Plastic Pipe Sleeves</td>
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<td>Post Setting Cement</td>
<td>Minwax &quot;Super Por-Rok Cement&quot; or BASF Set Products Division &quot;Set 45&quot;.</td>
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<td>Ladder Fall Prevention Devices</td>
<td>OHSA approved fall prevention device with harness.</td>
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<td>Anchor Bolts to Prime Painted Steel</td>
<td>ASTM High Strength bolts, nuts, and washers in accordance with the Structural and Miscellaneous Metals section.</td>
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<td>Anchor Bolts to Concrete or Masonry</td>
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<td>Shop Coatings</td>
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<td>Universal Primer</td>
<td>Ameron &quot;Amercoat 385 Epoxy&quot;, Carboline &quot;Rustbond&quot;, or Tnemec &quot;Series 27 F.C. Typoxy&quot;.</td>
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<td>Red Oxide Primer</td>
<td>SSPC 15, Type 1, or Fed Spec TT-P-636.</td>
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<tr>
<td>Epoxy Enamel</td>
<td>Gray; Ameron &quot;Amerlock 400 High-Solids Epoxy Coating&quot;, Carboline &quot;Carboguard 891&quot;, or Tnemec &quot;Series N140 Pota-Pox Plus&quot;.</td>
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<td>Asphalt Varnish</td>
<td>Fed Spec TT-C-494.</td>
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<td>Anodic Finish</td>
<td>AA-M10C22A41, clear unless otherwise required.</td>
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2-5. **FABRICATION.** Unless otherwise indicated on the Drawings, all railings provided under this section shall be of the same type and design.

2-5.01. **Welded Metal Railings.** All angles, offsets, or other changes in alignment in welded pipe railings shall be made with railing ells and welded connectors. Welded joints shall be flush type. Railings shall be smooth, with all projecting joints and sharp corners ground smooth. Members shall be neatly coped and continuously welded or mechanically connected at all junctions. Top rails shall run continuously over posts. All rails and posts shall be in the same plane and shall not be offset. All welding shall be done neatly and substantially by a process (e.g., TIG or MIG) producing a smooth weld. All weld spatter and burrs shall be removed, and all welds shall be thoroughly brushed with a stainless steel power wire brush.
Field joints shall be made with a splice-lock connector which shall provide a firm, 
permanent connection. The connector shall mechanically draw the railing 
sections together to form tight, hairline joint.

2-5.02. Fiberglass Railings. Fiberglass handrails and guardrails shall be 
fabricated into finished sections of the configurations indicated on the Drawings 
by fabricating and joining fiberglass tube shapes using molded connectors and 
pultruded components epoxy bonded and connected as recommended by the 
 railing manufacturer. Where kickplates are indicated, the kickplates shall be 
attached to the railing posts with stainless steel or nylon fasteners. Top rails 
shall run continuously over posts. All rails and posts shall be in the same plane 
and shall not be offset.

2-5.03. Guarding of Openings. Openings in railing shall be guarded by self 
closing gates. Self closing gates shall be fabricated of the same materials with 
the same finish as the guardrailing. The closure device shall be Manufacturer’s 
standard.

2-5.04. Sleeves. Sleeves for fixed handrail posts shall be fabricated from 
Schedule 40 PVC pipe or from Schedule 40 black steel pipe hot-dip galvanized 
after fabrication. Sleeves shall provide at least 1/4 inch clearance all around 
each post and shall be 5 inches long unless otherwise indicated on the Drawings.

Sleeves for removable posts shall have an outer and inner sleeve. The outer 
sleeve shall be fabricated from Schedule 40 black steel pipe and shall be hot-dip 
galvanized after fabrication. The inner sleeve shall be Schedule 40 PVC pipe.

2-5.05. Ladders. Ladders or climbing devices, and rest platforms shall be 
provided as indicated on the Drawings. Ladder rails intersecting guardrailing 
shall be configured to provide an aesthetically pleasing transition, although 
ladder rails need not be physically attached to the guardrailing. There shall be 
no gaps between ladder rails and adjacent guardrailing that would allow passage 
of a sphere greater than 4 inches in diameter. Railing gaps at ladders shall be 
protected by self-closing gates.

All necessary brackets, bolts, and anchors shall be provided for installing the 
ladders.

2-6. COATING.

2-6.01. Ungalvanized Steel. Not used.

2-6.02. Aluminum. All surfaces of aluminum which will be in contact with 
concrete shall be coated with epoxy enamel. All surfaces of aluminum which will
be in contact with dissimilar metals shall have a 15 mil thick sheet of oriented polyester film placed between the two surfaces.

All aluminum railings shall be provided with a clear anodic finish.

2-6.03. **Stainless Steel.** Not used.

2-6.04. **Fiberglass.** All fiberglass materials in outdoor locations shall be coated for UV protection. Railing color shall be yellow UNO.

2-6.05. **Other Surfaces.** Shop coating of galvanized steel or stainless steel surfaces will not be required.

**PART 3 - EXECUTION**

3-1. **INSTALLATION.** When railings and ladders are assembled, all posts shall be plumb and longitudinal members shall be parallel with each other and with the floor surface or slope of stairs. In any section or run of railing, the center lines of all members shall be in true alignment, positioned in the same vertical plane. All posts in fixed handrail sections and all ladders shall be rigidly attached to the supporting structure. After installation, railings and ladders shall be checked for final alignment, using a tightly drawn wire for reference. The maximum misalignment tolerance for railings shall be 1/8 inch in 12 feet. Bent, deformed, or otherwise damaged installations shall be replaced.

Cut or drilled fiberglass pieces shall be sealed with catalyzed resin in accordance with the fiberglass manufacture’s recommendations.

3-1.01. **Attachment to Concrete.** Posts shall be attached to concrete structures as indicated on the Drawings. Base flanges and side-mount brackets shall be installed with minimal disturbance to the reinforcing steel. Bolts shall be stainless steel adhesive anchors as specified in the Anchorage in Concrete and Masonry section.

Sleeves shall be rigidly supported in accurate alignment in the forms and shall be positioned vertically so that the top of each sleeve is approximately 1/2 inch below the finished concrete surface. The position of all sleeves shall be carefully measured before railings are fabricated. When the railing is set, the posts shall be wedged in accurate alignment, and the annular space between the posts and sleeves shall be filled with post setting cement to the top of the steel sleeve. Filling of the remaining space with sealant, as indicated on the Drawings, is covered in the Caulking section.
3-1.02. **Attachment to Steel or Aluminum.** Attachments to steel or aluminum shapes shall be made with flanges or with other special attachments or anchorages as detailed on the Drawings.

3-1.03. **Removable Attachments.** For removable guardrail sections in embedded sleeves, inner sleeves shall be set in outer sleeves in the same manner as specified herein for the setting of fixed posts. Particular care shall be taken to ensure that the inner sleeves are accurately spaced and plumbed, so that the handrail sections, when set in position, will stand in proper alignment and will be removable without binding.

Removable guardrail sections with base flanges or side mount brackets shall be secured in the bases with removable screws.

3-1.04. **Wall Mounted Handrailing.** Suitable wall brackets shall be provided where shown or required. Wall brackets shall be securely anchored to walls with stainless steel adhesive anchors as specified in the Anchorage in Concrete and Masonry section. Expansion anchors shall not be used unless specifically indicated on the Drawings.

3-1.05. **Connections.** Welding connectors and splice locks shall be installed in accordance with the manufacturer's recommendations. Other methods of making connections and changes in alignment will be considered, provided complete information covering the proposed method is submitted to Engineer for review.

End of Section
PART 1 - GENERAL

1-1. THE REQUIREMENT. Section 05521 shall apply only to the guardrails and handrails located on the Diversion Structure and Weir Box located at OCSD’s Plant 2.

The Contractor shall furnish all tools, equipment, materials, and supplies and shall perform all labor required to complete the Work as indicated on the Drawings and specified herein.

This Specifications section covers the Work necessary to furnish and install handrails and railings, complete.

Aluminum guardrail and handrail shall be installed complete where indicated on the Drawings and as specified herein. Aluminum guardrail and handrail shall be of the prefabricated, flush type in-line system, field-assembled type in accordance with U.S. OSHA and Cal/OSHA standards. All guardrails and handrails shall be fixed unless otherwise noted.

The ladder at the Diversion Structure shall be of same material.

Toeboards shall be installed at all locations where the drop from one level to another exceeds four (4) feet.

1-2. RELATED WORK SPECIFIED ELSEWHERE.

A. The requirements of the following Specifications sections and divisions apply to the Work of this Specifications section. Other sections and divisions of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this Work.

1. 03300, Cast-in-Place Concrete
2. 03600, Grouting

1-3. REFERENCE SPECIFICATIONS, CODES, AND STANDARDS.

A. All Work specified herein shall conform to or exceed the applicable requirements of the referenced portions of the following publications to the extent that the provisions thereof are not in conflict with other provisions of these Specifications sections.
B. Comply with the applicable editions of the following codes, regulations and standards.

1. Codes and Regulations:
   - **29 CFR 1910**
     Code of Federal Regulations, Title 29, Part 1910, U.S. Occupational Safety and Health Standards (OSHA)
   - **29 CFR 1926**
     Code of Federal Regulations, Title 29, Part 1926, U.S. Safety and Health Regulations for Construction (OSHA)
   - **CCR**
     California Code of Regulations, Title 8, Industrial Relations (Cal/OSHA)
   - **CCR**
     California Code of Regulations, Title 24, Part 2, California Building Code (CBC)

2. Industry Standards:
   - **ASTM A 167**
     Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
   - **ASTM A 193**
     Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications
   - **MIL-A-8625**
     Federal Specifications, Anodic Coatings for Aluminum and Aluminum Alloys
   - **SSPWC**
     “Green Book”, Standard Specifications for Public Works Construction
   - **ICC**
     International Code Council Evaluation Reports

3. Other Standards:
   - **AA**
     Aluminum Association Aluminum Design Manual
   - **AA**
     DAF45, Designation System for Aluminum Finishes
C. Comply with the reference specifications of the General Requirements and the Additional General Requirements.

D. In addition to the standards listed above, the railings and their installation shall be in accordance with the manufacturer's published recommendations and specifications.

E. Design Requirements:

1. Structural Performance of Railing Systems: Design, test, fabricate, and install railings to withstand the following structural loads without exceeding allowable design working stress or allowable deflection. Apply each load to produce maximum stress and deflection in railing system components.
   a. Railing System: Capable of withstanding the following load cases applied:
      (1) Concentrated load of 200 pounds applied at any point and in any direction in accordance with CBC and OSHA.
      (2) Uniform load of 50 pounds per linear foot applied in any direction in accordance with CBC.
      (3) Concentrated load need not be assumed to act concurrently with uniform loads in accordance with CBC.
   b. In-Fill Area of Railing Systems:
      (1) Capable of withstanding a horizontally applied normal load of 50 pounds applied to one (1) square foot at any point in system including panels, intermediate rails, balusters, and openings and space between railings.
      (2) Horizontal concentrated load need not be assumed to act concurrently with loads on top rails of railings.
   c. Calculated lateral deflection at top of posts shall not exceed one (1) inch.

1-4. CONTRACTOR SUBMITTALS.

A. Submittals shall be made in accordance with the General Requirements, Additional General Requirements, and as specified herein.

B. The following submittals and specific information shall be provided:

1. Shop Drawings. Include methods and fittings proposed for joining old and new handrailings.

2. Calculations: Engineering calculations shall be submitted for review. Engineering calculations shall include, but not be limited to, railings,
guardrail/handrail brackets, brackets, support flanges, and fasteners or anchors.

3. Test reports as specified in paragraphs entitled “Additional Specific Fabrications” and “Anchor Bolts, Fasteners, Concrete Anchors” in this Specifications section.

4. Calculations shall be submitted separately (for record purpose) providing a summary of loads used and item design. Calculations will not be checked or reviewed by the Engineer, and calculations will not be returned to the Contractor.

5. All shop drawings and calculations shall be signed and sealed by the California registered professional engineer who is in responsible charge for these designs.

C. A full-size sample section of railing showing proposed post and rail connections, finish, and fasteners shall be submitted with the shop drawings for review.

1-5. DELIVERY, STORAGE AND HANDLING.

A. Delivery of Materials: Manufactured materials shall be delivered in original, unbroken packages, containers, or bundles bearing the label of the manufacturer.

B. Storage: All materials shall be carefully stored in a manner that will prevent damage and in an area that is protected from the elements.

PART 2 - PRODUCTS

2-1. GENERAL. Aluminum guardrail and handrail systems and/or components shall be fabricated as shown or shall be an engineer-accepted prefabricated/pre-engineered system and/or components by one fabricator/manufacturer.

All aluminum guardrails and handrails shall be component systems complete with all anchors, attachments, balusters, brackets, caps, fasteners, gates (swing with self-latching hardware, self-closing hinges, hasps, etc.), posts, sleeves, trim, and any other related items required or necessary for a complete installation. Railings shall conform to the California Building Code, Cal/OSHA and U.S. OSHA requirements.

Manufacturers: CV Pipe Rail, by Crane Veyor Corp.; Wes Rail, by Moultrie Manufacturing Company, Golden Railings, Inc.; or equal
2-2. **MATERIALS.**

A. All rails, posts, and fitting-assembly spacers shall be formed from 6063 or -T6 extruded aluminum pipe of minimum 1-1/2-inch O.D. and 0.145-inch wall thickness. Pipe shall have special "close" tolerances to suit fittings used. All other aluminum parts shall be 6063 extruded aluminum, 6061-T6 aluminum, or 214-F aluminum castings. Unexposed parts shall be Type 316 stainless steel. All components shall be completely fabricated and assembled without external welding. All fasteners shall be Type 316 stainless steel. If internal welding is used, a procedure for quality control shall be submitted to the Engineer for review. End of rails shall have closures. Toeboard shall be 4 inches high with 1/4-inch effective thickness extruded or bent plate, and of the same material as the guardrail/handrail. Toeboard slip joint plates shall be stainless steel. For side-mounted guardrail/handrail, provide standard spacer block between post and toeboard to maintain 1/4-inch maximum clear spacing.

1. Guardrail midrail spacing shall be approximately halfway between the top rail and the floor, platform, runway, or ramp to comply with the requirements of the City of Huntington Beach, CA.

B. **Pipe:**

1. All rails, posts, and formed elbows shall be fabricated from 6063-T6 extruded aluminum pipe with a minimum tensile strength of 38,000 psi and a minimum yield strength of 35,000 psi, and with special close tolerance for tight fit and excellent appearance. All other aluminum parts shall be fabricated from 6063-T6 or 6061-T6 extruded aluminum of adequate strength for all loads.

2. Round tube and round picket railings shall be sleeve or side-mounted as shown on the Drawings. Posts shall be not less than 1-1/2-inch outside diameter. The posts shall be evenly spaced at not less than 4 feet nor more than 6 feet on centers. Field conditions may require some adjustment of spacing. Pickets shall be not less than 5/8-inch OD pickets, spaced at 4-1/2 inches on center; or 3/4-inch OD pickets, spaced at 6 inches on centers. The top railings shall be as long as possible, and the post shall not project through the top rails. Toeboard of picket rails shall be a specially extruded, snap-in bottom rail enclosure with toeboard or special extruded centered toeboard that is screw applied to bottom of the bottom rail.

C. **Fittings:**

1. All fittings shall be as shown or shall be one of the following types: A one-piece aluminum extrusion machined to final shape and attached to the handrail post with either concealed welds or a stainless steel
fastener. A one-piece connector of aluminum or stainless steel, either welded or attached to the guardrail/handrail post with stainless steel fasteners and designed to be completely covered when the handrail is connected. All fitting surfaces designed to be exposed to view after installation is complete will match the guardrail/handrail metal alloy, surface, shape, and anodized finish and shall be the continuous-diameter type for smooth appearance and to permit continuous sliding of the hands.

2. The guardrail/handrail post bolted baseplate connector shall be fabricated as shown on the Drawings, or equivalent, molded or extruded meeting all the appearance and strength requirements. The baseplate shown shall conform to ASTM A 167, Type 304 stainless steel with a minimum yield strength of 30,000 psi. The insert shown shall be fabricated from stainless steel pipe with a minimum wall thickness of 0.145 inch and with a minimum yield strength of 50,000 psi. The insert dimensions shall meet the required tolerances shown on the Drawings. Furnish test data to show that the yield strength of the material in the as-delivered pipe equals or exceeds 50,000 psi. Inserts using stainless steel with minimum yield strengths less than 50,000 psi shall have thicker walls to develop equal strength.

D. Additional Specific Fabrications:

1. The guardrails, handrails, and gates shall meet all applicable safety requirements of the federal, state, and local standards, regulations, and codes, including the height and withstand force requirements of U.S. OSHA; California Code of Regulations, Title 8 (Cal/OSHA), Sections 3209 and 3212; and as shown on Standard Drawings 100-S-055 and 100-S-080, as applicable. The gate shall be fabricated using 6063-T6 extruded aluminum, and as otherwise shown on the Drawings. Provide test reports to show that all gate hardware meets minimum safety strength requirements for handrails and guardrails.

2. The guardrail/handrail picket panels and clamps shall be fabricated using solid-bar 6063-extruded, 6105-extruded, or 6061-extruded aluminum as shown on the Drawings with finishes specified. All fasteners shall be stainless steel.

3. Toeboards and accessories shall be fabricated as indicated in the Contract Documents, or shall be molded or extruded by a guardrail/handrail manufacturer providing equivalent appearance, strength, and safety properties to that shown, using 6063 or 6061 aluminum with finishes as specified, meeting all applicable requirements of US OSHA, Cal/OSHA, and California Building Code. All fasteners shall be stainless steel. Provide expansion and contraction connections between each post as shown or equivalent.
4. Embedded Items: All metal anchorages to be embedded in concrete shall be furnished and installed under this Specifications section and shall be as shown on the Drawings and as specified herein.

E. Finishes:

1. The coating requirements shall conform to the American Architectural Manufacturers Association AAMA 611-98 Class I 0.7 mil thickness. Color shall be dark bronze and coordinated with the Engineer during design to match existing rails.

2. All exposed aluminum shall be hard anodized in accordance with MIL A 8625, Specifications Section 05035, Anodic Finish Coatings. All exposed prefabricated guardrail, handrail, toeboard, and picket panel, and toeboard components, except stainless steel fasteners, shall be anodized after fabrication.

3. All complete rails, modules, and components shall be cushion wrapped to prevent them from being scratched and dented during shipment, storage, and installation. Wrapping shall be left intact, insofar as possible, until the railing is completely installed.

4. Electrolysis Protection: Electrolysis protective material shall be alkali-resistant asphaltum base paint, Koppers "Bitumastic 50", Texaco "Cement 1401", or equal.

2-3. ANCHOR BOLTS, FASTENERS, CONCRETE ANCHORS.

A. Miscellaneous Fasteners:

1. Type 316 stainless steel elastic locknuts; Type 316 stainless steel flat washers; molded nylon flat washers; round head machine screws (RHMS); Type 316 stainless steel, all as supplied by McMaster-Carr Supply Company, Los Angeles, CA or equal.

2. Stainless steel bolts and nuts for bolting handrail to metal beams, unless otherwise shown, shall be ASTM A 193 and A 194, Type 316.

3. Anchor bolts, Type 316 stainless steel anchor bolt with a minimum yield strength of 30,000 psi, 5/8-inch minimum diameter with hex nuts, or size as shown.

4. Wedge anchors for exterior use and for interior use shall be 316 stainless steel with approved ICC evaluation reports.

5. Load values for tension pullout with special inspection shall be per the Drawings. Special inspection is required.

6. Concrete anchors sizes and quantity shall be based upon accepted test reports with special inspection where required. Submit
calculations and test data for review prior to use. Satisfy all applicable codes.

PART 3 - EXECUTION

3-1. FABRICATION OF ALUMINUM GUARDRAIL AND HANDRAIL SYSTEMS.

A. General: The Work shall be performed according to accepted shop drawings by workmen experienced in the fabrication and erection of aluminum railing systems of the type and quality specified. See the Drawings for other requirements.

B. Workmanship. All pipe cuts shall be square and accurate for minimum joint gap. Joint gaps shall not exceed 1/32 inch after installation. Cuts shall be clean, straight, and free of burrs and nicks. All holes shall be drilled and countersunk to the proper size, as required for a tight, flush fit of hook bolts, fitting assembly screws, and all other components. Where protection is applied for prevention of dissimilar materials electrolysis, care shall be taken that none of the protective material is visible when assembly is completed.

C. Rigidity: All other attachment brackets shall be spaced as specified on the manufacturer's installation drawings. Each post shall be a single unspliced pipe length. Lower rails shall be a single, unspliced length between posts, or continuous. Top rails shall be continuous whenever possible and a single, unspliced length shall always be attached to a minimum of three posts. Splices shall consist of a 6-inch-long solid aluminum rod sized to slip inside the joined members. Splices shall be within six (6) inches of a post. Exposed edges of pipe rail at a splice shall be eased to a 1/16-inch radius. Provide slip joint at 24-foot maximum centers for expansion of rails and toeboard. Gap at time of installation shall be based on temperature of handrail (3/8-inch gap at T=25 degrees Fahrenheit, 0-inch gap at T=100 degrees Fahrenheit). At concrete expansion joints, provide a 1-inch gap in slip joint. Insert sleeves shall be long enough to allow for the full range of movement.

D. Three-sixteenth-inch-diameter holes shall be provided in inconspicuous locations to drain interior of members. All fastenings and fasteners shall be as recommended or furnished by the manufacturer, and drawn up tight with a hand wrench or screwdriver so that the completed railing is rigid and completely free of play at all joints and attachments. All hook bolts shall be tightened to the torque recommended by the manufacturer. All pipe-to-fitting connections shall be secured with two (2) Type 316 stainless steel pop rivets per connection.
E. Protection of Finish: The Contractor shall use all precautions necessary to protect the finish from scratches, nicks, gouges, dents, etc., during assembly and installation and for the duration of the Contract.

F. Joining Existing Guardrail and Handrail: Proposed methods and fittings for joining old guardrail / handrail to new guardrail / handrail shall be submitted for acceptance. Trim for fittings shall be Type 316 or Type 304 stainless steel.

G. Guardrail/handrail post to be bolted to metal or concrete shall be furnished longer than needed and field cut to exact dimensions required to satisfy any vertical variations on the actual structure, or in lieu of field cutting, provide an approved fitting containing provisions for vertical adjustment. Field fitting shall be required. Shims or grout under baseplates shall not be used. Misfits shall be rejected.

H. The aluminum guardrail/handrail system shall be completely free of all burrs, nicks, and sharp edges when the installation is complete. Welding shall not be permitted.

I. Coat ends of aluminum posts to be set in grout or concrete as specified in Specifications Section 09800, Protective Coating.

J. The railing shall be erected in the field without cutting, drilling, welding, or tapping unless specifically accepted by the Engineer.

K. No exposed welds, rivets, or screws shall be permitted unless specifically indicated otherwise on the Drawings.

L. Field welding of aluminum connections shall not be permitted. Welded connections shall be permitted only where indicated on the Drawing and on the accepted shop drawings.

M. Welding shall conform to the SSPWC Section 304-2.1.2. Welded fabrications to be anodized shall be welded using filler alloy rods that will not discolor when anodized. ER 5154, ER 5254, ER 5183, ER 5356 or ER 5556 filler alloy rods shall be used.

N. Railing panels shall be in conformance with SSPWC Section 304-2.1.2

O. For structures on curves, either horizontal or vertical, the railing shall conform to the SSPWC Section 304-2.1.2.
3-2. **INSTALLATION.**

A. Assembly/installation of guardrail / handrail system shall be performed in strict accordance with manufacturer’s written recommendations for installation and the details shown.

B. The railing shall be erected in conformance with the SSPWC Section 304-2.1.3.

C. The railing installation shall be in conformance with the SSPWC Section 304-2.1.3.

D. Aluminum pipe rails shall be fastened to fittings with Type 316 stainless steel flush-set screws or pop rivets; the use of epoxy adhesive will not be permitted. The Contractor shall be responsible for the workmanship, rigidity, and protection of the finish throughout the installation.

E. After erecting the railing, any abrasions or exposed steel shall be repaired as specified.

F. Protection from Entrapped Water: All exterior installations and interior installations subject to high humidity shall have provisions made to drain water from the railing system. When posts are mounted in concrete or when bends or elbows occur at low points, weep holes of 1/4-inch diameter shall be drilled at the lowest possible elevations, one hole per post or rail. Hole shall be drilled in the plane of the rail.

G. Expansion Joints:
   1. Provide at intervals of not more than 24 feet on centers and at structural joints as hereinafter specified.
   2. Provide slip joint with internal sleeve extending 2 inches beyond each side of joint. Provide slip-joint gap of 0.2 inch to allow for expansion.
   3. Fasten to one side using either adhesive or two blind rivets set at 120 degrees and 240 degrees interval from top of pipe.
   4. Locate joints within 12 inches of posts. Locate expansion joints in rails to also coincide with expansion joints in the structural walls and floors that support the railings.

H. Setting Posts:
   1. Embedded:
      a. Clean dust and foreign matter from sleeves or blockouts.
b. Moisten interior of hole and surrounding surface with clean water. Install Category II-B nonmetallic grout as specified in Specifications Section 03600, Grout.

c. Brace railing until grout sets.

2. Surface Mounted:

a. The post-bolted baseplate connectors shall sit solidly on concrete, stair stringer or other material as shown on the Drawings. The use of shims, wedges, grout, etc. for handrail post alignment or any other reason shall not be permitted.

b. The guardrail/handrail posts shall be furnished longer than needed and then accurately measured in the field for correct length, cut and secured to the post baseplate connector as shown on the Drawings.

I. Posts and Rails:

1. Set posts plumb and aligned to within 1/8 inch in 12 feet.

2. Set rails horizontal or parallel to rake of steps to within 1/8 inch in 12 feet.

3. All posts and rails shall be in the same plane. There shall be no projections or irregularities to present a hazard or prevent a user from sliding his hand continuously along the top rail.

J. Guardrail and Handrail Wall Brackets: Support wall rails on brackets, spaced not more than six (6) feet on centers. Provide in-wall anchor backplates on solid blocking on stud walls.

K. Toeboard: Toeboards shall be accurately measured in the field for correct length (after guardrail/handrail post installation), cut and secured to posts as shown on the Drawings. Provide toeboards at all handrails at the following locations:

1. Where drop to lower level exceeds 4 feet except where concrete curbs are furnished.

2. At guardrails protecting ladderway floor openings and/or platforms with access provided by ladderway, including ship stairs (ship ladders) per California Code of Regulations, Title 8 (Cal/OSHA), Sections 3209 and 3212.

   a. At guardrail gates unless indicated otherwise on the Drawings.
L. Cleaning:

1. Wash thoroughly using clean water and soap. Rinse with clean water.
2. Do not use acid solution, steel wool, or other harsh abrasive.
3. If stain remains after washing, restore in accordance with recommendations of manufacturer, or replace handrails with an acceptable finish.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers the fabrication and installation of metal and fiberglass grating.

Both inch-pound (English) and SI (metric) units of measurement are specified herein; values expressed in inch-pound units shall govern.

1-2. GENERAL.

1-3. SUBMITTALS. Detailed fabrication and erection drawings covering the grating shall be submitted in accordance with the Submittals Procedures sections. Drawings shall indicate locations of grating supports, profiles, thicknesses, lengths, markings of panels, and fastening methods.

1-4. DELIVERY, STORAGE, AND HANDLING. Materials shall be handled, transported, and delivered in a manner which will prevent bends, dents, scratches, or damage of any kind. Damaged materials shall be promptly replaced. Materials shall be stored off the ground.

PART 2 - PRODUCTS

2-1. PERFORMANCE AND DESIGN REQUIREMENTS.

2-1.01. Design Criteria. Except as modified herein, the manufacture and fabrication of metal grating shall comply with recommendations in the "Metal Bar Grating Manual" of the National Association of Architectural Metal Manufacturers (NAAMM). Grating depth shall be as indicated on the Drawings.

Fiberglass grating shall be designed and fabricated to support 100 psf live load with a maximum deflection not greater than L/150 or 1/4 inch, unless indicated otherwise on the Drawings.

2-1.02. Carbon Steel Grating. Carbon steel grating shall be the welded type. Bearing bars shall be at least 3/16 inch thick with center-to-center spacing of 1-3/16 inch. Grating shall be galvanized.

2-1.03. Stainless Steel Grating. Stainless steel grating shall be the pressure locked type. Bearing bars shall be at least 3/16 inch [5 mm] thick with center-to-center spacing of 1-3/16 inch. Grating shall be a mill finish.
2-1.04. **Aluminum Grating.** Aluminum grating shall be the pressure locked type, with cross bars deformed or swaged to prevent turning. Bearing bars shall be at least 3/16 inch thick flat stock or equivalent I-bars, with center-to-center spacing of 1-3/16 inches. Cross bar center-to-center spacing shall be 4 inches maximum. Grating shall be a mill finish.

2-1.05. **Fiberglass Grating.** Fiberglass grating shall be pultruded type with 6 inch cross bar spacing unless indicated on the Drawings to be molded type. All pultruded grating shall have a surfacing veil and UV inhibitors in the resin. Molded grating shall have a square mesh pattern. Walking surfaces of pultruded grating shall have a grit finish. Walking surfaces of molded grating shall be concave or have a grit finish.

2-2. **MATERIALS.**

<table>
<thead>
<tr>
<th>Material</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Steel Grating</td>
<td>NAAMM MBG 531, ASTM A1011, rectangular, welded, galvanized after fabrication.</td>
</tr>
<tr>
<td>Galvanizing</td>
<td>ASTM A123, A153, A385; G90 coating.</td>
</tr>
<tr>
<td>Stainless Steel Grating</td>
<td>NAAMM MBG 531 ASTM A167, Type 304, 304L, 316, or 316L alloy, rectangular, pressure locked; mill finish.</td>
</tr>
<tr>
<td>Aluminum Grating</td>
<td>NAAMM MBG 531, ASTM B221, 6063-T6 or 6061-T6 alloy, pressure or swage locked, mill finish.</td>
</tr>
<tr>
<td>Fiberglass Grating</td>
<td>ASTM E-84, D635</td>
</tr>
<tr>
<td>Molded Type</td>
<td>Isophthalic polyester resin, ASTM E-84 flame spread of 25 or less; IKG Industries &quot;Corgrate Molded SM&quot;, Fibergrate Composite Structures molded grating, Strongwell &quot;Duragrate&quot;, Seasafe &quot;Gator-Grate&quot;.</td>
</tr>
<tr>
<td>Pultruded Type</td>
<td>Vinyl ester resin, ASTM E-84 flame spread of 25 or less; IKG Borden &quot;Corgrate FI&quot; (flush top), Fibergrate Composite Structures &quot;Safe-T-Span&quot;, Strongwell &quot;Duradek/Duragrid&quot;, Seasafe &quot;Gator-Deck&quot;.</td>
</tr>
<tr>
<td>Grating Stair Treads</td>
<td>Grating stair treads shall match the material and finish of grating in adjacent platforms and floors. Treads shall have a permanently attached or integral non-skid nosing.</td>
</tr>
</tbody>
</table>
Grating Fasteners
Manufacturer's standard, AISI Type 316 stainless steel.

Clips, Bolts, Nuts, Washers
Manufacturer’s standard, AISI Type 316 stainless steel.

Welded Threaded Steel Studs
ASTM A108 fully threaded studs automatically welded with compatible nuts and washers; TRW Nelson Type CFL or acceptable equal.

Stepped Locking Fasteners
Non-penetrating, non-welded mechanical fasteners, with stainless steel clips and bolts, galvanized cast iron body; Lindapter “Grate-Fast” or Grating Specialty Co. “G-Clip”.

Fiberglass Grating Support Legs
Adjustable fiberglass legs specifically designed to support elevated molded fiberglass grating; Fibergrate Corporation “Grating Legs” or Strongwall Corporation “Elevated Floor System”.

Fiberglass Curb Angle
Vinyl ester resin, fiberglass trim angle with integral concrete anchorage; Fibergrate Composite Structures “EZ angle” or Strongwell Corporation “Fiberglass Curb Angle”.

2-3. FABRICATION. Grating shall be fabricated in panels that can be easily handled by plant personnel. Unless otherwise indicated on the Drawings, the weight of individual panels shall not exceed 150 lbs. Panels shall be within ±1/4 inch of authorized length and ±1/4 inch of authorized width and shall have a maximum difference in length of opposite diagonals of 1/4 inch. The spacing of bearing bars shall be within 1/32 inch of authorized spacing. Cross bars and edge bars of adjacent panels shall align. After installation, there shall be not more than 1/4 inch clearance between panels. All bearing bars shall be parallel. Bands and toeplates shall align within 1/8 inch tolerance, vertical and horizontal.

Angular, circular, and re-entrant cuts in steel grating may be made by flame cutting. All other cuts in steel grating shall be sawed or sheared. Cuts shall be clean and smooth, without fins, beads, or other projections. Any damaged protective coating shall be fully restored.

All cuts in aluminum grating shall be sawed or sheared. All cuts in fiberglass grating shall be cut. All fiberglass grating which requires cutting shall have the affected surfaces sealed with catalyzed resin sealant of equal or superior corrosion resistance to the grating.
Grating panels shall be arranged so that openings are centered on a joint between panels. Toeplates extending the full depth of the grating and 4 inches above the top shall be provided around openings. Toeplates shall be welded to each bearing bar. The ends of bearing bars need not be banded unless required by the Drawings. Bands shall be welded to the first, the last, and every fourth intermediate bar. Bands and toeplates shall be 3/16 inch thick. Crossbars shall be cut off flush with the outside face of side bars.

Steel frames anchored to or cast in concrete to support grating shall be stainless steel or hot-dip galvanized after fabrication. The anchorage of fiberglass curb angles shall consist of intermittent embedded shapes or interlocking deformations on the back side of the angle.

2-4. **SHOP COATING.** Finish painting of grating, if required, is covered in the protective coatings section.

2-4.01. **Galvanizing.** All galvanizing shall be done by the hot-dip process after fabrication, in conformity with the requirements of ASTM A123, A153, and A385.

2-4.02. **Aluminum.** All surfaces of aluminum which will be in contact with concrete, mortar, or dissimilar metals shall be given a coat of epoxy enamel on the contact surfaces.

2-4.03. **Fiberglass.** All cut edges of fiberglass grating shall be sealed with catalyzed resin sealant of equal or superior corrosion resistance to the grating or as specified by the manufacturer. Sufficient quantities of edge repair coating shall be supplied with the grating.

**PART 3 - EXECUTION**

3-1. **GENERAL.** All grating shall lie flat, with no tendency to rock when installed. Poorly fitting or damaged grating shall be rejected. Grating openings may be field cut with the approval of Engineer, provided that no more than four adjacent bearing bars are cut. If the grating is cut or modified in the field, affected surfaces shall be repaired or sealed to assure restoration of the corrosion resistance of the grating. Field cut openings must be spaced so that there are at least as many continuous bars between each opening as there are cut bars at the opening.

3-2. **ATTACHMENTS TO SUPPORTING STRUCTURE.** All grating supported on steel, aluminum, or fiberglass structures shall be attached. Grating shall be attached to the supporting structure in accordance with the grating manufacturer's recommendations and submittals. Single span grating over flumes, manholes, pits, or other openings in concrete floors may rest unattached in recesses constructed for that purpose. To preclude excessive accumulation of
tolerances, an extra-long panel shall be provided for each unanchored grating cover that exceeds 20 feet in length. The panel shall be cut to the required dimension after the remainder of the grating panels have been installed.

3-2.01. **Prime Painted Steel Supports.** Unless otherwise required or indicated on the Drawings, clip or flange block fasteners or stepped locking fasteners shall be used to attach grating to prime painted steel supports. Clip fasteners shall be secured to the supporting steel with through bolts in drilled holes. Through bolts shall be stainless steel. Fusion welded threaded studs may be utilized if the primer is removed before welding or if a suitable weldable primer is used. Welded studs shall be cleaned and prime painted to match the support steel prior to finish painting.

3-2.02. **Galvanized Steel Supports.** Unless otherwise indicated on the Drawings, stepped locking fasteners shall be used to attach grating to galvanized steel supports. The galvanized coating shall not be damaged.

3-2.03. **Stainless Steel, Aluminum, and Fiberglass Supports.** Unless indicated otherwise on the Drawings, clip or flange block fasteners or stepped locking fasteners shall be used to attach grating to stainless steel, aluminum, or fiberglass supports. Fasteners shall be secured to the supporting structure with stainless steel through bolts in drilled holes. Welded fasteners shall not be used.

3-3. **FINISH TOUCHUP.** After erection, all grating shall be cleaned. Damaged coatings shall be touched up in accordance with the grating manufacturer's recommendations to fully restore the corrosion resistance of the grating. Cut ends of fiberglass grating pieces shall be sealed with catalyzed resin sealant of equal or superior corrosion resistance to the grating itself or repaired in accordance with the manufacturer's recommendations to assure full undamaged performance.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers the procurement and installation of anchors in concrete and masonry. It includes cast-in-place anchor bolts and anchor rods, adhesive anchors for both threaded rods and reinforcing bars, expansion anchors, and undercut anchors.

1-2. GENERAL. Unless otherwise specified or indicated on the Drawings all anchors shall be cast-in-place anchor bolts or anchor rods, with forged heads or embedded nuts and washers. Unless otherwise indicated, anchors for structural steel members connected to concrete shall have a diameter of at least 3/4 inch. Anchors designed by manufacturers of products such as railings, ladders, and non-structural components shall have a diameter of at least 1/2 inch.

Unless otherwise indicated on the Drawings, anchors used in the following locations and applications shall be of the indicated materials.

<table>
<thead>
<tr>
<th>Cast-In-Place Anchor Bolts and Anchor Rods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submerged locations</td>
</tr>
<tr>
<td>Locations subject to splashing</td>
</tr>
<tr>
<td>Buried locations</td>
</tr>
<tr>
<td>Anchorage of structural steel columns</td>
</tr>
<tr>
<td>Other exterior locations</td>
</tr>
<tr>
<td>Other interior locations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adhesive, Expansion, and Undercut Anchors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submerged locations</td>
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<td>Buried locations</td>
</tr>
<tr>
<td>Anchorage of structural steel columns</td>
</tr>
<tr>
<td>Other exterior locations</td>
</tr>
</tbody>
</table>
Other interior locations: Carbon steel.

Adhesive, expansion, and undercut anchors may be used instead of cast-in-place anchors only where specifically indicated or permitted on the Drawings or with the specific acceptance by Engineer.

1-3. **SUBMITTALS.** Data, catalog cuts, and manufacturer’s research reports (from independent organizations such as ICC-ES or IAPMO UES) indicating the manufacturer and types of adhesive anchors, expansion anchors, and undercut anchors to be supplied shall be submitted in accordance with the Submittals Procedures section.

If Contractor requests use of products other than those indicated herein, calculations may be required as part of the submittal package. Calculations shall be prepared by a professional engineer licensed in the state of the project, using methods and procedures required by the building code. Contractor shall demonstrate that the proposed substitute anchors are equivalent in all necessary criteria, including strength, spacing and edge distance limitations, embedment depth limitations, temperature limitations, and any other criteria required by Engineer.

1-4. **DELIVERY, STORAGE, AND HANDLING.** Materials shall be handled, transported, and delivered in a manner which will prevent damage or corrosion. Damaged materials shall be promptly replaced. Materials shall be shipped and stored in original manufacturer's packaging.

**PART 2 - PRODUCTS**

2-1. **MATERIALS.** Unless otherwise indicated on the drawings, materials shall be as indicated below.

**Cast-In-Place Anchor Bolts and Anchor Rods**

- **Carbon steel**: ASTM F1554, Grade 36 with compatible nuts.
- **Galvanized steel**: ASTM F1554, Grade 36 with compatible nuts; hot-dip galvanized, ASTM F2329.
- **Stainless steel**: Bolts, ASTM F593, Alloy Group 1 or 2; nuts, ASTM F594, Alloy Group 1 or 2.
Flat Washers ANSI B18.22.1; of the same material as anchor bolts and nuts.

Expansion Anchors in Concrete Products shall be single component anchors tested in accordance with ICC AC193, and shall have a manufacturer's research report in compliance with the applicable building code. The anchors shall be approved for use in cracked concrete, and for resisting seismic forces. Hilti "Kwik-Bolt TZ" or Powers Fasteners “Power-Stud+SD2” (carbon steel), “Power-Stud+SD4” (304 stainless steel), and “Power-Stud+SD6” (316 stainless steel).

Expansion Anchors in Grouted Concrete Masonry Units Products shall be single component anchors tested in accordance with ICC AC01, and shall have a manufacturer's research report in compliance with the applicable building code. Hilti “Kwik-Bolt TZ Masonry Anchors”, Simpson “Wedge-All”, or Powers Fasteners “Power-Stud+ SD1”.

Undercut Anchors in Concrete Products shall be tested in accordance with ICC AC193, and shall have a manufacturer's research report in compliance with the applicable building code. Hilti “HDA Undercut Anchor” (carbon steel) and “HDA-R Undercut Anchor” (stainless steel), or Powers Fasteners “Atomic+ Undercut Anchor” (A36 carbon steel).

Adhesive Anchors in Concrete Products shall be tested in accordance with ICC AC308/ ACI 355.4, and shall have a manufacturer’s research report in compliance with the applicable building code. The anchors shall be approved for use in cracked concrete, and for resisting seismic forces.

Threaded Rods and Nuts (Carbon Steel) ASTM A36 or ASTM F1554 Grade 36.
<table>
<thead>
<tr>
<th>Material Type</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threaded Rods and Nuts</td>
<td>ASTM F593, CW.</td>
</tr>
<tr>
<td>(Carbon Steel)</td>
<td></td>
</tr>
<tr>
<td>Reinforcing Bars</td>
<td>ASTM A615, Grade 60, deformed.</td>
</tr>
<tr>
<td>Reinforcing Bars, weldable</td>
<td>ASTM A706, Grade 60, deformed.</td>
</tr>
<tr>
<td>Adhesive</td>
<td>Hilti “HIT-HY 200”, or Powers Fasteners “Pure 110+”.</td>
</tr>
<tr>
<td>Adhesive Anchors in Grouted Concrete Masonry Units</td>
<td>Products shall be tested in accordance with ICC AC58, and shall have a manufacturer’s research report in compliance with the applicable building code.</td>
</tr>
<tr>
<td>Threaded Rods and Nuts</td>
<td>ASTM A36.</td>
</tr>
<tr>
<td>(Carbon Steel)</td>
<td></td>
</tr>
<tr>
<td>Threaded Rods and Nuts</td>
<td>ASTM F593 CW (Hilti or Powers systems), or ASTM A193 Grades B6, B8, or B8M (for Simpson system).</td>
</tr>
<tr>
<td>(Stainless Steel)</td>
<td></td>
</tr>
<tr>
<td>Adhesive</td>
<td>Hilti &quot;HIT HY 70&quot;, Powers “AC100+ Gold”, or Simpson “SET XP”.</td>
</tr>
<tr>
<td>Adhesive Anchors in Hollow Concrete Masonry Units</td>
<td>Products shall be tested in accordance with ICC AC58, and shall have a manufacturer’s research report in compliance with the applicable building code.</td>
</tr>
<tr>
<td>Threaded Rods and Nuts</td>
<td>ASTM A36.</td>
</tr>
<tr>
<td>(Carbon Steel)</td>
<td></td>
</tr>
<tr>
<td>Threaded Rods and Nuts</td>
<td>ASTM F593 CW (Hilti or Powers systems), or ASTM A193 Grades B6, B8, or B8M (for Simpson system).</td>
</tr>
<tr>
<td>(Stainless Steel)</td>
<td></td>
</tr>
<tr>
<td>Adhesive</td>
<td>Hilti “HIT HY 70”, Powers “AC100+ Gold”, or Simpson “SET XP”.</td>
</tr>
<tr>
<td>Screen Tubes</td>
<td>As recommended by the manufacturer.</td>
</tr>
</tbody>
</table>
Adhesive Anchors in Unreinforced Brick Masonry

Products shall be tested in accordance with ICC AC60, and shall have a manufacturer’s research report in compliance with the applicable building code.

Threaded Rods and Nuts

ASTM A307.

Adhesive

Hilti “HIT HY 70”, Simpson “SET”.

Screen Tubes

As recommended by the manufacturer.

2-2. ANCHORS.

2-2.01. Cast-in-Place Anchor Bolts and Anchor Rods. Cast-in-place anchor bolts and anchor rods shall be delivered in time to permit setting prior to the placing of structural concrete or masonry grout. Anchor sleeves shall not be used unless acceptable to Engineer. Unless installed in sleeves, anchor bolts and anchor rods shall be provided with sufficient threads to permit a nut to be installed on the concrete side of the concrete form or the supporting template. Two nuts, a jam nut, and a washer shall be furnished for cast-in-place anchor bolts and anchor rods indicated on the Drawings to have locknuts; two nuts and a washer shall be furnished for cast-in-place anchor bolts and anchor rods without locknuts.

2-2.02. Adhesive, Expansion, and Undercut Anchors. When adhesive, expansion, or undercut anchors are indicated on the Drawings, only acceptable systems shall be used. Acceptable systems shall include only those systems and products specified or specifically indicated by product name on the Drawings. Alternative anchoring systems may be used only when specifically accepted by Engineer.

Unless otherwise required, single nuts and washers shall be furnished for adhesive anchors, expansion anchors, and undercut anchors. Adhesive anchors shall be free of coatings that would weaken the bond with the adhesive.

Adhesive anchors in hollow CMU masonry and unreinforced brick masonry shall utilize screen tubes as recommended by the manufacturer.

PART 3 - EXECUTION

3-1. GENERAL. Anti-seize thread lubricant shall be liberally applied to projecting, threaded portions of stainless steel anchors immediately before tightening of the nuts.
3-1.01. Compliance With Manufacturer’s Instructions. Post-installed anchors shall be installed in accordance with the manufacturer’s printed installation instructions and all applicable requirements of the manufacturer’s research report for the specific anchor system. If conflicts are found between the Drawings, the manufacturer’s printed installation instructions, and the manufacturer’s research report installation requirements, Contractor shall notify Engineer for resolution.

3-1.02. Special Inspection. Special inspection requirements for cast-in-place and post-installed anchors shall be as indicated in the Code-Required Special Inspections and Procedures section. Anchorage work shall be performed in a manner that allows the inspections to take place without adversely impacting the schedule.

3-2. CAST-IN-PLACE ANCHOR BOLTS AND ANCHOR RODS. Cast-in-place anchor bolts and anchor rods shall be carefully positioned with templates and secured in the forms prior to placing concrete, or in the bond beams prior to placing masonry grout. Contractor shall verify that anchorage devices are positioned in accordance with the Drawings and with applicable equipment or structure submittal drawings.

Threads, bolts, and nuts spattered with concrete or masonry grout during placement shall be cleaned prior to final installation of the bolts and nuts.

Sleeves shall be filled with non-shrink grout.

3-3. ADHESIVE ANCHORS. Adhesive shall be statically mixed in the field during application. All proportioning and mixing of the components shall be in accordance with the manufacturer’s recommendations.

Anchors or bars shall be installed in holes hammer drilled into hardened concrete or masonry. Drill shall be set to rotation-only mode when drilling into hollow CMU or into brick. Diameter of holes shall be 1/16 inch larger than the outside diameter of the rod or bar unless recommended otherwise by the anchor system manufacturer. Holes shall be prepared by removing all dust and debris using procedures recommended by the adhesive manufacturer.

Adhesive anchors and holes shall be clean, dry, and free of grease and other foreign matter at the time of installation. The adhesive shall be placed and the rods or bars shall be set in accordance with the recommendations of the manufacturer. Care shall be taken to ensure that all spaces and cavities are filled with adhesive, without voids.

3-3.01. Concrete Installation. Unless indicated otherwise on the Drawings, reinforcing bars shall be embedded to a depth of 15 bar diameters, and threaded rods shall be embedded to a depth that will develop the yield strength of the rod.
Adhesive anchors in concrete shall be installed under the following conditions.

- **Minimum Age of Concrete Prior to Anchor Installation**: 21 days.
- **Concrete Temperature Range**: Maximum short-term temperature 162°F, maximum long-term temperature 110°F.
- **Moisture Condition**: Dry concrete.
- **Type of Lightweight Concrete**: N/A
- **Hole Drilling and Preparation**: Hammer drill only.

Installation of adhesive anchors into concrete that are either horizontal or upwardly inclined shall be performed only by personnel certified by the ACI/CRSI Adhesive Anchor Installation Certification Program.

3-3.02. **Masonry Installation.** Anchors shall be installed to meet all criteria in the manufacturer’s installation instructions and ICC-ES reports, including but not limited to minimum compressive strength at time of installation, minimum edge distances, minimum clearances from mortar joints, minimum anchor spacing, and use of screen tubes.

3-4. **EXPANSION AND UNDERCUT ANCHORS.** Expansion and undercut anchors shall be installed using all procedures and accessory devices recommended by the anchor manufacturer.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers the fabrication and erection of structural and miscellaneous metal items not covered in other sections.

Except as otherwise specified or indicated on the Drawings, all work shall conform to the applicable provisions of the AISC "Steel Construction Manual" (14th edition) with the exception of the “Code of Standard Practice for Steel Buildings and Bridges”; and the Aluminum Association "Specification for Aluminum Structures".

Special inspection during the fabrication and erection of structural steel, if required by the local building code, is addressed in the quality control section.

1-2. SUBMITTALS. Complete data, fabrication drawings, and setting or erection drawings covering all structural and miscellaneous metal items shall be submitted in accordance with the Submittals Procedures section.

All bolted connections and welds shall be properly identified on the shop drawings. Welding procedures, welding procedure qualification records and welder qualifications shall be submitted.

Submittals for high strength bolts, tension control bolts and load indicator washers shall include statements from the bolt and washer manufacturers certifying satisfactory compliance with the governing standards and the specified tests.

1-3. DELIVERY, STORAGE, AND HANDLING. Materials shall be handled, transported, and delivered in a manner which will prevent bends, dents, significant coating damage, or corrosion. Damaged materials shall be promptly replaced. Structural and miscellaneous metal work shall be stored on blocking so that no metal touches the ground and water cannot collect thereon. The material shall be protected against bending under its own weight or superimposed loads.

Bolting materials shall be stored indoors. Weld rod shall be stored in accordance with the supplier’s instructions and AWS D1.1.

1-4. FABRICATOR QUALIFICATION. All fabricating plants providing structural steel shall be qualified fabricators who participate in the AISC Certification program and are designated an AISC Certified Plant, Category STD.
Plant certification is not required for fabrication of miscellaneous metal which does not meet the AISC definition for structural steel found in the AISC “Steel Construction Manual” (13th edition), Part 16.

PART 2 - PRODUCTS

2-1. GENERAL. All structural steel shall be detailed and fabricated to facilitate compliance with OSHA 29 CFR Part 1926 subpart R and all other pertinent OSHA and local safety regulations.

All field connection materials shall be furnished.

2-2. MATERIALS.

Steel

Shapes (W, WT) ASTM A992.
Shapes (S, M, HP, C) ASTM A36 or ASTM A572 Grade 50.
Other Shapes (angles) ASTM A36.
Plates and Bars ASTM A36.
Sheets ASTM A1008 CS Type B or A1011 CS Type B.
Pipe ASTM A53, Type E or S, Grade B (F_y = 35 ksi).
Round Structural Tubing ASTM A500, Grade B (F_y = 42 ksi).
Square and Rectangular Structural Tubing ASTM A500, Grade B (F_y = 46 ksi).
Checkered Plate ASTM A786, carbon steel, skid resistant pattern as standard with the manufacturer; Inland “4-way Floor Plate” or U.S. Steel “Multigrip Floor Plate”.

Bolts and Nuts

Bolts, High Strength ASTM A325, Type 1; tested in accordance with Article 9.2 thereof.
Bolts, Tension Control Type (Twist off) | ASTM F1852. Equivalent to ASTM A325.
---|---
Bolts, unfinished | ASTM A307.
Nuts, Heavy-Hex | ASTM A563, grade and finish compatible with bolts.
Nuts, Self-Locking | Prevailing torque type; IFI-100, Grade A.

**Washers**

- **Flat, Hardened**: ASTM F436, Type 1.
- **Lock**: ANSI/ASME B18.21.1, helical spring type.
- **Beveled**: ASTM F436.
- **Load Indicator**: ASTM F959, compressible-washer-type direct tension indicator; type compatible with bolts tested in accordance with Article 10.2 of ASTM F959.

**Threaded Rods (Including Hanger Rods for Pipe Supports)** | ASTM A36. Threaded rods shall have sufficient threading to permit the maximum adjustment available. Continuously threaded rod is not acceptable for rods over 12 inches in length.

**Forged Steel Clevises and Turnbuckles** | AISI C-1035.

**Forged Steel Eyebolts and Eyenuts** | AISI C-1030, ANSI B 18.15 Type 2 shoulder pattern unless otherwise required.

**Forged Steel Sleeve Nuts** | AISI C-1018, Grade 2.

**Stainless Steel Shapes** | ASTM A1069 or A276, Type 316L.
Plates
ASTM A240, Type 316L.

Pipe
ASTM A312, Grade TP316L.

Tube
ASTM A269, Grade TP316L.

Checkered Plate
ASTM A793, Type 316L, raised pattern A.

Bolts
ASTM F593, Alloy Group 1 or 2, minimum yield strength of 45 ksi.

Nuts
ASTM F594, Alloy Group shall match that of the bolts. Nuts shall have a minimum proof stress equal to or greater than the minimum full-size tensile strength of the bolts.

Washers

Flat
ANSI/ASME B18.22.1, Type 316.

Lock
ANSI/ASME B18.21.1, helical spring type, Type 316.

Threaded Rods (Including Hanger Rods for Pipe Supports)
ASTM A593, Alloy Group 1 or 2, minimum yield strength of 45 ksi.

Cast Iron
ASTM A48, Class 35B or better.

Aluminum

Sheet and Plate

Rolled Sections
ASTM B308, Alloy 6061-T6. All members shall be Aluminum Association standard shapes.

Rod and Bar (Rolled or Drawn)
ASTM B211, Alloy 6061-T6 or 2017-T4.

 Extrusions
ASTM B221, Alloy 6063-T5 or T6.

 Pipe

 Rivets
ASTM B316, Alloy 6061-T6.
Bolts, Aluminum  
ASTM F468, Alloy 2024-T4.

Nuts, Aluminum  
ASTM F467, Alloy 6061-T6.

Washers, Aluminum

- Flat  
  ANSI/ASME B18.22.1, Type 6061 T-6.

- Lock  

Castings  
ASTM B26 or B85.

Checkered Plate  
ASTM B632, Type 6061-T6.

Rails

- Crane  
  ASTM A1.

- Railroad  
  ASTM A1.

Bird Screen  
2 mesh [12 mm square openings], brass or copper wire cloth, min wire dia 0.063 inch.

Body Solder  
Flux-core wire, ASTM B32, Alloy Grade 20B.

Shop Coatings

- Universal Primer  
  As indicated in protective coatings section.

- Epoxy Enamel  
  As indicated in protective coatings section.

- Galvanizing  
  ASTM A123, A153, A385, and F2329 as applicable.

2-3. **FABRICATIONS.** The following fabrications shall be constructed as indicated on the Drawings and as specified herein.

2-3.01. **Stairs.** Stairs shall be fabricated to the dimensions, arrangements and sizes indicated on the Drawings. Stairs shall be true to line and slope, shall be rigidly supported, and shall be braced and tightened to prevent movement. All
treads shall be level and in perfect alignment and spacing. Handrails shall be in alignment and rigidly connected.

After installation, stairs shall be rigid and shall not sway noticeably or deflect under foot traffic. If necessary to prevent noticeable movement, additional supports or bracing shall be provided.

2-3.01.01. Stair Design. Stairs connected landings shall be designed by the stair supplier in general accordance with details indicated on the Drawings. The design shall comply with all applicable provisions of the local building code, ANSI A117.1, and OSHA as applicable. The drawings shall be sealed and signed by a professional engineer registered in the state of California. If requested, calculations shall be submitted to Engineer.

The completed fabrications shall support a uniform live load of 100 lbs per square foot and a concentrated load of 300 lbs applied at the center of the span. Individual treads and platforms shall be designed to support a uniform live load of 100 lbs per square foot or a 300 lb concentrated live load applied on an area of 4 square inches. Vertical deflections under full live load shall be limited to span/240. Stairs and landings shall be braced or otherwise designed to avoid noticeable sidesway.

The stair design and details shall be coordinated with the handrailing and guardrailing supplied. Stair members shall be adequate to accept loads from the rail posts based upon the criteria in the Handrailing, Guardrailing, and Ladders section.

Connections between the stair members and the supporting structure shall be adequate to transfer all loadings, and shall be designed in accordance with all applicable provisions of the AISC manual and ACI 318 Appendix D. The number and type of connections shall comply, at a minimum, with the Drawings. All necessary brackets, bolts, and anchors shall be provided.

2-3.01.02. Nosings. All stair treads shall have non-skid nosings, either fabricated integrally with the tread or attached with stainless steel bolts and self-locking nuts.

2-3.01.03. Grating Stairs. Treads shall be fabricated from grating material in accordance with the grating section.

2-3.01.04. Pan Type Stairs. Not used.

2-3.01.05. Cast Aluminum Stairs. Not used.
2-3.02. **Checkered Floor Plates.** Checkered floor plates shall be painted steel unless specifically designated on the Drawings as galvanized steel, stainless steel or aluminum. Shop welded stiffeners or grating backup shall be provided as indicated on the Drawings. Stiffeners and grating backup shall be of the same material as the checkered plate.

Checkered floor plates which are indicated to be removable shall be detailed and fabricated in sections which weigh no more than 150 lb (667 N), and shall be provided with lifting holes to facilitate removal. Warped or bent plates shall be straightened so they will lie perfectly flat.

Checkered floor plates shall be secured to structural shapes or grating using 3/8 inch [9 mm] stainless steel slotted flathead machine screws at 12 inch centers, Lindapter “Floor-Fast” stepped locking fasteners or as indicated on the Drawings. Connection devices shall not protrude above the plate surface. Access holes shall be provided in the plate if required to allow access to grating hold-down devices beneath the plate.

2-3.03. **Stop Plates and Grooves.** Stop plates shall be fabricated with the edges accurately finished. Plates shall be provided with suitable lifting handles and angle stiffeners as indicated on the Drawings. Each stop plate shall be permanently marked to identify its intended location.

Stop plate grooves shall be cast iron Neenah “Series R-7501” with all interior surfaces machined.

Stop plate grooves shall be installed plumb and straight within a tolerance of 3/32 inch and with the opposite sides and bottom aligned in a single plane to prevent binding of the stop plate. If necessary to meet this requirement, a space shall be boxed out for guides, and the guides grouted in place later. Stop plates shall be set in place as needed for testing and startup procedures.

2-3.04. **Basin Effluent Launders.** Not used.

2-3.05. **Basin Weir Plates.** Not used.

2-3.06. **Scum Baffles.** Not used.

2-3.07. **Metering Weirs.** Not used.

2-3.08. **Bar Screens.** Bar screens shall be fabricated from bars and shapes in accordance with the details indicated on the Drawings. Carbon steel bar screens shall be hot-dip galvanized after fabrication.

2-3.09. **Lime Troughs.** Not used.
2-3.10. **Runway Beams.** Steel beams used as underhung crane or hoist runways shall be straight and level. The upper surface of the lower flange of each beam shall be smooth, with all projections ground off. Joints shall be close-fitting and free from unevenness. The beams shall be rigidly supported in exact alignment. A section of each runway beam shall not be installed until after the crane or hoist has been installed.

Stops as recommended by the crane or hoist manufacturer shall be bolted in place on each end of each runway beam to limit the travel of the crane or hoist. Stops shall be so located that the crane or hoist does not come into contact with any part of the structure or piping. If the crane or hoist is required to be powered, at the power feed end of the runway the stops shall be designed so that the cable trolleys will pass beneath the stops. The stops shall be so located that there is sufficient room on the runway for storage of the cable trolleys beyond the stops. Secondary stops shall be provided for the cable trolleys.

2-3.11. **Crane Rails.** Not used.

2-3.12. **Structural Steel Bolted Connections.** Bolt holes shall have a diameter nominally 1/16 inch larger than the nominal bolt diameter. Bolt holes for one ply of vertical diagonal bracing connections may be oversized to a diameter nominally 3/16 inch larger than the nominal bolt diameter.

2-4. **SHOP COATING.** All structural and miscellaneous metal items shall be shop coated as specified herein. The requirements for field painting are covered in the protective coatings section.

Contact surfaces of structural steel slip critical bolted connections shall not be shop coated. Contact surfaces of structural steel bearing type bolted connections may be shop coated.

2-4.01. **Cleaning.** Surfaces shall be dry and of proper temperature when coated, and shall be free of grease, oil, dirt, dust, grit, rust, loose mill scale, weld flux, slag, weld spatter, and other objectionable substances. Articles to be galvanized shall be pickled before galvanizing. All other ferrous metal surfaces shall be cleaned by solvent, high-speed power wire brushing or by blasting to the extent recommended by the paint manufacturer and as required in the protective coatings section.

2-4.02. **Edge Grinding.** Sharp projections of cut or sheared edges of ferrous metals which will be submerged in operation, except for items specified to be hot-dip galvanized, shall be ground to a radius as needed to ensure satisfactory paint adherence and as required in the protective coatings section.
2-4.03. **Prime Painted Steel.** Unless otherwise specified or indicated on the Drawings, all ungalvanized structural and miscellaneous steel shall be given a universal prime coat in the shop after fabrication. The dry film thickness of the universal primer shall be at least 5 mils. Steel surfaces shall be prime-coated as soon as practicable after cleaning. Steel shall not be moved or handled until the shop coat is dry and hard.

2-4.04. **Galvanizing.** Steel materials required to be galvanized are indicated on the Drawings. All galvanizing shall be done by the hot-dip process after fabrication. An approved zinc-rich paint shall be used to touch up minor coating damage. Materials with significant coating damage shall be regalvanized or replaced.

Bolts, nuts, and washers shall be galvanized when connected materials are galvanized or where indicated on the Drawings. The use of zinc-plated bolts will not be acceptable.

2-4.05. **Stainless Steel.** Unless otherwise specified, all items fabricated from stainless steel shall be thoroughly cleaned and degreased after fabrication. Pickling or a light blast cleaning shall produce a modest etch and remove all embedded iron and heat tint. Surfaces shall be subjected to a 24 hour water test or a ferroxyl test to detect the presence of residual embedded iron and shall be retreated as needed to remove all traces of iron contamination. Surfaces shall be adequately protected during shipping and handling to prevent contact with iron or steel objects or surfaces.

2-4.06. **Aluminum.** All surfaces of aluminum which will be in contact with concrete, mortar, or dissimilar metals shall be given a coat of epoxy enamel.

2-4.07. **Casting.** Shop coating of miscellaneous iron castings will not be required.

2-4.08. **Other Surfaces.** Painting of zinc coated steel or bronze surfaces will not be required.

**PART 3 - EXECUTION**

3-1. **STRUCTURAL STEEL ERECTION.** Structural steel shall be erected so that individual pieces are plumb, level, and aligned within a tolerance of 1:500. The elevations of the top of floor and roof members shall be within 1/16 inch of the elevations indicated on the Drawings. The faces of girts and other supporting members for rigid wall panels shall be in vertical planes within a maximum variation of 1/8 inch.
All members and parts, as erected, shall be free of warps, local deformations, and unauthorized bends. All parts shall be assembled accurately as indicated on the Drawings. Light drifting will be permitted to draw parts together, but drifting to match unfair holes will not be permitted. Any enlargement of holes necessary to make connections in the field shall be done by reaming with twist drills and only with the approval of Engineer. Enlarging holes by burning will not be permitted.

Baseplates shall be set level in exact position and grouted in place.

All materials shall be erected in compliance with OSHA 29 CFR, Part 1926, Subpart R, and with all other applicable OSHA and local safety regulations.

3-1.01. Inspection and Testing. Special inspection will be performed in accordance with the applicable building code. The erector shall provide access as needed to facilitate all inspections and shall provide timely notification during erection when inspection milestones are approaching.

3-2. STRUCTURAL STEEL BOLTED CONNECTIONS. Unless otherwise indicated on the Drawings, bolted connections for structural steel, as defined in the AISC manual, shall be made with ASTM A325 high strength bolts conforming to the "Specification for Structural Joints Using ASTM A325 or A490 Bolts" as approved by the Research Council on Structural Connections. The method of installation, pretensioning procedures, bolting equipment and tools shall likewise conform to the above referenced standard.

When assembled, all joint surfaces, including those adjacent to the bolt heads, nuts, or washers, shall be free of loose mill scale, dirt, burrs, oil, and other foreign material that would prevent solid seating of the parts.

Beveled washers shall be used when the bearing faces of bolted parts have a slope of 1:20 or greater with respect to a plane perpendicular to the bolt axis. Bolt length shall be increased as needed to accommodate the beveled washers.

If oversized holes are provided in an outer ply, a hardened flat washer shall be installed over each hole during bolting. Load indicator washers shall not be substituted for hardened flat washers required for oversized holes.

Tightening of each connection assembly shall progress systematically from the most rigid part of the joint toward the free edges until all have been sufficiently rotated or the load indicator washers on all bolts have been closed to the average gap stipulated by the load indicator washer manufacturer.

Except as otherwise indicated on the Drawings or specified herein, bolted connections shall be bearing type with threads excluded from the shear plane. Slip critical connections shall be used in diagonal bracing connections, where
oversize holes or slotted holes parallel to the direction of the load are used, and where indicated on the Drawings.

Bolts in all structural steel connections, both bearing and slip critical, shall be fully pretensioned in accordance with the AISC standards unless specifically noted otherwise on the Drawings. The calibrated wrench method of pretensioning bolts will not be acceptable. Acceptable pretensioning methods are as follows:

<table>
<thead>
<tr>
<th>Connection Type</th>
<th>Acceptable Pretensioning Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bearing</td>
<td>Turn of the nut method and load-indicator washers are acceptable. Tension control (twist-off) type bolts may be used only if approved by Engineer.</td>
</tr>
<tr>
<td>Slip-Critical</td>
<td>Load indicator washers.</td>
</tr>
</tbody>
</table>

3-2.01. **Turn of the Nut Method.** The bolt, nut, and material shall be match marked. A wax lumber marker or paint shall be used to clearly mark the assembly.

3-2.02. **Load-Indicator Washers.** Load indicator washers shall be installed in accordance with the manufacturer’s recommendations, as supplemented herein. To facilitate proper tightening of fastener assemblies with load indicator washers, a hardened flat washer shall be installed under the turned element (bolt head or nut) and between the turned element and the load indicator washer protrusions, in all cases. Whenever possible, the load indicator washer shall be installed on the head end of the bolt. If the bolt head will not be visible for inspection of the indicator washer after installation, or if the bolt head must be turned to tighten the assembly, the load indicator washer may be installed on the nut end of the bolt.

3-2.03. **Tension Control (Twist-off) Bolts.** Patented tension control bolts shall be of equivalent size and strength to the indicated high strength bolts, and shall be installed in strict accordance with the manufacturer's instructions. Load-indicator washers are not required on tension control bolts.

3-3. **MISCELLANEOUS STEEL BOLTED CONNECTIONS.** Connections for miscellaneous steel fabrications not included in the AISC definition of structural steel may be made with unfinished bolts unless indicated otherwise on the Drawings. Unless otherwise indicated on the Drawings all unfinished bolts shall be snug tight.

3-4. **STRUCTURAL, STAINLESS, AND MISCELLANEOUS STEEL WELDING.** Welding and related operations shall conform to applicable provisions of AWS D1.1 for steel and AWS D1.6 for stainless steel. All welding shall be performed in accordance with written procedures, using only those joint details which have prequalified status. All welding shall be performed by welders qualified in accordance with the American Welding Society.
All welds shall be visually inspected in accordance with AWS procedures.

Welds not dimensioned on the Drawings shall be sized to develop the full strength of the least strength component of the connection.

Where structural or miscellaneous steel connections are welded, all butt and miter welds shall be continuous and, where exposed to view, shall be ground smooth. Intermittent welds shall have an effective length of at least 2 inches and shall be spaced not more than 6 inches apart.

Surfaces to be welded and surfaces within 2 inches of a weld shall be free from loose or thick scale, slag, rust, moisture, grease, paint and other foreign materials that would prevent proper welding or release objectionable fumes.

Only shielded metal arc, gas metal arc, flux cored arc, submerged arc, and gas tungsten arc welding are permitted. For flux cored arc welding, only E70xx one (1) or five (5) wire electrodes with supplemental gas shielding shall be permitted. Use of electroslag or electrogas welding processes or the short-circuiting transfer mode of the gas metal arc process will not be acceptable.

Field welded connections shall not be substituted for field bolted connections indicated on the Drawings.

Deformed bar anchors, headed studs, concrete anchors and shear connectors shall be welded with an automatic stud welding gun per the manufacturer’s recommendation. Hand welding will not be acceptable.

3-5. STRUCTURAL AND MISCELLANEOUS ALUMINUM. Unless otherwise noted, all work shall conform to applicable provisions of the Aluminum Association "Specification for Aluminum Structures".

3-5.01. Connections. Connections not specifically detailed on the Drawings shall develop the full strength of the least strength member of the connections. Bolted connections shall be all-bolted bearing type, equipped with a helical spring lock washer under the stationary element (bolt head or nut) and a flat washer under the turned element. All bolts shall be fully tightened. Bolts and nuts for structural aluminum connections shall be stainless steel. Bolts and nuts for nonstructural miscellaneous aluminum assemblies shall be stainless steel or aluminum. A sufficient number of bolts shall be provided in each connection to develop the shear strength of the member.

Welded connections shall be made in accordance with the American Welding Society D1.2, Structural Welding Code - Aluminum. All welding shall be performed by welders qualified in accordance with American Welding Society.
Welds shall be free of porosity, cracks, holes, and flux. Welded connections shall not be substituted for bolted connections without prior approval of Engineer.

3-5.02. **Erection.** Structural aluminum shall be erected so that individual pieces are plumb, level, and aligned within a tolerance of 1:500. The elevation of horizontal members shall be within 1/16 inch of the elevation indicated on the Drawings.

Baseplates shall be set level in exact position and grouted in place.

End of Section
Section 06100
ROUGH CARPENTRY

PART 1 - GENERAL

1-1. SCOPE. This section covers miscellaneous items required by the drawings to be of wood construction. Rough carpentry shall include:

a. Wood grounds.
b. Wood nailers and blocking.
c. Miscellaneous wood framing.
d. Fire retardant sheathing.
e. Rough hardware and fasteners.

1-2. SUBMITTALS. Drawings and data for rough carpentry and field fabricated items will not be required.

1-3. PROTECTION AND STORAGE. Lumber shall be protected and kept under cover, both in transit and at jobsite. Lumber shall be carefully stacked on suitable supports in a manner which will ensure proper ventilation and drainage.

All lumber shall be delivered to the jobsite bearing grade stamps of the Western Wood Products Association or Southern Pine Inspection Bureau. All lumber shall be segregated by grades. Extreme care shall be exercised in unloading the lumber to prevent damage, splitting, or breaking of materials.

All plywood shall be identified according to species, grade, and glue type by the stamp of the American Plywood Association.

PART 2 - PRODUCT

2-1. MATERIALS.

<table>
<thead>
<tr>
<th>Lumber</th>
<th>American Standard Lumber conforming to PS20, moisture content 19 percent or less; sized dry.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural Dressed</td>
<td>Southern pine or Douglas fir, S4S; structural light framing and structural joists and planks, No. 2; studs, stud grade.</td>
</tr>
</tbody>
</table>
Pressure Treated Southern pine, pressure treated with waterborne preservative (alkaline copper quaternary ammonium) in accordance with AWPA C1 and AWPA P5.

Plywood

General Purpose PS1, waterproof, resin-bonded, exterior type; APA Group 1, Grade Ext-BB, or better unless otherwise specified.

Sheathing, Fire Retardant FR-S rated plywood, APA rated sheathing, exterior, span rating 32/16, Exposure 1, 3/4 inch thick, pressure treated with fire retardant chemicals, Hickson "Dricon".

Moisture Barrier Tyvek Housewrap by DuPont


Wood Screws 18-8 stainless steel or brass.

Self-tapping Steel Screws Length and size as required by code.

Nails Galvanized or aluminum coated.

Rough Hardware Galvanized steel, 18-8 stainless steel, brass, or aluminum.

**PART 3 - EXECUTION**

3-1. **ROUGH CARPENTRY.** Rough carpentry shall include lumber work generally, except finish work.

The Contractor shall install all wood framing, blocking, grounds, and nailers as indicated on the drawings or required to complete a finished building. In addition to all framing indicated on the drawings, nailers, blocking, and other backing required for other work and trades shall be installed.
At all times during execution of this portion of the contract, sufficient workmen and supervisors shall be present who are thoroughly familiar with rough carpentry construction and the materials and techniques specified or indicated on the drawings.

All rough carpentry shall produce joints true, tight, and well nailed, with all members assembled in accordance with the drawings and with all pertinent codes and regulations.

Individual pieces of lumber shall be selected so that obvious defects will not interfere with the placement of bolts, proper nailing or making of joints. All pieces with defects which render them unusable shall be discarded. Individual pieces of lumber which are too small to use in fabricating the Work with minimum joints shall be discarded.

Whether or not lumber has been installed, it may be rejected by the Engineer for excessive splits, warp, twist, bow, crook, mildew, or fungus, as well as for improper cutting and fitting.

Carpentry work shall be set to required levels and lines, with members plumb and true.

Carpentry shall be securely attached to substrates by anchoring and fastening as indicated and as required for strength and by recognized standards.

Framing members shall not be bored or cut for pipes, ducts, conduits, or for any other reasons except where accepted by the Designer.

The premises shall be kept in a neat, safe, and orderly condition at all times during the execution of this portion of the Work and shall be free from accumulation of sawdust, cut ends, and other debris.

Connections between members shall be tight. Washers shall be provided under all bolt heads and nuts in contact with lumber. Installation of fasteners shall not cause splitting of wood.

Structural lumber in exterior locations; lumber in contact with concrete, masonry, earth, or water; and all wood nailers shall be pressure treated unless otherwise specified.

OSB sheathing for temporary walls shall be installed at locations indicated on the drawings. Unless otherwise required by local building code, sheathing shall be attached to wood framing with nails at 12 inch centers along edges and at 16 inch centers each way in the field. All joints shall occur over framing members. Panels shall span over two or more supports. Joints shall be accurately aligned.
House wrap shall be installed over OSB sheathing using sufficient staples to endure local weather conditions for the life of the temporary wall.

Nailers shall be provided where indicated on the drawings. The nailers shall be continuous and shall be installed level and straight. Each section of nailer shall be secured by at least two anchor bolts.

End of Section
PART 1 - GENERAL

1-1. THE REQUIREMENT. The Contractor shall furnish and install vinyl plastic liner in reinforced concrete structures as shown on the drawings and herein specified. The liner shall effectively protect the concrete underneath from corrosion. The liner shall be continuous and free from any holes, defects, or other faults, and all joint welding and sealing shall be as impervious as the liner. All vinyl plastic liner shall be white.

Interior areas of reinforced concrete structures shall be sealed and protected with the specified lining as shown on the Drawings. All joints between individual sheets or sections of liner shall be continuously heat welded using welding strips of the same material as the liner but without the integral extension ribs.

Unless otherwise noted, all material, methods and testing required for the installation of liners in manholes and structures, and the field sealing and welding of joints shall be done in strict conformity with applicable published sections of the Standard Specifications for Public Works Construction, latest edition.

1-2. RELATED WORK SPECIFIED ELSEWHERE. The requirements of the following specifications sections and divisions apply to the work of this specifications section. Other sections and divisions of the specifications, not referenced below, shall also apply to the extent required for proper performance of this work.

1. 03100, Concrete Formwork
2. 09940, Protective Coating

1-3. REFERENCE SPECIFICATIONS, CODES, AND STANDARDS. All work specified herein shall conform to or exceed the applicable requirements of the referenced portions of the following publications to the extent that the provisions thereof are not in conflict with other provisions of these specifications sections.

Comply with the applicable editions of the following codes, regulations and standards.

1. Codes and Regulations:
   SCAQMD South Coast Air Quality Management District
2. Industry Standards:

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM D 638</td>
<td>Standard Test Method for Tensile Properties of Plastics</td>
</tr>
<tr>
<td>ASTM D 412</td>
<td>Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubber and Thermoplastic Elastomers-Tension</td>
</tr>
</tbody>
</table>

Comply with the reference specifications of the General Requirements and the Additional General Requirements.

1-4. CONTRACTOR SUBMITTALS. Submittals shall be made in accordance with the general requirements, additional general requirements and as specified herein.

The following submittals and specific information shall be provided.

1. Record Drawings: The Contractor shall furnish Record Drawings of all fabricated items and accessories in accordance with the General Requirements, Additional General Requirements and as specified herein.

a. The Contractor shall submit to the Engineer Record Drawings of installation details showing how each structure will be lined. These drawings shall show how returns, corners, and joints will be located and constructed. No liner shall be placed until these drawings have been favorably reviewed and accepted by the Engineer.

2. Certifications: Submit written evidence of welder qualifications and certifications which shall be subject to acceptance by the Engineer.

1-5. QUALITY ASSURANCE.

A. Contractor Qualifications:

1. Applicators: The application of plastic liner to forms and other surfaces shall be considered as highly specialized work. Personnel performing this type of work shall be trained in methods of installation and shall demonstrate their ability to the Engineer.

2. Welders: Each welder shall prequalify by successfully passing a welding test before doing any welding. Requalification may be required at any time deemed necessary by the Engineer. All costs
associated with qualification and requalification of welders shall be borne by the Contractor. All test welds shall be made in the presence of the OCSD representative and shall consist of the following:

a. Two pieces of liner, at least 15 inches long and 9 inches wide, shall be lapped 1-1/2 inches and held in a vertical position.

b. A welding strip shall be positioned over the edge of the lap and welded to both pieces of liner. Each end of the welding strip shall extend at least 2 inches beyond the liner to provide tabs.

c. The weld specimen shall be submitted to the Engineer and shall be tested as follows:

(1) Each welding strip tab, tested separately, shall be subjected to a 10-pound pull, normally to the face of the liner with the liner being held firmly in place. There shall be no separation between the welding strip and liner when the welding tabs are submitted to the test pulls.

(2) Three test specimens shall be cut from the welded sample and tested in tension across the welds. If none of the specimens fail when tested as specified herein, the weld will be considered as satisfactory in tension.

(3) If one of the specimens fails to pass the tension test, a retest will be permitted. The retest shall consist of testing three additional specimens cut from the original welded sample. If all three of the retest specimens pass the test, the weld shall be considered satisfactory.

(4) A disqualified welder may submit a new welding sample when, in the opinion of the Engineer, there has been sufficient off-the-job training or experience to warrant re-examination.

1-6. WARRANTY. The contractor shall comply with the warranty requirements as specified elsewhere in the contract documents.

PART 2 - PRODUCTS

2-1. COMPOSITION. The materials used in all sheets of plastic liner and in all joint, corner, and welding strips for the liner shall be a high molecular weight polyvinyl chloride (PVC) resin and other necessary ingredients compounded to make permanently flexible sheets and strips. PVC resin shall constitute not less than 99 percent, by weight, of the resin used in the formulation. Copolymer resins shall not be permitted.
The material used in joint strips and in plain sheets of plastic liner shall be identical to that used in sheets having locking extensions.

Changes in formulation shall be permitted only after prior notification of the Engineer and demonstration to the Engineer that the modified plastic liner meets or exceeds all requirements in this Specifications section. The demonstration shall be subject to Engineer’s acceptance.

Plastic liner shall be impermeable to sewage gases and liquids and shall be nonconductive to bacterial or fungal growth. All lines shall be factory checked electrically to ensure freedom from any porosity.

The lining shall have good impact resistance, shall be flexible, and shall have an elongation sufficient to bridge a 1/8-inch-wide settling crack, which may occur in the pipe structure or joint after installation, without loss of the lining integrity.

Once cast into the concrete of structures, the lining shall be permanently and physically attached to the concrete by T-shaped integral locking extensions and shall not rely on an adhesive bond except where specifically indicated. The lining shall withstand a 15-psi back hydrostatic pressure applied to the under surface of the lining without losing anchorage and without rupture or leakage.

2-2. PHYSICAL PROPERTIES.

A. At any time prior to final acceptance of the work, including during manufacture, the engineer may sample any sheet or strip. Samples shall be subject to the following tests:

1. Tensile specimens shall be prepared in accordance with ASTM D 412, Test Method B. These shall be cut from sheets, joint strips, and flat welding strips.

2. Weight change specimens shall be 1 by 3 inches and of specified sheet thickness.

3. Test specimens shall be conditioned to a constant weight at 110 degrees Fahrenheit before and after submersion in the following solutions for a period of one hundred twelve (112) Days at 77 degrees Fahrenheit plus or minus 5 degrees. At twenty-eight (28) Day intervals, tensile specimens and weight change specimens shall be removed from each of the chemical solutions and tested.

<table>
<thead>
<tr>
<th>CHEMICAL SOLUTION</th>
<th>CONCENTRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulphuric Acid</td>
<td>20 percent</td>
</tr>
<tr>
<td>Sodium Hydroxide</td>
<td>5 percent</td>
</tr>
</tbody>
</table>

 Orange County Water District 06620 POLYVINYL CHLORIDE 
 Groundwater Replenishment System -4- February 2019 
 Final Expansion Issued for Bid
4. All plastic liner sheets, joint, corner and welding strips shall have the following physical properties when tested at 77 degrees Fahrenheit plus or minus 5 degrees:

<table>
<thead>
<tr>
<th>Property</th>
<th>Initial</th>
<th>After 112 Days exposure in above-listed chemical solutions**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength</td>
<td>2200 psi min.</td>
<td>2100 psi min.</td>
</tr>
<tr>
<td>Elongation at break</td>
<td>200 percent min.</td>
<td>200 percent min.</td>
</tr>
<tr>
<td>Indentation hardness (Shore durometer, Type D)</td>
<td>Inst. 50 to 60</td>
<td>+5 with respect to initial test result</td>
</tr>
<tr>
<td>Weight change</td>
<td></td>
<td>+1.5 percent</td>
</tr>
</tbody>
</table>

**If any specimen fails to meet the one hundred twelve (112) Day requirements before completion of the one hundred twelve (112) Day exposure, the material shall be subject to rejection.

5. Liner locking extension embedded in concrete shall withstand a test pull of at least 100 pounds per linear inch, applied perpendicularly to the concrete surface for a period of one (1) minute, without rupture of the locking extensions or withdrawal from embedment. This test shall be made at 75 degrees Fahrenheit plus or minus 5 degrees.

6. All plastic liner sheets, including locking extensions, all joint, corner and welding strips shall be free of cracks, cleavages, or defects adversely affecting the protective characteristics of the material. The

---

<table>
<thead>
<tr>
<th>Ammonium Hydroxide</th>
<th>5 percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Hypochlorite</td>
<td>1 percent</td>
</tr>
<tr>
<td>Nitric Acid</td>
<td>1 percent</td>
</tr>
<tr>
<td>Ferric Chloride</td>
<td>1 percent</td>
</tr>
<tr>
<td>Soap</td>
<td>0.1 percent</td>
</tr>
<tr>
<td>Detergent (Linear Alkyl Benzyl Sulfonate or Gas)</td>
<td>0.1 percent</td>
</tr>
<tr>
<td>Bacteriological mg/l</td>
<td>BOD not less than 700</td>
</tr>
</tbody>
</table>
Engineer may authorize the repair of such defects by approved methods.

7. Specimens shall meet the requirements listed under "PHYSICAL PROPERTIES", set forth above.

B. Thickness of Material: Liner to be bonded to concrete by means of integral locking extensions embedded in the concrete shall have a minimum thickness of 0.065 inch. Liner to be bonded to concrete or steel surfaces by means of adhesive shall have a minimum thickness of 0.094 inch. Welding strips shall have a minimum thickness of 0.094 inch and a maximum thickness of 0.156 inch. Joint strips shall have a minimum thickness of 0.075 inch.

C. Sheet and Strip Size:

1. Sheets of liner shall be as large as practicable to adequately fit the intended use.

2. Large sheets shall be formed in the shop by lapping basic-sized sheets a minimum of 0.50 inch and fusing the sheets together in such a manner as to produce a continuous welded joint. Specimens taken from shop welded joints shall show no cracks or separation and shall be tested in tension after flexing. Each specimen shall withstand a minimum load of 132 pounds per linear inch of weld, or the product of 2000 psi times the minimum thickness in inches of the material adjoining the weld, whichever is greater. The thickness shall be taken within a 2-inch gage length.

3. Tears, cracks, wrinkles, or separation in the laps shall be cause for rejection.

4. Joint strips shall be 4 plus or minus 0.25 inches wide and shall have each edge beveled prior to application.

5. Welding strips shall be 1 plus or minus 0.15 inch wide. All welding and outside corner strips shall have edges beveled at time of manufacture.

D. Locking Extensions:

1. All liner cast into concrete shall have integral locking extensions embedded in the concrete. Liner may be bonded to concrete surfaces with an adhesive if specifically shown on the Drawings. Locking extensions shall be of the same material as the liner plate and shall be integral with the sheets for liner plate. Locking extensions shall have an approved cross-section with a minimum height of 0.375 inch and a minimum web thickness of 0.085 inch. They shall be approximately 2-
1/2 inches apart and shall be made so that when the extensions are embedded in concrete, the liner will be held permanently in place.

2. Locking extensions shall be parallel and shall be continuous except where omitted for joints and transverse weep channels.

E. Weep Channels:

1. At 8-foot maximum intervals along liner longitudinally, a gap not less than 2 inches (3-1/2 inches in the case of extruded sheets) nor more than 4 inches wide shall be left in all locking extensions for liners of cast-in-place structures to provide an unobstructed transverse weep channel. Any area behind liner that is not properly served by regular weep channels shall have additional weep channels 2 inches wide provided by cutting away locking extensions. Provisions shall be made to permit water behind the liner of concrete manhole shafts to drain into the weep channels of the lined structure. Weep channels shall be cut into the extruded sheet so that a maximum of 1/32 inch of the base locking extension is left on the sheet.

2. At transverse joints in cast-in-place structures, a gap of not less than 2 inches nor greater than 4 inches shall be left in all locking extensions to provide a transverse weep channel. If locking extensions are removed to provide a weep channel at joints, the base of the extension left on a sheet shall not exceed 1/32 inch.

3. A transverse weep channel shall be provided approximately 12 inches from each liner return where surfaces lined with plastic liner join surfaces that are not so lined.

4. As part of the work of installing the liner, all outlets of transverse weep channels shall be cleared of obstructions that would interfere with their proper function.

F. Flaps: When transverse liner flaps are required, they shall be fabricated so that a maximum of 1/32 inch in height of the locking extension is left on the sheet.

2-3. ADHESIVES AND CLEANERS. Adhesives, solvents, and activators proposed for use for application to plain sheet shall be submitted to the engineer for acceptance. Adhesives used on the liner shall be limited to those products accepted by the engineer. No adhesive shall be applied to liner or to any of the liner strips, which will deleteriously affect the liner or strip in any way. The use of most adhesives and solvents is subject to record-keeping rules of the SCAQMD as described in Specifications Section 09800, protective coating.

Adhesive products and flammable solvents shall not be used for any purpose in connection with plastic liner with locking extensions.
Cleaning agents for use with plastic liner with locking extensions shall be water soluble or dispersible, nonflammable, and not detrimental to the plastic liner.

**PART 3 - EXECUTION**

3-1. **GENERAL.** The installation of all plastic liner shall be done in accordance with the contract documents.

Liner shall be applied and secured to the forms, shall be inspected and be subject to Engineer’s acceptance prior to the placement of reinforcing steel.

Special terminations shall be required at slide gate frames, manholes, pipe sleeves, and at other such locations in existing structures to receive PVC liner. The Contractor shall submit drawings showing details of how terminations not shown on the Contract Documents are to be made. Methods of making terminations shall be subject to the Engineer’s acceptance. Approved bonding agents may be used to seal edges where PVC liner joins metal items cast in concrete. All surfaces to be bonded shall be cleaned. Mixing and application of approved bonding agents shall be in accordance with the manufacturer’s instructions.

3-2. **PLACING PLASTIC LINER.**

A. Coverage:

1. Liner shall cover, as a minimum, the areas to be lined as shown on the Drawings. The offset of each longitudinal terminal edge of sheet on adjoining pipe sections after pipe is installed shall not be greater than 1-1/2 inches.

2. At a station where there is a difference in coverage, as shown on the Drawings, and the longitudinal terminal edges of liner downstream from said station are lower than those upstream, the terminal edges of the liner installed in the section of pipe or structure immediately upstream from the station shall be sloped uniformly for the entire length of the section of pipe or structure from the limits of the smaller coverage to those of the greater coverage. Wherever the longitudinal terminal edges of liner downstream from the station are higher than those upstream, the slope shall be accomplished uniformly throughout the length of the section of pipe or structure immediately downstream from the station. An approved locking extension shall be provided along all tapered lower terminal edges of liner.
B. Positioning Liner:

1. All liner installed in pipe shall be positioned so that the locking extensions are parallel with the axis of the pipe. Liner shall be centered with respect to the “T” of the pipe when the inner form is positioned. Liner shall be set flush with the inner edge of the bell end of a pipe section and shall extend either to the spigot end or to approximately 4 inches beyond the spigot end, depending on the type of liner joint to be made with the adjoining pipe.

2. All liner installed in a cast-in-place structure shall be positioned so that the locking extensions are vertical in walls and parallel to the axis of the structure in slabs. All liner installed in precast structures shall be positioned with locking extensions horizontal unless otherwise indicated on the Drawings.

3. Liner sheets shall be closely fitted to inner forms. Sheets shall be cut to fit curved and warped surfaces using a minimum number of separate pieces.

4. The Contractor shall furnish sketches to the Engineer showing the proposed layout of the liner sheets for cast-in-place structures. The sketches shall show the location and type of all field welds.

5. The Engineer may require the use of patterns or the marking of sheet layouts directly on the forms where complicated or warped surfaces are involved.

6. At transverse joints between regular size sheets of liner used in cast-in-place structures and at all pipe joints, the space between ends of locking extensions, measured longitudinally, shall not exceed 4 inches. Where sheets are cut and joined for the purpose of fitting irregular surfaces, this space shall not exceed 2 inches.

C. Securing Liner in Place:

1. Unless alternative methods are accepted by the Engineer, liner shall be secured in place to the inner pipe forms with steel banding straps and the sheet shall be provided with strap channels. Only finish nails may be used on wood forms.

2. Where form ties or form stabilizing rods pass through liner, provisions shall be made to maintain the liner in close contact with the forms during concrete placement.

D. Liner Returns:

1. A liner return shall be installed where shown on the Drawings and wherever surfaces lined with plastic liner join surfaces that are not so
lined, such as brick, clay pipe, cast-iron pipe, manhole frames, and metal or clay tile gate guides.

2. Unless otherwise indicated, returns shall be made as follows:
   a. Each liner return shall be a separate strip of liner at least 3 inches wide joined to the main liner by means of approved corner strips.
   b. Corner strips shall be welded continuously to the return and to the main liner and applied wherever possible from the back of the lining.
   c. Locking extensions shall be provided on returns to lock the returns to the concrete of plastic-lined, cast-in-place structures. Locking extensions will not be required on liner returns installed on lined precast concrete pipe and structures.
   d. Each liner shall be sealed to adjacent construction with which it is in contact as shown on the Drawings or as accepted by the Engineer.

3-3. CONCRETE OPERATIONS.

A. Concrete Placement:
   1. Concrete placed against liners shall be carefully vibrated to avoid damage to the liner and to produce a dense, homogeneous concrete securely anchoring the locking extensions into the concrete. External vibrators shall be used in addition to internal vibrators, particularly along the lower terminal edge of plastic liner.
   2. If approved stiffeners are used along locking extensions of liner installed in forms for pipe, they shall be withdrawn completely during the placement of concrete in the forms. The concrete shall be revibrated to consolidate the concrete in the void spaces caused by the withdrawal of the stiffeners.

B. Form Removal:
   1. In removing forms, care shall be taken to protect liner from damage. Sharp instruments shall not be used to pry forms from lined surfaces. When forms are removed, any nails that remain in the liner shall be pulled without tearing the liner and the resulting holes clearly marked. Form tie holes shall be marked before ties are broken off and all areas of serious abrasion of the liner shall be marked.
   2. Liner in pipe shall be cleaned at the direction of the Engineer and repaired prior to shipment of the pipe.
   3. Banding straps used in securing liner to forms for pipe and cast-in-place structures shall be removed within the limits of the unlined invert,
and voids left in the invert at the edge of the liner shall be filled with cement mortar or other material accepted by the Engineer.

3-4. FIELD JOINING OF LINER.

A. General:

1. No coating of any kind shall be applied over any joint, corner, or welding strip, except where nonskid coating is applied to liner surfaces.

2. Adhesive shall not be applied to the surfaces of cement mortar in pipe joints, or to the surfaces of liner or joint strips opposite said mortar and concrete surfaces.

3. Transverse joints are those perpendicular to the locking extensions.

B. Field Joints in Pipe Installations (For Reference):

1. Field joints in liner at pipe joints shall be one of the following types:
   a. Type P-1: A Type P-1 joint shall consist of a 4-inch joint strip, centered over the mortared pipe joint and secured along each edge to adjacent liner by means of a welding strip. The gap between ends of lock extensions shall not exceed 4 inches.
   b. Type P-2: A Type P-2 joint shall be made with an integral part of the liner extending 4 inches, plus 1/4 inch, beyond the spigot end of the pipe, overlapping the liner downstream from the pipe joint by at least 1/2 inch and secured to the downstream liner by means of a welding strip. The 4-inch liner flap extending beyond the spigot end of pipe shall be devoid of locking extensions and shall be protected from damage during pipe handling and jointing operations. Excessive tension and distortion in the flap caused by bending it back sharply at the end of the pipe will not be permitted. Flaps on extruded sheet shall be as stated in the paragraph entitled "Flaps" of this Specifications section.

2. Any flap that has been bent and held back during pipe laying and jointing operations shall be allowed to return to its original shape and flatness well in advance of making the liner joint.

3. For beveled pipe, the liner extension at the spigot end of the pipe shall be trimmed to extend 4 inches beyond and parallel to the beveled end. Length between ends of locking extensions shall not exceed 4 inches.

4. Field joints in liner at pipe joints shall not be made until the mortar in the pipe has been allowed to cure for at least forty-eight (48) hours.

5. All joints between lined pipe and lined cast-in-place structures shall be either Type C-1 or Type C-2 as specified herein.
C. Field Joints in Cast-in-Place Structures:

1. Field joints in liner on cast-in-place structures shall be one of the following types:

   a. Type C-1: A Type C-1 joint shall be made in the same manner as a Type P-1 joint is made. The width of the space between adjacent sheets of liner in a Type C-1 joint shall not exceed 2 inches. This type of joint is the only type permitted collateral with contraction joints in concrete. Its only other use is for joints between pipes and cast-in-place structures.

   b. Type C-2: A Type C-2 joint shall be made by overlapping sheets not less than 1-1/2 inches and securing the overlap to the adjacent liner by means of a welding strip. The upstream sheet shall overlap the downstream sheet. The length of that part of the overlapping sheet not having locking extensions shall not exceed 4 inches.

      (1) A welding strip shall be applied to the back of the joint. This type of joint may be used at any transverse liner joint other than those collateral with contraction joints in concrete and shall be used for liner joints made at longitudinal joints in concrete.

   c. Type C-3: A Type C-3 joint shall be made by putting sheets of liner together and applying a welding strip over the back of the joint before concrete is placed, and applying a welding strip over the front of the joint after concrete is placed. A Type C-3 joint shall not be permitted at a transverse joint that extends to a lower terminal edge of liner or at any joint where the gap between adjoining sheets of liner exceeds 1/8 inch.

2. Installation of Welding Strips:

   a. Welding strips shall be fusion welded to joint strips and liner by qualified welders using only approved methods and techniques. The welding operation of any joint shall be continuous until that joint has been completed.

   b. At the lower terminal edges of liner, each transverse welding strip shall be extended at least 2 inches to provide a tab for testing the weld as described in paragraph entitled “Field Testing” in this Specifications section.
3. Joint Reinforcement:

a. A 12-inch-long welding strip shall be applied as a reinforcement across each joint in liner that extends to the lower terminal edge of liner on each side of a pipe or structure. These reinforcement strips shall be centered over the joint being reinforced, shall be located as close to the lower edge of liner as practicable, and shall be welded in place after the transverse welding strips have been tested and the test tabs removed.

3-5. APPLICATION OF PLASTIC LINER WITH ADHESIVES.

A. Concrete Surfaces:

1. The concrete surface shall be cured and etched by sandblasting to develop a slightly granular surface. Permits for the equipment and allowable methods from the SCAQMD shall be posted on or near sandblasting equipment as required. When permitted by the Engineer, the concrete surface may be acid etched in lieu of being sandblasted.

2. After the sandblasting, the concrete surface shall be thoroughly cleaned of dust. Surfaces etched with acid shall be thoroughly dried before applying primer.

3. The concrete surface shall then receive two brush coats of an approved primer. Coverage shall not exceed 250 square feet per gallon for each coat of primer. The first coat of primer shall be thinned with an equal amount of approved thinner. The first primer coat shall be permitted to dry for at least two (2) hours before the application of the second primer coat. The second coat of primer shall be applied unthinned and permitted to dry for at least four (4) hours.

4. The concrete surface and the back surface of the liner shall each be given two coats of an approved adhesive. Two hours drying time shall be allowed between application of these coats. Coverage shall not exceed 250 square feet per gallon for each coat of adhesive.

5. One coat of an approved activator shall be applied to both the adhesive coat on the liner and the adhesive coated concrete. Application of activator shall be limited to the extent that the application of coated liner can be completed within a twenty (20)-minute period. The activator shall be applied evenly by brushing. Coverage of the activator shall not exceed 500 square feet per gallon.

6. When the surface of the adhesive is barely tacky to the touch, the liner shall be positioned with one edge firmly pressed down. The liner shall then be rolled into place, care being taken to avoid the formation of air pockets. All joints shall be tight-fitting butt joints. The surface of the liner shall be rubbed vigorously to secure the liner firmly in place.
7. Corner and welding strips shall be positioned over all joints and welded in place.

3-6. NONSKID SURFACES.

A. All surfaces of liner shown on the Drawings to be nonskid shall be treated as follows:

1. After all corner and welding strips have been installed, the surface of the liner shall be cleaned, dried, and sprayed with an adhesive coating recommended by the manufacturer of the liner.

2. The surface shall then be liberally sprinkled with clean, dry, well-graded sand, all of which will pass through a No. 30 sieve but be retained on a No. 70 sieve.

3. After the sanded surface has thoroughly dried, all excess sand shall be brushed away, and a seal coat of the adhesive coating shall be sprayed over the sand in sufficient quantity to coat and bond the sand to the liner.

4. The coated sand surface shall be allowed to dry thoroughly before any walking is permitted thereon.

3-7. APPLICATION OF PLASTIC LINER BY MECHANICAL MEANS. Where mechanical application is indicated on the drawings and only where indicated, plastic liner shall be furnished and installed in accordance with the notes and details shown thereon. The plastic liner shall be of the same composition as stated in paragraph entitled "composition" of this specifications section, 3/32 inch thick and manufactured without locking extensions for all lined surfaces. Plastic liner plain sheet shall be attached to the structure by molly drive-nail anchors (1/2 by 1-1/2 inch) no. 6520 or equal, as shown on the drawings. Stainless steel strap bands (1/2 by 1/8 inch) with 1/4 by 3-inch tap-ins on 12-inch centers shall be used, as shown on the drawings. All areas shall be spark-tested by the contractor in the presence of the engineer and all holes patched by the contractor, subject to acceptance by the engineer.

3-8. APPLICATION OF PLASTIC LINER TO STEEL SURFACES. All fabrication and welding of steel to be lined with plastic liner shall be completed before the liner is installed except for field welding.

All steel surfaces to which plastic liner is to be applied shall be sandblasted, leaving surfaces free of all mill scale, rust, grease, moisture, and other deleterious substances. All interior welds shall be ground smooth and all weld spatters removed. After welds are ground, weld metal shall not project more than 1/16 inch above the structure surface. In the event that field welding is required, the plastic liner shall not be installed closer than 12 inches to the weld.
Plastic liner shall be installed in the weld area after welding on the steel has been completed.

The application of primer, adhesive, activator, and liner to steel surfaces shall conform to the requirements set forth herein for bonding of liner to concrete surfaces with adhesive. All field joints shall be tight-fitting butt joints. After the liner has been applied to steel surfaces, corner strips or welding strips shall be applied over all joints and welded in place.

3-9. PROTECTION AND REPAIR OF LINER. All necessary measures and precautions shall be taken to prevent damage to liner from equipment and materials used in, or taken through, the work. Any damage to installed liner shall be repaired by the contractor in accordance with the requirements set forth herein for the repair of liner.

All nail and tie holes and all cut, torn, and seriously abraded areas in the liner shall be patched. Patches made entirely with welding strip shall be fused to the liner over the entire patch. The use of this method is limited to patches that can be made with a single welding strip. The use of parallel, overlapping or adjoining welding strips shall not be permitted. Larger patches may consist of smooth liner over the damaged area with edges covered with welding strips fused to the patch and to the liner adjoining the damaged area. The size of a single patch of the latter type shall be limited only as to its width, which shall not exceed 4 inches.

Wherever liner is not properly anchored to concrete, or wherever patches larger than those permitted above are necessary, the repair of liner and the restoration of anchorage shall be as directed by the Engineer.

3-10. GAS FLAPS. Gas flaps shall be installed at all locations shown on the contract documents or when directed by the engineer in accordance with details shown on the drawings.

3-11. TESTING.

A. Shop Testing:

1. All liner shall be shop tested for holes, using an approved spark detector operating at a minimum of 20,000 volts. Sheets having holes shall be repaired in the shop and retested prior to shipping the sheets to the Project site or the pipe manufacturing plant. Repairs shall be made only by welders prequalified as provided herein. The repair and retest results shall be subject to Engineer's acceptance.

2. All sheets to be used in reinforced concrete pipe shall be tested at the pipe manufacturer’s plant as well as in the field.
B. Field Testing:

1. The surface of liner shall be cleaned to permit visual inspection and spark testing. All welds shall be physically tested with a nondestructive probing method. All liner, when installed, shall be tested by the Contractor in the presence of the Engineer, using a spark-type detector. All areas of liner failing to meet the field test shall be properly repaired and retested.

2. The Contractor shall furnish a high-voltage detector for testing. The detector shall be set at 20,000 volts and a ground wire from instrument ground output terminal attached to the conductive substrate to ensure a positive electrical contact. When testing concrete surfaces, the ground wire shall be attached to the rebars. If they are not visible, the ground wire shall be placed directly against the bare concrete surface and weighted with a damp cloth or paper sand-filled bag.

3. Periodically during the test, the exploring electrode should contact the conductive substrate to verify that the instrument is properly grounded. The exploring electrode should move over the surface of the dry liner at a rate of approximately 1 ft/sec (0.3 m/sec) using a single pass. Moisture on the coating surface may cause erroneous indications. If moisture exists, remove or allow the surface to dry before conducting the test.

4. Discontinuities that require repair shall be identified with a marker that is compatible with the repair coating or one that is easily removed.

5. All repairs to the liner shall be retested by the Contractor in the presence of the Engineer.

6. Any spark testing of liner by the Contractor for the Contractor's own purpose shall be done with a detector accepted by the Engineer.

7. Holiday testing shall be made following these procedures.

8. Each welding strip that extends to a lower edge of the liner shall be tested. The welding strips shall extend below the liner providing a tab. A 10-pound pull shall be applied, normally to the face of the pipe or structure by means of a spring balance. Liner adjoining the welding strip shall be held against the concrete during application of the force. The 10-pound pull shall be maintained if a weld failure develops, until no further separation occurs. Defective welds shall be retested after repairs have been made. Tabs shall be trimmed away neatly by the liner installer after the welding strip has passed inspection. The Contractor shall provide all equipment required to test liner in the manner recommended by the manufacturer and as described above. The Contractor shall also provide personnel qualified to perform the testing. Testing shall be performed in the presence of the Engineer.

End of Section
DIVISION 7 – Thermal and Moisture Protection
PART 1 – GENERAL

1-1. SCOPE. This section covers furnishing and installation of dampproofing for concrete.

Dampproofing of concrete surfaces exposed to water in potable water treatment, distribution, or pumping facilities, shall be with NSF certified epoxy enamel, and shall be in accordance with the Protective Coatings section. Waterproofing is covered in the Elastomeric High-Solids Urethane Lining Systems section.

PART 2 - PRODUCTS

2-1. MATERIALS. Materials to be used shall be as follows:

- Coal Tar Epoxy: Ameron “Amercoat 78HB Coal Tar Epoxy, Carboline “Bitumastic 300 M”, Tnemec “46H-413 Hi-Build Tneme-Tar”, or Sherwin-Williams “Hi-Mil Sher-Tar Epoxy”.
- Emulsified asphalt: Henry “HE 107-Asphalt Emulson”.
- Epoxy Enamel: As specified in the Protective Coatings section.
- Membrane: Grace “Bituthene 3000 and Bituthene Low Temperature”.

Emulsified asphalt shall be solvent free and made from asphalt emulsified with bentonite clay and water.

Membrane shall be a self-adhesive rubberized asphalt/polyethylene waterproofing material with a minimum thickness of 1/16 inch (1.5 mm).

2-2. SURFACES TO BE DAMPPROOFED. Exterior wall surfaces which are poured against sheeting or undisturbed earth need not be dampproofed. The following concrete surfaces that are not in contact with treated or potable water shall be dampproofed:

- All exterior concrete wall surfaces forming a part of an interior room or dry pit which will be in contact with earth backfill below finished grade and above the top of the footings or bottom slabs.
b. All exterior wall surfaces of cast-in-place and precast concrete electrical manholes and handholes below finished grade and above the top of the footings or bottom slabs.

c. All walls in contact with liquid where the opposite face is above grade or exposed in an interior room, except when waterproofing is specified.

d. The following structures shall be dampproofed:
   - Microfiltration Structure
   - Secondary Effluent Pump Station
   - Diversion Structure
   - Weir Box
   - Metering Structure
   - Valve Vaults

PART 3 - EXECUTION

3-1. SURFACE PREPARATION. When dampproofing is applied, concrete surfaces shall be clean and dry. Any repairs to existing concrete shall be made as part of the surface preparation in accordance with the Concrete Crack Repair section. Concrete repair methods shall be acceptable to the Engineer. Except where membrane is applied, new concrete shall cure at least 28 days before dampproofing material is applied. Concrete shall be allowed to cure in accordance with the membrane manufacturer’s recommendation before membrane dampproofing is applied. Concrete shall be prepared to receive the dampproofing material as recommended by materials manufacturer.

All dirt, dust, sand, grit, mud, oil, grease, and other foreign matter shall be removed in accordance with ASTM D4258 and the surface abraded when recommended by the manufacturer of the dampproofing material. Abrading shall be done in accordance with ASTM D4259. Prior to application of the coating, the surfaces shall be thoroughly washed, or cleaned by air blasting, to remove all dust and residue.

3-2. APPLICATION. Dampproofing materials shall not be thinned unless recommended by the manufacturer. Dampproofing using coal tar epoxy shall be applied in at least two coats, with a total dry film thickness of at least 20 mils.

Surfaces not intended to be dampproofed shall be protected from contamination, discoloration, or other damage. Such surfaces shall be masked as necessary to protect uncoated areas and to confine the dampproofing to the intended limits.

Surfaces shall be dry and at recommended temperature when dampproofing is applied. Unless properly protected, coatings shall not be applied in wet, damp,
or foggy weather or when windblown dust, dirt, or debris, or insects would collect on the coating. Dampproofing, other than low temperature membrane dampproofing, shall not be applied when the temperature of the air or the surface is below 50°F, unless approved by manufacturer. Low temperature membrane dampproofing may be applied at air and surface temperatures as low as 25°F if approved by manufacturer and acceptable to the Engineer.

Dampproofing shall be applied by brush, high pile rollers, or spray equipment complying with the manufacturer's recommendations. If blistering occurs, all blisters larger than 1/4 inch in diameter shall be broken before the subsequent coat is applied.

Emulsified asphalt shall be installed in accordance with manufacturer's recommendations and at the maximum coverage rate recommended by manufacturer that is acceptable to Engineer.

Membrane shall be installed in accordance with manufacturer’s recommendations including the recommended primer.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers the water repellent coating for exterior surfaces of the architectural concrete.

1-2. GENERAL. The water repellent coating shall be delivered in unopened containers, labeled with the manufacturer's name, and shall be applied in accordance with the manufacturer's recommendations.

1-3. SUBMITTALS. Complete specifications covering the materials furnished under this section shall be submitted in accordance with the submittals section. Data verifying that the applicator has been trained and licensed by the manufacturer of the water repellent coating shall also be submitted.

1-4. WARRANTY. The water repellent coating shall have a 5 year written warranty against moisture penetration through the treated areas.

PART 2 - PRODUCTS

2-1. MATERIALS. The water repellent coating shall be "Blok-Lok" manufactured by Rainguard Products Company, Huntington Beach, California.

PART 3 - EXECUTION

3-1. SURFACE PREPARATION. New concrete shall be allowed to cure for 30 days prior to application of the coating, and moisture content on any surface shall not exceed 15 percent as registered on an electronic moisture meter.

The surfaces to which the water repellent coating is to be applied shall be clean and dry. All dirt, grease, asphalt, tar, stains, clinging mortar, efflorescence, and contamination of every kind shall be removed by suitable methods.

All deformities, cracks, bug-holes, honey combing, etc. shall be neatly filled; the filled areas shall be allowed to cure and become dry and hard before the water repellent coating is applied. All joints shall be tight and sound.
3-2. **APPLICATION.** All exterior architectural concrete shall be sealed with water repellent coating applied by experienced, fully trained applicators licensed by the manufacturer of the coating.

The water repellent coating shall be applied in one or two coats, as recommended by the manufacturer, with 48 hours between coats, unless otherwise recommended by the manufacturer. Sufficient coats shall be applied to achieve a consistent and uniform appearance.

The water repellent coating shall be applied with airless spraying equipment using low pressure and tip sizes as recommended. The coating shall be applied as a flood coat as recommended by the manufacturer.

Care shall be taken to shield all surfaces that are not to be covered with the water repellent coating. Any such surfaces which are contaminated shall be immediately and thoroughly cleaned.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers thermal insulation and associated items not covered in other sections.

Insulation to be installed under the roofing membrane is specified in the roof covering section. Mechanical ductwork insulations are specified in the heating, ventilating, and air conditioning section. Glass fiber pads for the acoustical treatment system are covered in the acoustical treatment section.

1-2. GENERAL. Thermal insulation shall be furnished and installed as specified herein and as indicated on the drawings. Thermal insulation shall batt type.

1-3. SUBMITTALS. Complete specifications covering the materials furnished shall be submitted in accordance with the submittals section.

A sample of each type of thermal insulation shall be submitted in accordance with the submittals section, and such samples will be held to be representative of the properties and characteristics of the finally installed insulation.

1-4. STORAGE AND HANDLING. All materials shall be delivered in the original unopened packages bearing the name of the manufacturer and the brand. Insulation shall be stored under cover in a dry place and shall be protected from the weather at all times. Good fire safety practices shall be observed at all times during storage and installation.

PART 2 - PRODUCTS

2-1. MATERIALS. Materials to be used shall conform to the following:

Batt Type Insulation

Standard: ASTM C665, mineral or glass fiber, Type II, Class C (nonreflective membrane, one face), 6 inch thick with R value of 19; Owens-Corning or Manville.
2-2. LOCATION FOR INSTALLATION.

2-2.01. Standard Batt Insulation. Standard batt insulation shall be installed in metal stud assemblies at the locations indicated on the drawings.

2-2.02. Safing. Safing insulation shall be installed where required for fire wall closures and other locations as indicated on the drawings.

PART 3 - EXECUTION

3-1. INSTALLATION OF BATT INSULATION.

3-1.01. Metal Stud Walls. Batt type insulation shall be forced into the space between the metal studs for a friction-fit installation. Insulation with non-reflective membrane covering shall be installed with the membrane covering on the inside (warm) face of the wall.

3-1.02. Safing Type. Safing insulation shall be neatly stuffed to completely fill all voids between the metal deck and walls and also to fill all voids where steel members penetrate fire walls. Manufacturer's standard safing clips shall be provided as required.

End of Section
Section 07412
METAL WALL PANELS

PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing and erection of two types of metal wall panels, including trim, copings, flashings, clips, fasteners, sealants, and appurtenances, as indicated on the Drawings and as specified herein.

1-2. GENERAL. The materials to be furnished and installed under this section include, but are not limited to, the following:

- Factory-formed, insulated and field-assembled wall panels.
- Subgirts, where required.
- Flashings, trim, copings, and closures.
- Clips, spacers, and shims.
- Caulking and sealing materials.
- Fasteners.

1-3. SUBMITTALS. Submit product data that includes material descriptions, dimensional characteristics of individual components and profiles and finishes of panels and components. Before fabrication, detailed fabrication and erection drawings shall be submitted in accordance with the Submittals section. Submittals shall include jointing, trim, and flashing and coping details, including termination and penetrations.

1-4. HANDLING AND STORAGE. The wall panel materials shall be handled in a manner, which will prevent bending, dents, scratches, or damage of any kind. Damaged units and accessories will be rejected and shall be replaced by and at the expense of the Contractor promptly after rejection. Materials shall be stored under cover at all times.

1-5. FINISH. Wall panels, trim, seam corners, flashings, copings and all exposed appurtenances shall have finish coatings as specified in the Materials section of this specification.

1-5.01. Color Selection. The colors shall be selected by the Engineer to match the existing Reverse Osmosis Building from the manufacturer’s full range of standard and custom colors. Samples shall be submitted for color selection.

1-6. WARRANTY. The manufacturer of the metal wall systems shall furnish to the Owner a warranty covering materials for a period of 2 years and finish for a period of 20 years from the date of acceptance. Wall panels shall be designed
for 20 psf wind pressure and a maximum deflection of L/180. Span lengths between supports shall be as indicated on the Drawings. This warranty shall also cover any panels that are reused from the existing building.

The applicator of the metal systems shall provide a warranty covering installation and workmanship for a period of 2 years from the date of acceptance, including any reinstalled existing panels.

PART 2 - PRODUCTS

2-1. MATERIALS. Materials shall conform to the following:

Field Assembled Wall System

Concealed Fastener (Lap Seam)

Metal Wall Panel

“Sleek AZ” coated sheet steel, 7/8 inch deep by 12 inches wide, 20 gage, G90 Galvanized with finish coating system; Centria “1W-60A” or approved equal.

Subgirts

Hat shaped steel furring channel as shown on the drawings, 18 gage, G90 galvanized; Centria "Hat shaped subgirt" or approved equal.

Factory Formed Wall System

Insulated Flat Exterior Panels

Smooth surface, core insulation between 22 gage, zinc coated (galvanized) steel sheets, 30 inches wide by 2 inch depth, G90 Galvanized with finish coating system; Centria "Formawall 'Dimensions' Series", or approved equal. Thermal resistance value equal to R= 13.9.

Flashings, Trim and Coping

Periphery trim shall have concealed fasteners wherever possible. Extruded aluminum sections shall be supplied with finish matching panels. Extruded aluminum profiles as indicated on the drawings shall be formed with 6063-T5 aluminum.
with the exposed surface finished to match wall panels. All joints in extrusions shall have internal lapstrips faced on the outside with bond breaker tape and face sealed with silicone sealant. Extrusions shall be designed to eliminate field applied sealants. Sheet metal trim shall be material with finish to match the panels. Gauges shall be adequate to insure flatness. Perimeter sill trim shall be designed to not hold water and shall have weep holes where required.

Clips, Spacers, and Shims

Manufacturer's standard, noncorroding.

Fasteners

Manufacturer's standard self-tapping screws or bolts with separate cupped washers and bonded neoprene gaskets; Alloy 305 stainless steel for all exterior, and for interior in contact with aluminum; cadmium plated steel in contact with interior steel, concealed where possible.

Caulking Tape

Reinforced polyisobutylene, Interchemical “Prestite 162”, Pecora “B-44 Extru-Seal”, or approved equal.

Caulking Compound

Polybutene, Presstite “412.9”, Tremco “RP545 Seamsealer”, or approved equal.

Finish

Concealed Fastener (Lap Seam) Metal Wall Panel

Exposed finish coat shall be “Durallure Finish System” et. al. coating comprising 55% aluminum/zinc alloy and clear
acrylic clear coat, manufacturer’s unbrushed natural look.

Concealed finish manufacturer’s standard light colored acrylic or polyester backer finish, 0.5 total dry film thickness.

**Insulated Flat Exterior Panels**

Manufacturer's standard “fluoropolymer three-coat system”, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer top coat: 70% polyvinylidene fluoride by weight and min thickness per coat 1.5 mil.

Concealed finish manufacturer’s standard light colored acrylic or polyester backer finish, 0.5 total dry film thickness.

Metal panel returns and mitered panel corners shall match the conditions of the existing building at similar conditions.

**PART 3 - EXECUTION**

3-1. **INSPECTION.** The applicator shall examine the surfaces on which the work is to be applied. The applicator shall notify the Engineer, in writing, if the surfaces are not suitable to receive the metal wall panels. Applicator shall obtain and verify all field measurements prior to fabrication of the wall panels.

3-2. **FABRICATION.** Panels (Lap Seam) shall be field assembled as indicated on the Drawings and specified herein.

Wall panels, flashings, trim, and accessories shall be fabricated in accordance with the details on the Drawings, to tolerances, which will ensure proper fit, appearance, and weathertightness when erected.

The wall panel system shall be fabricated so that no fasteners are exposed after erection, except where exposed fasteners are incorporated in the design or are required for securing flashing and trim. The field assembled system shall consist of liner panels, insulation, and subgirts as indicated.
Flashings shall include all materials referred to on the Drawings as flashings, trim, or closures.

3-3. **INSTALLATION.** The Contractor shall check the alignment of the girts and other steel supporting the wall panel materials. The Contractor shall notify the Engineer if any of the supporting structural steel is not aligned to the tolerances established by the AISC.

Materials shall be installed by experienced mechanics who are directly employed by the wall panel manufacturer or by an erector currently franchised by the panel manufacturer and who has experience in installing projects of similar or greater complexity.

Both metal wall panel systems shall be installed complete with all flashings, copings, appurtenances and accessories. Joints and seams shall be maintained in correct horizontal and vertical alignment.

Adequate provisions shall be made for framing around all openings indicated on the Drawings with finished flashings matching the wall panels.

All joints shall be securely sealed and drawn tight during erection as indicated on the Drawings or as directed by the panel manufacturer, to provide permanent, positive and complete protection against infiltration of air or moisture.

All trim, extrusions, closure panels, copings and flashings shall be installed to provide watertight joints. All penetrations shall be coordinated with the work of other trades. Any damaged materials shall be replaced; only minor scratches and abrasions may be touched up.

3-4. **CLEANING.** After installation is complete, all exposed surfaces of the wall panel systems, including flashings, copings and accessories, shall be cleaned of all dust, dirt, grease, and other foreign material to the satisfaction of the Engineer.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing and installation of modified bitumen roofing, complete with vapor retarder, fasteners, insulation, flashings, and accessories. The roof system shall meet UL Class A rating and FM wind uplift Classification 1-60.

1-2. GENERAL. Except as otherwise indicated on the Drawings, all new roof decks shall be covered with an insulated, hot asphalt mop applied, SBS modified bitumen roofing system. The roofing shall provide a watertight roof under all conditions of weather and service except physical damage due to unforeseen causes.

The term "square" as used herein, shall mean an area of 100 square feet.

1-3. QUALITY ASSURANCE.

1-3.01. Manufacturer's Field Services. The roofing manufacturer shall provide the following field services:

a. Conduct daily inspections of the project, with written daily reports to be filed weekly with Engineer. Inspector will be a full-time employee of the roofing manufacturer, with a minimum of five years of employment with the company.

b. Update Engineer after daily inspections as to any changes in the progress and quality of the work as observed.

c. Inform Engineer of those matters observed which he considers to be in violation of the contract requirements.

d. Report to Engineer in writing any failure or refusal of Contractor to correct unacceptable practices called to his attention.

e. Supervise the taking of test cuts and the restoration of the cut areas. Test cuts shall be taken to verify that all materials and installation conform to the Drawings.

f. Confirm after completion of the work, based on his observations and tests, that he has observed no application procedure in conflict with the Drawings other than those that may have been previously reported.
1-3.02. **Inspection.** After application of the roofing membranes, Engineer may, at his discretion, require that five samples be cut from the finished roofs at the locations directed. Samples shall be approximately 15 inches square, cut across the plies to the top of the insulation, exposing all layers of membrane, from which neat 12 inch square samples may be made. Test samples shall be sent to an acceptable testing laboratory to be examined for weight, number of plies, type of felt, full uniform mopping, ply adhesion, and other characteristics. Costs of testing, if required, will be paid by Owner.

If test sample examination reveals faulty construction or insufficient quantity of materials, additional materials shall be furnished and applied, and other corrective measures taken, by Contractor as directed by a representative of the roofing material manufacturer. Additional test cuts shall then be made if requested by Engineer.

Test sample cutout areas shall be patched in accordance with the manufacturer's recommendations. No extra payment will be made for repair of cutout areas.

1-4. **SUBMITTALS.** Complete specifications and data covering the materials furnished under this section shall be submitted in accordance with the Submittals Procedures section. The data supplied for bitumen shall include the equivaliscous temperature (EVT), flash point (FP), finished blowing temperature (FBT), and softening point (SP).

Drawings shall be submitted indicating the manufacturer's recommended layout for each area of tapered insulation and crickets indicated on the Drawings.

1-5. **ROOFING PERFORMANCE.** The roofing Contractor shall be responsible for the satisfactory performance of the roof coverings and membrane flashings for a period of 2 years after roof installation.

In addition to the roofing Contractor's responsibility, the manufacturer of the roofing membrane materials (felt, asphalt, and bitumen) shall furnish to Owner, through the roofing Contractor, a guarantee which shall warrant the quality of the roofing membrane, insulation, flashing materials and workmanship and the application of the roofing membrane, fabric flashings, insulation and accessories. The guarantee shall be for a period of 20 years from the date of application. The guarantee shall cover conditions of wind uplift speed of 55 miles per hour. The guarantee shall provide for the maintenance of the roof covering in a watertight condition and the repair of all leaks that may occur due to defective materials, improper workmanship, and normal weather exposure.

The dollar amount of the warranty shall be unlimited (no dollar limit).

Copies of the guarantee shall be executed in duplicate and delivered to Engineer.
PART 2 - PRODUCTS

2-1. MATERIALS. All materials used in construction of the roof membrane shall be furnished by the same manufacturer. To establish type and quality of materials, Drawings are based on Celotex or Schuller products. Other systems would be considered if requirements of these Drawings are met. Materials shall be manufactured by firms of national reputation and shall conform to the following:

<table>
<thead>
<tr>
<th>Product</th>
<th>Specification/Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot mop applied SBS Roofing System</td>
<td>NRCA specification plate. MBS1-I-M-G2-M with base sheet; Celotex &quot;SBS-4-F-M&quot; or Schuller &quot;SBS-4PID&quot;.</td>
</tr>
<tr>
<td>Base Sheet</td>
<td>ASTM D4601, Type II fiberglass reinforced base sheet; Celotex &quot;Vaporbar GB&quot; or Schuller &quot;GlasBase&quot;.</td>
</tr>
<tr>
<td>Intermediate Plies</td>
<td>ASTM D2178, Type VI fiberglass reinforced ply sheet, Celotex &quot;Celo-Glass-AGS&quot; or Schuller &quot;GlasPly Premier&quot;.</td>
</tr>
<tr>
<td>Cap Sheet Membrane</td>
<td>Polyester reinforced, premium grade SBS modified bituminous cap sheet surfaced with mineral granules; Class A fire rating. Nominal 170 mils minimum, including mineral surface. Celotex &quot;SBS-FR&quot; or Schuller &quot;DynaLastic 180 FR&quot;.</td>
</tr>
<tr>
<td>Flashing Sheets</td>
<td>Asphalt impregnated glass fiber sheet, Celotex &quot;AB-20-Plus&quot; or Schuller &quot;Glas-Tile Reinforced Flashing Sheet&quot;.</td>
</tr>
<tr>
<td>Bituminous Materials</td>
<td></td>
</tr>
<tr>
<td>Asphalt Primer</td>
<td>ASTM D41.</td>
</tr>
<tr>
<td>Mopping Asphalt</td>
<td>First quality domestic grade, Type III, ASTM D312 mopping grade.</td>
</tr>
<tr>
<td>Plastic cement</td>
<td>ASTM D4586, Type II.</td>
</tr>
<tr>
<td>Vapor Retarder</td>
<td>ASTM D4601, Type II fiberglass reinforced base sheet.</td>
</tr>
<tr>
<td><strong>Insulation</strong></td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Composite</strong></td>
<td>Composite board with 1/2 inch minimum perlite board factory bonded to polyisocyanurate foam with opposite side faced with glass fiber felts; ASTM C1289, Type III; Apache &quot;Millox&quot;, GAF &quot;Isotherm Composite&quot;, Schuller/NRG &quot;E-NRG-Y2 Composite&quot; or as recommended by the membrane manufacturer.</td>
</tr>
<tr>
<td><strong>Flat</strong></td>
<td>Uniform thickness as indicated on the Drawings.</td>
</tr>
<tr>
<td><strong>Tapered</strong></td>
<td>Thickness and slope as indicated on the Drawings.</td>
</tr>
<tr>
<td><strong>Cricket System</strong></td>
<td>Insulation manufacturer's standard factory pre-cut cricket system, pattern as indicated on the Drawings.</td>
</tr>
<tr>
<td><strong>Perlite Board</strong></td>
<td>ASTM C728, expanded perlite blended with binders, 1 inch thick; Celotex &quot;Celo-Therm&quot;, GAF &quot;GAFTEMP Permalite&quot;, or as recommended by the membrane manufacturer.</td>
</tr>
<tr>
<td><strong>Roof Barrier Board</strong></td>
<td>ASTM C1177, 5/8 inch, glass mat gypsum roof board; Georgia Pacific &quot;Dens-Deck Fireguard&quot;.</td>
</tr>
<tr>
<td><strong>Cover Board</strong></td>
<td>ASTM C728, 1/2 inch expanded perlite board; &quot;GAFTEMP Perlite Recover Board&quot;, Schuller &quot;Retro-Fit Board&quot; or as recommended by membrane manufacturer.</td>
</tr>
<tr>
<td><strong>Preformed Cant Strips</strong></td>
<td>Celotex &quot;Fiberboard&quot; or Schuller &quot;FesCant Plus&quot;, 4 inches x 4 inches.</td>
</tr>
<tr>
<td><strong>Edge Strips</strong></td>
<td>Celotex &quot;Fiberboard&quot; 12 inches wide.</td>
</tr>
<tr>
<td><strong>Mechanical Fasteners</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Metal Deck Applications</strong></td>
<td>Corrosion resistant type for metal deck specified, Factory Mutual approved for roof insulation used, and for fire and wind resistance requirements specified.</td>
</tr>
<tr>
<td><strong>Asphalt Walkway Planks</strong></td>
<td>Granule surfaced, 1/2 inch thick, Celotex &quot;Carey Tred&quot; or Meadows &quot;Whitewalk&quot;.</td>
</tr>
</tbody>
</table>
Expansion Joint Cover  International Permalite "Metalastic Mark II" or Schuller "Expand-o-Flash", with PVC, encapsulated carbon steel, or exposed stainless steel flanges.

Roofing Nails  1-1/2 inch galvanized barbed type, 11 gage thick, with 7/16 inch diameter heads.

Sheet Metal Screws  1/4 - 14 x 1-1/2 HWH with sealing washer, zinc plated.

Masonry Nails  Hardened-steel screw type, 9 gage, with 5/16 inch diameter heads.

Unless otherwise specified, parapet caps, gravel stops, cap and counterflashings, sheet lead, pitch dams, and similar metal items are covered in the Sheet Metal section.

PART 3 - EXECUTION

3-1. INSPECTION. The roofing membrane manufacturer's representative and the roofing subcontractor shall conduct all required inspections and shall submit to the roofing manufacturer all required drawings, details, and completed questionnaires as needed to obtain the specified warranty.

3-2. PREPARATION OF ROOF SURFACES. New roof surfaces shall be cleaned and inspected before any roofing materials are applied. All drainage fixtures shall be set at the proper level to permit free flow of water.

The roof surfaces to be covered shall be smooth, hard, dry, and free from high spots and depressions, frost, or effects of frost. Roof surfaces shall be swept clean and free from dust, loosened cement scale, and debris. Roof surfaces shall be examined for openings, holes, or crevices which might allow bitumen to drip or flow through the deck or between the deck and vertical projections. Such openings shall be filled or covered before any roofing materials are applied.

3-3. CONSTRUCTION OF ROOF COVERING ASSEMBLIES. The roof coverings systems shall be as specified herein and as indicated. The roofing system assemblies shall conform to one or more of the following systems as indicated on the data sheet and on the Drawings. The applied weights of steep asphalt shall be the specified weight, ±20 percent.
3.4. **APPLICATION OF ROOFING.** Roofing shall be applied only when the outdoor temperature is above 40°F.

Throughout the work, steep asphalt shall be maintained within the recommended equiviscous temperature range and shall be hot when the felts are embedded therein. Asphalt and bitumen shall not be heated above the flash point. The temperature shall be checked each day with a thermometer by the manufacturer's representative. The kettle must be equipped with a working thermometer.

All joints between precast concrete roof panels shall be prepared to prevent bitumen dripping through the joints. The joints shall either be taped; stripped-in with a relatively heavy weight coated base sheet or modified bitumen base sheet set in hot steep asphalt or solvent-based asphalt roof cement; or stripped-in with a torch applied modified bitumen sheet; or other joint treatment recommended by the roof membrane manufacturer prior to the roof membrane applications.

3.4.01. **Barrier Board.** Where polystyrene insulation is applied over metal deck, barrier board shall be installed prior to installation of the insulation. Barrier board shall be installed with approved fasteners in accordance with Factory Mutual and manufacturers recommendations. Barrier board shall be installed in maximum lengths with edge joints parallel to and on deck ribs. End joints shall be staggered.
3-4.02. **Nailers.** Nailers shall be continuous and shall be installed level and straight. At least two anchor bolts shall be provided for each nailer. Washers shall be placed under all bolt heads and nuts in contact with lumber.

3-4.03. **Vapor Retarder.** The entire surface of each metal or concrete roof deck requiring vapor retarder shall receive one ply of base sheet to serve as the vapor retarder. The vapor retarder shall be installed atop the deck as specified in the Assemblies section. All plies shall be lapped 19 inches, and shall be embedded in and coated with steep asphalt. All end laps shall be at least 6 inches, and all laps shall be thoroughly sealed. Flashings shall be provided at all vertical projections.

Before proceeding with the remainder of the roofing installations, the vapor retarder shall be examined for damage. Damaged areas shall be repaired to the satisfaction of Engineer.

3-4.04. **Insulation.** All insulation shall be dry when installed and shall be covered with the specified roofing membrane the same day it is installed.

Insulation boards shall be laid with joints staggered between parallel courses and between layers, if applicable. Abutting edges of boards shall be laid in moderate contact, not forced into place. At vertical surfaces, insulation shall be cut neatly to provide a clearance of not more than 1/2 inch.

Each insulation board shall be firmly embedded in steep asphalt.

Insulation boards for tapered systems shall be positioned in accordance with the manufacturer’s layout to produce roof slopes and drainage patterns as indicated on the Drawings. The installed thickness of insulation shall be as indicated on the Drawings.

Crickets to provide positive roof drainage as indicated on the Drawings shall be installed as indicated on the Drawings per the manufacturer’s recommendations.

All insulation over metal roof decks and where recommended over concrete decks by the membrane manufacturer, shall be anchored to the deck with mechanical fasteners in accordance with FM Bulletin 1-28 and the FM Approval Guide. Installation of the mechanical fasteners shall be in accordance with the manufacturer’s recommendations.

3-4.05. **Cover Board.** Recover boards shall be installed over all polystyrene insulation as recommended by the roofing manufacturer. Cover boards shall be attached as recommended by the membrane manufacturer for the wind design specified.
3-4.06. **Preformed Cant Strips and Tapered Edge Strips.** Preformed cant strips and tapered edge strips shall be firmly embedded in a thick layer of asphalt mastic applied to all roof insulation and wall or curb surfaces which will be in contact with edges of the cant or edge strip.

3-4.07. **Roofing Membrane.** All composite insulation shall have one ply of base sheet solidly embedded in approximately 25 lbs of asphalt per square, taking care to leave no voids, gaps, or fishmouths.

All polystyrene insulation shall be covered with a 1/2 inch thick expanded perlite cover board prior to installation of roofing membranes. Attachment of the cover board shall conform to the membrane manufacturer's requirements. After cover board installation, one ply of base sheet shall be solidly embedded in approximately 25 lbs of asphalt per square, taking care to leave no voids, gaps, or fishmouths.

Over the base sheet, two intermediate plies of ply sheet and one ply of torch-down cap sheet for APP systems or one ply of cap sheet set in hot mopped asphalt for SBS systems, shall be installed in accordance with the manufacturer's recommendations. The intermediate plies and cap sheet shall run parallel to the base sheet. The intermediate ply sheets shall be side-lapped a minimum of 3 inches. The cap sheets shall also have sides lapped a minimum of 3 inches.

On all SBS style membrane applications, care shall be taken to properly apply the membrane by mopping the hot asphalt flood coat over previous plies to eliminate any non-bonding or air entrapped under the cap sheet. While the asphalt is still hot, mineral aggregate matching the mineral surfacing of the cap sheet shall be broadcast into the asphalt that bleeds out of the laps.

Where cant strips are used in connection with metal counterflashings at masonry walls or concrete curbs or metal curbs, the base sheet and all roofing plies shall extend up the cant and 2 inches up the vertical face of the curb or wall and shall be cut off, unless otherwise recommended by the manufacturer of the roofing materials.

At the end of each day's work, temporary water cutoffs, consisting of two plies of roofing felt solid mopped into place, shall be installed to protect the unfinished edges of the insulation and roofing. Cutoffs shall be removed when work is resumed.

3-5. **ROOF FLASHING.** Completed flashings which have soft or vacant areas between plies shall be removed and relaid in a manner which will produce a firm, solid installation, resistant to damage from applied pressure or loading of any kind.
3-5.01. **Base Flashings.** Base flashings at walls, curbs, or other masonry or concrete projections above the roof surface shall consist of the same modified bitumen cap sheet installed per manufacturer's recommendations.

At parapet walls and gravel stops, the cap sheet shall extend to cover the horizontal surface of the wood nailers as indicated on the Drawings.

All walls shall be primed with asphalt primer.

3-5.02. **Projections Through Roof.** All projections, such as equipment supports, vent pipes, and sleeves, shall be flashed with sheet metal as specified in the Sheet Metal section, and shall make permanently watertight connections with the roof covering.

3-5.03. **Roof Drains.** Roof drains are covered in the Plumbing section and are indicated on the Drawings. Should roof drains of types other than those indicated on the Drawings be used, flashing details shall be appropriately modified.

Roof drains shall be thoroughly flashed. All roofing plies shall be extended over the flashing lip and down inside across the full width of, and beneath, the flashing clamp. When roofing plies have been thus placed, a flashing sheet of 4 lbs lead approximately 30 inches square, furnished under the Sheet Metal section, shall be firmly embedded in asphalt mastic applied over the installed roofing. All lead will be primed with asphalt primer. After the metal flashing has been installed, the flashing clamp shall be drawn down to clamp metal flashing and roofing plies firmly in place. The cap sheet flashing shall then be installed over the metal flashing. The flashing shall extend at least 6 inches beyond the edges of the metal flashing.

3-5.04. **Flashings for Gravel Stops.** Flashings for gravel stops shall be as recommended by the roof system manufacturer and as specified herein. Flashings shall be installed after the metal gravel stops have been properly attached atop roofing membrane system as specified herein and in Section 07600. Unless otherwise required, flashings for stripped-in gravel stops shall be applied in strips, each strip being firmly embedded in asphalt. The first flashing strip shall be a layer of base sheet extending beyond edge of metal gravel stop a minimum of 3 inches onto field membrane. The top flashing strip shall consist of a strip of cap sheet membrane completely covering base sheet and extending a minimum of 6 inches onto field membrane. Ends of adjacent flashing strips shall be lapped at least 3 inches, with laps in adjacent plies staggered.

3-6. **EXPANSION JOINT COVERS.** Expansion joint covers shall be furnished and installed at the locations and in accordance with the details indicated on the Drawings. Installation shall be after roofing membrane is in place, and all work shall conform to the manufacturer's recommendations. Prefabricated transitions
shall be used for all corners, tees, and crossovers. Nails shall be provided with neoprene gaskets.

3-7. **ASPHALT PLANK WALKWAYS.** After roofing membrane is in place, asphalt plank walkways shall be installed, where indicated on the Drawings. Asphalt planks shall be spaced with ends 4 inches apart. Unless otherwise required by the membrane manufacturer, the planks shall be set in hot bitumen.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers sheet metal for miscellaneous sheet metal flashing. The following sheet metal items are covered in other sections:

   a. Ductwork, louvers, and other sheet metal for the heating, ventilating, and air conditioning system.

1-2. GENERAL. Installation of wall and roof flashings shall be as indicated on the Drawings and as specified in the building masonry and roofing sections.

Flashing members to be built into concrete or roofing shall be delivered at the proper time for incorporation into the work.

When installing sheet metal items, care shall be taken to avoid marring and improper bending. All components shall be stored in clean, dry storage areas. Contact with corrosive or staining materials shall be prevented. All damaged sections shall be replaced and only undamaged units shall be installed.

1-3. SUBMITTALS. Complete specifications, data, and catalog cuts or drawings covering the items furnished under this section shall be submitted in accordance with the Submittals Procedures section.

PART 2 - PRODUCTS

2-1. MATERIALS.

   Galvanized Steel        ASTM A366 or A569; hot-dip galvanized in accordance with ASTM A525, G90 minimum.

   Stainless Steel         ASTM A167, Type 302 or 304, AISI 2B finish unless otherwise specified.

   Sheet Aluminum          ASTM B209, Alloy 3003-H14, mill finish.
Extruded Aluminum        ASTM B221, Alloy 6053 or 6063.
Solder                   ASTM B32, Alloy Grade 50A (50-50).
Soldering Flux

  For Stainless Steel    Zinc chloride type, Fed Spec 0-F-506, Type II.
  For Other Metals       Acid type, Fed Spec O-F-506, Type I, Form A.
Fasteners               Same metal as sheet metal being fastened.
Plastic Cement          Asphalt roof cement, asbestos-free; ASTM D4586, Type II.

2-2. **EXPOSED METAL.** All exposed or contacting metal and flashings shall be of the same material.

2-2.01. **Types and Materials.**

  Parapet Coping          Pre-finished, pre-manufactured .050 inch aluminum. Metal-Era “Perma-Tite” tapered coping. Color to be selected by Engineer.
  Downspouts              Pre-finished .032 inch aluminum with an oven baked 70 percent “Kynar 500” fluoro-polymer coating; flush surface, 4” X 6”, complete with strap hangers.
  Scuppers                Prefinished .032 inch aluminum with an oven baked 70 percent “Kynar 500” fluoro-polymer coating; size and profile as shown in the Drawings
  Counterflashings        Stainless steel, 26 gage. Lower edge clips at 16 inches on center.
  Miscellaneous Metal Flashings  Stainless steel, 26 gage.
  Cap Flashing            Stainless steel, 26 gage.
2-3. **PARAPET COPINGS.** Copings on parapet walls shall be Metal-Era Anchor-Tite coping. Copings shall be complete with welded miter corners, joint covers and flashing, hold-down clips, and anchors and fasteners necessary for proper installation.

Finish shall be a 20-year “Kynar 500” based fluropolymer coating. The coping color will be selected from manufacturer's standard and custom colors on manufacturer provided color charts or samples. Generically printed color charts will not be acceptable for color selection.

2-4. **SCUPPERS AND DOWNSPOUTS.** Metal scuppers and downspouts shall be provided and installed as indicated on the Drawings and specified herein. The scuppers and downspouts shall be furnished and installed complete with all accessories as specified or required to complete the installation. Scuppers shall be coordinated with the installation of the roofing system to ensure a watertight installation.

Scuppers and downspouts shall be constructed from minimum .032 inch aluminum and shall have all exterior surfaces covered with a baked Kynar finish. The color shall be selected by the Engineer from a manufacturer provided color chart or samples. Generically printed color sheets will not be acceptable for color selection. The downspouts shall have a 4" x 6" cross section.

2-5. **COUNTERFLASHINGS.** Counterflashings shall be provided, at the locations indicated on the Drawings, to overlap roof base flashings. Counterflashings shall be fabricated in sections not exceeding 10 feet in length; sections shall overlap at least 3 inches and shall form a slip joint, but shall not be interlocked. Corners in counterflashings shall be closed watertight as specified herein. Counterflashing at roof end walls shall extend a minimum 10 inches above the standing seam metal roof with 4 inches minimum overlap over the base flashing. Lower edge clips are to be installed at 16 inches on center. A continuous bead of caulking shall seal the top of the flashing in contact with the concrete walls.

2-6. **MISCELLANEOUS METAL FlashING.** Metal flashings shall be provided for vents, sleeves, and similar projections through the roof.

2-7. **CAP FLASHING.** Cap flashings shall be provided at all roof ventilators and elsewhere as indicated on the Drawings. Cap flashings shall be fabricated in sections not exceeding 10 feet in length; sections shall overlap at least 3 inches and shall form a slip joint, but shall not be interlocked. All corners and all joints other than slip joints shall be closed watertight as specified herein.
PART 3 - EXECUTION

3-1. WATERTIGHT JOINTS. Joints in sheet metal work shall be closed watertight unless slip joints are specifically required. Watertight joints shall be mechanically interlocked and then thoroughly soldered for metals other than aluminum. Joints in aluminum or between aluminum and other metals shall be sealed with acrylic sealant.

All joints shall be wiped clean of flux after soldering. Acid flux shall be neutralized by washing the joints with sodium bicarbonate.

3-2. PARAPET COPINGS. Unless otherwise indicated on the Drawings or specified, parapet copings shall be installed in conformity with the instructions and recommendations of the copings manufacturer. Copings shall be installed with 1/2 inch space between the end sections. The finished installation shall have a uniformly smooth vertical face in accurate alignment.

3-3. MISCELLANEOUS METAL FLASHING. Metal flashings shall be installed as specified in the Single-Ply Roofing section.

3-4. CAP FLASHING. Cap flashings shall be installed after membrane base flashings have been completed. Cap flashings shall be anchored in place as indicated on the Drawings.

3-5. COUNTERFLASHINGS. Counterflashings shall be installed after membrane base flashings have been completed. Counterflashings shall be fitted into reglets or receivers and securely locked in place in accordance with the manufacturer's recommendations.

3-6. PROTECTION. Adequate protection shall be provided during shipment, site storage, and installation, to prevent damage to materials or finished work.

Aluminum to be placed in contact with concrete, mortar, or dissimilar metals shall be given a heavy coat of coal tar paint.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers miscellaneous roof accessories.

Power roof ventilators and roof hoods are specified in the heating, ventilating, and air conditioning section. Roof drains and vents are specified in other sections.

1-2. GENERAL. Roof accessories shall be provided and installed at the locations and in accordance with the details, arrangements, and dimensions indicated on the drawings. Fasteners as required for mounting the accessories shall be provided.

1-3. SUBMITTALS. Complete specifications, detailed drawings, and setting and erection drawings covering roof accessories shall be submitted in accordance with the submittals section.

PART 2 - PRODUCTS

2-1. METAL CURBS. Prefabricated metal curbs shall be provided for roof ventilators, roof hoods, and other penetrations as indicated on the drawings. Metal curbs shall be as manufactured by the Pate Company, Broadview, Illinois; or Uni-Curb, Inc., Chicago, Illinois. The curbs shall be constructed of 14 gage galvanized steel according to the details indicated on the drawings. Metal curbs for ventilators and other openings shall have continuous welded corner seams, factory-installed wood nailers, and well liners as indicated on the drawings.

Metal curbs for the roof ventilators and hoods shall be sized to fit the units furnished and shall be securely fastened to the roof deck. Curbs shall be shop painted with a rust-inhibitive primer.

2-2. METAL EQUIPMENT SUPPORTS. Equipment curbs shall be provided and installed for all sled-mounted equipment as indicated on the drawings to be mounted on the roof. The supports shall be fabricated of 14 gage galvanized steel as indicated on the drawings. Supports shall be manufactured by the Pate Company "Model ES-2", or equal. The equipment supports shall have continuous corner seams, factory-installed wood nailers, integral baseplates, and 18 gage galvanized steel cap flashing members, complete with lag screws and
washers. Configuration of the supports shall be as indicated on the drawings, and lengths shall be as required for the equipment furnished.

2-4. **ROOF SCUTTLE.** The metal roof scuttles indicated on the drawings shall be Type "S" as manufactured by the Bilco Company, or equal. Cover shall be 11 gage aluminum with 3 inch beaded flange, neatly welded. Insulation shall be glass fiber 1 inch thick, fully covered and protected by an 18 gage aluminum metal liner.

Curb shall be 12 inches in height and 11 gage aluminum. It shall be formed with a 3-1/2 inch flange with holes provided for securing to the roof deck. Curb shall be equipped with an integral metal cap flashing of the same gage and material as the curb, full welded at the corners for absolute weathertightness. Insulation on the exterior of the curb shall be rigid fiber board 1 inch in thickness.

Each scuttle shall be completely assembled with heavy pintle hinges, compression spring operators enclosed in telescopic tubes, positive spring latch with turn handles and padlock hasps inside and outside, and neoprene draft seal. Cover shall be equipped with an automatic hold-open arm complete with red vinyl grip handle to permit easy one hand release. All hardware shall be stainless steel. Manufacturer shall guarantee proper operation and against defects in material or workmanship for a period of five years.

2-5. **SAFETY POST.** A safety post shall be installed on the fixed ladder below each roof scuttle. The post shall be manufactured of high strength steel with telescoping tubular section that locks automatically when fully extended. Upward and downward movement shall be controlled by a stainless steel spring balancing mechanism. Unit shall be model "1" "Ladderup" safety post as manufactured by the Bilco Company, or equal. Unit shall be completely assembled with fasteners for securing to one of the ladder rails in accordance with the manufacturer's instructions.

**PART 3 - EXECUTION**

3-1. **INSTALLATION.** All products provided under this section shall be installed in accordance with the manufacturer’s instructions. Unless otherwise noted, all anchors shall be non-corrosive type.

All installations interfacing with roofing membrane and sheet metal flashings shall be coordinated with those sections.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers miscellaneous roof, floor and wall expansion joints.

1-2. GENERAL. Roof, floor and wall expansion joint assemblies shall be provided and installed at the locations and in accordance with the details, arrangements, and dimensions indicated on the drawings. Fasteners as required for mounting the accessories shall be provided.

1-3. SUBMITTALS. Complete specifications, detailed drawings, and setting and erection drawings covering joint systems shall be submitted in accordance with the submittals section.

PART 2 - PRODUCTS

2-1. ROOF EXPANSION JOINT. Roof to roof bellows type assembly with black EPDM cover and closed cell foam, 12 inches wide: standard galvanized flanges as manufactured by Balco Inc. model “BRBG-6-CE”.

2-2. FLOOR EXPANSION JOINT COVER SYSTEM. Joint covers shall permit unrestrained movement of joint without disengagement of cover. Assemblies shall be extruded from 6063-T5 (ASTM B221) aluminum with a mill finish on cover and base as manufactured by Balco Inc. model “6FVS-1E”.

2-3. EXTERIOR WALL EXPANSION JOINT SYSTEM. Extruded 6063-T5 (ASTM) aluminum base with flexible UV resistant “santoprene” expansion joint inserts for exterior walls that allow for 100% movement. Exterior wall expansion joint system shall be model “FCVS-6” as manufactured by Balco Inc.

2-4. INTERIOR WALL EXPANSION JOINT SYSTEM. Extruded 6063-T5 (ASTM) aluminum base with flexible UV resistant “santoprene” expansion joint inserts for exterior walls that allow for 100% movement. Interior wall expansion joint system shall be model “TCWW-6” as manufactured by Balco Inc.
PART 3 - EXECUTION

3-1. INSTALLATION. All products provided under this section shall be installed in accordance with the manufacturer’s instructions. Unless otherwise noted, all anchors shall be non-corrosive type.

All installations interfacing with roofing membrane and sheet metal flashings shall be coordinated with those sections.

All installations interfacing with concrete, the curtain wall system and the metal wall panel systems shall be coordinated with those sections.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers caulking and sealing. Fire rated caulking is covered in the Fireproofing section.

1-2. GENERAL. The terms "caulking" and "sealing", as used on the Drawings and in these Specifications, are synonymous. Both terms indicate the materials specified herein. Oil-base caulking shall not be used on this Project.

1-3. APPROVALS. All caulking shall meet the requirements of the standards specified herein. All caulking and sealing to be used in contact with potable water shall meet the requirements of ANSI/NSF Standard 61.

1-4. SUBMITTALS. Specifications and data covering the materials proposed for use, together with samples or color cards showing the manufacturer's full line of sealant colors, shall be submitted in accordance with the Submittals Procedures section.

PART 2 - PRODUCTS

2-1. MATERIALS.

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thiokol Sealants (polysulfides)</td>
<td>Fed Spec TT-S-00227E, Class A or</td>
</tr>
<tr>
<td></td>
<td>ASTM 920 Type M; polysulfide rubber,</td>
</tr>
<tr>
<td></td>
<td>two component.</td>
</tr>
<tr>
<td>Nonsag</td>
<td></td>
</tr>
<tr>
<td>Submerged Service, Non potable water</td>
<td>Pecora &quot;Synthacalk GC-2+&quot;.</td>
</tr>
<tr>
<td>Nonsubmerged Service</td>
<td>Pecora &quot;Synthacalk GC-2+&quot;;</td>
</tr>
<tr>
<td></td>
<td>Polymeric Systems “PSI-350”.</td>
</tr>
<tr>
<td>Self-Leveling, nonsubmerged</td>
<td>A. C. Horn &quot;Hornflex Traffic Grade&quot;;</td>
</tr>
<tr>
<td></td>
<td>Polymeric Systems “PSI-350”.</td>
</tr>
<tr>
<td>Urethane Sealants (Polyurethanes)</td>
<td>Fed Spec TT-S-00227E, Class A, Type</td>
</tr>
<tr>
<td></td>
<td>2 and ASTM C920, Type M, Grade NS, two component.</td>
</tr>
</tbody>
</table>
Nonsag

**Submerged Service**

Potable Water  Polymeric Systems “RC-270”; Sika “Sikaflex-2cNS.”

Nonpotable Water  Polymeric Systems “RC-270”.

Nonsubmerged Service  Bostik "Chem-Calk 500"; Tremco "Vulkem 227"; Pecora "Dynatrol II"; Tremco "DYmeric 240"; Sika “Sikaflex-2cNS”.


Bostik “Chem-Calk 600”; Pecora “AC20”; Tremco “Mono 555”.

Silicone Sealant  Silicone rubber, neutral color; Dow Corning "Mildew-Resistant silicone 786”; General Electric "Silicone Sanitary 1702 Sealant”.

Primer  As recommended by the sealant manufacturer.

Backup Material  Polyethylene or polyurethane foam as recommended by the sealant manufacturer; Dow "Ethafoam SB" or Plateau "Denver Foam”.

Bondbreaker Tape  Adhesive-backed polyethylene tape as recommended by the sealant manufacturer.

2-2. **COLORS.** Colors of sealants shall be as selected by Engineer from the manufacturer's standard line of colors. Different colors may be required for different locations.

2-3. **LOCATIONS TO BE CAULKED.**

2-3.01. **With Thiokol or Urethane Sealant (Nonsag) - Submerged Service.**

All joints requiring caulking in submerged locations.

Surface of basin weir plates in contact with supporting structure.
2-3.02. **With Thiokol or Urethane Sealant (Nonsag) - Nonsubmerged Service.**

Entire perimeter of frames for exterior metal doors.

Entire perimeter of metal louvers.

Entire perimeter of metal dampers and metal shutters.

Entire perimeter of aluminum windows.

Control joints in masonry walls.

Perimeter of aluminum entrances and assemblies, except exterior side of exterior sills.

Joints on the underside of prestressed, precast roof members where exposed to view.

Around service sinks.

Joints between masonry and cast-in-place concrete, where indicated on the Drawings.

Other locations where caulking is indicated on the Drawings, specified in other sections, or required for weatherproofing.

2-3.03. **With Thiokol or Urethane Sealant (Self-Leveling).**

Horizontal joints in walks or drives.

Horizontal joints in traffic-bearing decks and slabs.

Annular space around handrail posts set in sleeves.

2-3.04. **With Acrylic Sealant.**

Watertight joints in sheet metal work.

2-3.05. **With Silicone Sealant.**

Around floor urinals
PART 3 - EXECUTION

3-1. JOINT PREPARATION. All surfaces to receive sealant shall be clean, dry, and free from dust, grease, oil, or wax. Concrete surfaces which have been contaminated by form oil, paint, or other foreign matter which would impair the bond of the sealant to the substrate shall be cleaned by sandblasting. All surfaces shall be wiped with a clean cloth saturated with xylol or other suitable solvent, and shall be primed before the sealant is applied.

Unless otherwise recommended by the sealant manufacturer and permitted by the Engineer, the depth of sealant in a joint shall be equal to the width of the joint, but not more than 1/2 inch. Backup material shall be provided as necessary to control the depth of sealant and shall be of suitable size so that, when compressed 25 to 50 percent, the space will be filled. Backup material shall be rolled or pressed into place in accordance with the manufacturer's installation instructions, avoiding puncturing and lengthwise stretching. If depth of the joint does not permit use of backup material, bondbreaker tape shall be placed at the bottom of the joint to prevent three-sided adhesion.

3-2. SEALING. Sealing work shall be done before any field painting work is started. The air temperature and the temperature of the sealed surfaces shall be above 50°F when sealing work is performed.

Upon completion of the sealing work, each sealed joint shall have a smooth, even, tooled finish, flush with the edges of the sealing recess, and all adjacent surfaces shall be clean. Sealant shall not lap onto adjacent surfaces. Any sealant so applied as to prevent the painting of adjacent surfaces to a clean line, or with an excess of material outside the joint and feathered onto surfaces, shall be removed and the joint resealed.

End of Section
DIVISION 8 – Doors and Windows
PART 1 - GENERAL

1-1. **SCOPE.** This section covers the furnishing and installation of hollow metal doors and frames. Unless otherwise indicated or specified, all steel doors shall be flush type.

Structural steel door frames and finish hardware are covered in the Structural and Miscellaneous Metals section and the Finish Hardware section, respectively.

1-2. **GENERAL.** Doors, frames, and appurtenances shall be furnished and installed as specified herein and in accordance with the details and arrangements indicated on the Drawings.

Doors, frames, and appurtenances furnished under this section shall be fabricated and assembled and erected, in full conformity with Drawings, specifications, engineering data, instructions, and recommendations of the manufacturer unless exceptions are noted by Engineer.

1-3. **SUBMITTALS.**

   A. General Submittals:

      1. Complete detail drawings of all items specified herein shall be submitted in accordance with the Submittals Procedures section. Drawings shall show elevations of each door type; details of each frame type; location or identification of each item; typical and special details of construction; methods of assembling sections; location and installation requirements for hardware; size, shape, and thickness of materials; joints; connections; and finish.

1-4. **DELIVERY, STORAGE, AND HANDLING.** Shipping shall be in accordance with the Product Deliver Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section.

Materials shall be handled, transported, and delivered in a manner which will prevent bends, dents, scratches, or damages of any kind. Damaged materials shall be promptly replaced.
PART 2 - PRODUCTS

2-1. PERFORMANCE AND DESIGN CRITERIA.

2-1.01. Governing Standard. Except as modified or supplemented herein, all steel doors and frames shall conform to the requirements of ANSI/SDI 100, Level 2, Model 2.

2-1.02. Metal Thicknesses. Metal thicknesses and gages of steel sheet metal specified herein are the minimum required. Gages refer to US Standard gage.

2-1.03. Nomenclature. The nomenclature used herein conforms to ANSI/SDI A250.8.

2-2. ACCEPTABLE PRODUCTS.

Flush panel doors with foamed-in-place polyurethane or rigid urethane core and accompanying frames shall be equivalent to the following or approved equal:

The Ceco Corporation "Imperial".
Pioneer Industries "CHT Series".

2-2.01. Fire Doors. Not used.

2-3. MATERIALS. Materials used in the manufacture of steel doors and frames shall be as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doors and Frame</td>
<td>ASTM A1008/A1008M or A1011/A1011M, stretcher leveled, commercial quality sheet steel with smooth, clean surface; galvanized, per ASTM A653/A653M with G90 minimum coating.</td>
</tr>
<tr>
<td>Internal Reinforcing</td>
<td>ASTM A1008/A1008M, cold-rolled steel.</td>
</tr>
<tr>
<td>Fillers for Internally Reinforced Doors</td>
<td>Injected polyurethane foam, CFC and HCFC free.</td>
</tr>
<tr>
<td>Thermal Characteristics</td>
<td>R Factor: 11.0 (ASTM C518).</td>
</tr>
<tr>
<td>Anchoring Devices</td>
<td>Zinc-plated where exposed; zinc-plated or galvanized where concealed; non-corrosive.</td>
</tr>
<tr>
<td>Expansion Anchors</td>
<td>As specified in the Anchorage in Concrete and Masonry section.</td>
</tr>
</tbody>
</table>
2-4. FRAMES. Frames for doors, and removable mullions shall be formed of steel to the sizes, 14 gage, and shapes required.

2-4.01. Workmanship. The finished work shall be strong, rigid, neat, and free from defects. Molded members shall be fabricated straight and true, with corner joints well formed, and with fastenings concealed where practicable.

2-4.02. Joints. Joints for frames shall be mitered or butted and continuously welded on the reverse side to produce rigid joints which are invisible on the face of the frame. Frame bottoms shall be held rigidly in position by spreader bars to maintain proper alignment during shipment and erection.

2-4.03. Hardware Provisions. Frames shall be prepared at the factory for the specified hardware. Frames shall be mortised, reinforced, drilled, and tapped for mortised hardware, and shall be reinforced for surface-applied hardware. Cover boxes shall be provided in back of all hardware cutouts. Frames for all doors except weatherstripped doors shall be punched to receive silencers, three holes on the lock side of single door frames and one hole for each leaf in heads of double door frames. Lock strikes shall be set out and adjusted to provide clearance for silencers.

Concealed metal reinforcements shall be provided for hardware in at least the following thicknesses:

- Hinge reinforcement: 10 gage
- Strike reinforcement: 14 gage
- Closer reinforcement: 12 gage
- Other reinforcement: 14 gage

2-4.04. Removable Mullions. Mullions shall be of reinforced tubular construction, connecting neatly with the head frame and secured in place by concealed concealed fasteners. Cutouts or removable plates shall be provided for access to fasteners.

2-4.05. Reinforcing. Not used.

2-4.06. Wall and Floor Anchors. Metal anchors of the sizes and shapes required for the adjoining type of wall construction shall be provided. Jamb anchors shall be fabricated from steel, of at least the same thickness as the frames. Anchors
shall be located near the top and bottom of each frame and at intermediate points spaced not more than 32 inches apart.

For frames set in masonry, jamb anchors shall be at least 10 inches long, adjustable, and corrugated or other deformed type.

For frames set in metal stud partitions, anchors shall be welded to the backs of frames. Anchors shall be fastened to steel studs with 1/4 inch diameter machine bolts, or by welding.

For frames set in hardened concrete or existing masonry walls, anchorage shall be provided as indicated on the Drawings.

Door frames shall be provided with a 16 gage thick base clip at each jamb for floor anchorage. Clips shall be sized and drilled for at least two 3/8 inch diameter anchoring devices. Where floor fill occurs at a door opening, the bottom of the frame shall terminate at the indicated finished floor level and shall be supported by adjustable extension clip angles anchored to the structural slab.

2-4.07. **Stops and Beads.** Metal glazing beads shall be furnished with hollow metal frames at transoms, sidelights, interior glazed panels, and other locations where glazed frames are indicated on the Drawings. Glazing stops shall be formed as an integral part of the frames, and the frames shall be prepared to receive the glazing beads. Where frames are exposed to weather, the integral stops shall be located on the exterior side of the frames. Beads having a molded shape shall be mitered at corners. Rectangular beads may be either mitered or butted at corners.

2-5. **DOORS.** Doors indicated on the Drawings as hollow metal, including doors with glazed and louvered openings, shall be as specified herein. Doors shall be prepared to receive the hardware specified in the Finish Hardware section.

2-5.01. **Workmanship.** Doors shall be rigid, neat in appearance, and free from defects. Molded members for glazed doors shall be formed straight and true, with joints coped or mitered, well formed, and in true alignment. All welded joints on exposed surfaces shall be dressed smooth so that they are invisible after finishing.

2-5.02. **Sizes and Clearances.** Doors shall be of 1-3/4 inch thickness, and type indicated on the Drawings, of the sizes and design indicated. Clearances for doors, except fire doors, shall be 1/8 inch at jambs and heads, 1/4 inch at meeting stiles of pairs of doors, and 3/4 inch at bottom, unless otherwise indicated.
2-5.03. **Construction.** Doors shall have 18 gage thick seamless outer sheets. Side edges of doors shall be flush and closed watertight. All seams shall be continuously welded and ground smooth. Doors shall be prepared at the factory for hardware, for glazing, and for louvers as indicated on the Drawings. Door edges shall be beveled or rounded.

Flush foam-filled doors shall have all internal spaces completely filled with foamed-in-place polyurethane core or rigid urethane core chemically bonded to the interior surfaces of the door.

Outswinging exterior doors shall be finished flush at the top, with all seams and joints closed watertight as specified for side edges.

2-5.04. **Hardware Provisions.** Doors shall be mortised, reinforced, drilled, and tapped for mortised hardware. Reinforcing units shall be provided for locksets. Reinforcing plates shall be provided for mortised and surface-applied hardware in at least the following thicknesses:

- Hinge reinforcement: 10 gage
- Surface-applied closers and hold-open arms: 12 gage
- Other reinforcement: 14 gage

Where concealed overhead door closers are required, the necessary cutouts, reinforcement, and provisions for fasteners shall be made in the heads of doors.

The locations of hardware items shall be in accordance with DHI "Recommended Locations for Builders' Hardware for Standard Steel Doors and Frames".

2-5.05. **Stops and Beads.** Metal glazing beads shall be furnished with hollow metal doors where glazed doors are indicated on the Drawings. Glazing stops may be formed as an integral part of the doors, or separate glazing beads provided for both sides of the glass. Doors shall be prepared to receive the glazing beads. Beads shall be snapped into place, or shall be fastened with oval-head machine screws spaced at 9 inch centers maximum. Beads having a molded shape shall be mitered at corners. Rectangular beads may be either mitered or butted at corners.

Where glazed doors are exposed to weather, all seams and joints on all sides of the glass panel, except joints in removable beads, shall be closed watertight as specified for side edges.

2-5.06. **Astragals.** The meeting edges of all exterior double doors, of interior double doors scheduled to be weatherstripped shall be provided with flat bar astragals. Astragals shall be applied to the active leaf unless otherwise
indicated. When the astragal is attached to the inactive leaf, the active leaf shall be prepared for a lockset with a 3-3/4 inch backset.

2-5.07. **Louvers.** Not used.

2-6. **SHOP FINISH.** A primer shall be applied to all surfaces of ferrous metal furnished under this section. Metal surfaces shall be cleaned and given a phosphate or equivalent treatment to ensure maximum corrosion protection and paint adherence. A dip or spray coat of synthetic resin, rust-inhibitive metallic oxide, or rust-inhibitive zinc chromate primer shall be applied to all surfaces, then baked or oven-dried. Finished surfaces shall be smooth and free from irregularities.

**PART 3 - EXECUTION**

3-1. **INSTALLATION.** Frames shall be set in position, plumbed, aligned, and braced securely until permanent anchors are set. Frames shall be anchored to floors with expansion anchors or as indicated on the Drawings. Jamb anchors shall be built into walls and secured to adjoining construction. Spreader bars shall remain in place until frames have been built into the walls.

3-1.01. **Glazing Beads.** Glazing beads, when provided, shall be fastened to frames with oval-head machine screws spaced at 9 inch maximum centers.

End of Section
Section 08120

FIBERGLASS REINFORCED DOORS AND DOOR FRAME SYSTEMS

PART 1 - GENERAL

1-1. THE REQUIREMENT.

A. The Contractor shall furnish and install all fiberglass reinforced door and door frame systems and related items, complete and operable, including all finish hardware and all appurtenant work, all in accordance with the Contract Documents.

1-2. RELATED WORK SPECIFIED ELSEWHERE.

A. Section 08700 Finish Hardware
B. Section 08800 Glass and Glazing

1-3. SECTION INCLUDES.

B. Fiberglass Door Frames.
C. Fiberglass Reinforced Plastic (FRP) Transoms.

1-4. REFERENCE SPECIFICATIONS, CODES AND STANDARDS.

A. Comply with the reference specifications of the GENERAL REQUIREMENTS.
B. Comply with the current provisions of the following Standards.

   ASTM D 635  Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
   NFPA 252    Standard Methods of Fire Tests of Door Assemblies.
SDI-100  Recommended Specifications for Steel Doors and Frames.

UL 10B   Standard for Fire Tests of Door Assemblies.

UL 305   Standard for Panic Hardware.

1-5.  SYSTEM DESCRIPTION.

A.  Performance Requirements:

1.  Door opening assemblies:
   a.  Maximum flame spread 25 in accordance with ASTM E 84, self-extinguishing in accordance with ASTM D 635.
   b.  USDA accepted.

1-6.  SUBMITTALS.

A.  Submit under provisions of Section 01300 Submittals.

B.  Product Data: Manufacturer's printed product data indicating characteristics of products specified in this Section.

C.  Shop Drawings:

1.  Plans: Indicate location of each door opening assembly in project.

2.  Elevations: Dimensioned elevation of each type door opening assembly in project; indicate sizes and locations of door hardware, and lites and louvers, if specified.

3.  Details: Installation details of each type installation condition in project; indicate installation details of glazing, if specified.

4.  Schedule: Indicate each door opening assembly in project; cross-reference to plans, elevations, and details.

D.  Selection Samples: Manufacturer's standard color chips.

E.  Verification Samples: Two (2) samples to verify color match.

F.  Manufacturer's Instructions: Printed installation instructions for door opening assemblies.

G.  Warranty Documents: Manufacturer's standard warranty documents, executed by manufacturer's representative, countersigned by the Contractor.
1-7. **DELIVERY, STORAGE, AND HANDLING.**

A. Packing, Shipping, Handling and Unloading: Package door opening assemblies in manufacturer's standard containers.

B. Store door assemblies in manufacturer's standard containers, on end, to prevent damage to face corners and edges.

1-8. **WARRANTY.**

A. Manufacturer's Warranty:

1. Manufacturer's 10-year warranty against failure due to corrosion from specified environment.

2. The hardware manufacturer's warranty shall be included with the hardware installation.

**PART 2 - PRODUCTS**

2-1. **MANUFACTURERS.**

A. Acceptable Manufacturers:

1. FIB-R-DOR Division of Advance Fiberglass, Inc.

2. Chem-Pruf Door Company.

3. Or Equal.

2-2. **MATERIALS.**

A. Fiberglass Mat: Minimum 1.5 ounces per square foot.

B. Resins: Manufacturer's formulation for fabricating units to meet specified requirements.

C. Anchors: Manufacturer's standard stainless steel expansion anchors for existing openings, and stainless steel masonry tee anchors for new construction.

D. Fasteners: Stainless steel.

E. Glazing: Type specified in Section 08800 Glass and Glazing; factory installed.
2-3. MANUFACTURED UNITS.

A. Non-rated Fiberglass Reinforced Plastic (FRP) Doors:

3. Construction:
   a. Core: All voids between the door plates shall be completely filled with the equivalent of 4-6 pounds of expanded polyurethane foam, having a flame spread of 25 or less per ASTM E-84. A phenolic-coated kraft honeycomb may be substituted for urethane when approved by the Engineer.
   b. Door Plates: Molded in one continuous piece, resin reinforced with hand-laid glass fiber mat, nominal 1/8 inch thick, minimum 15 mil gel-coated surface.
   c. Door Edges: Minimum three (3) layers resin-reinforced glass fiber mat, nominal 3/8 inch thick, machine tooled.
5. Finish: Minimum 15 mil gel-coated smooth gloss surface with a minimum value 88 in accordance with ASTM D 523.
6. Color: To be selected from manufacturer’s standard colors.
7. Color: To be selected from manufacturer’s standard colors.

B. Non-rated Fiberglass Frames:

1. Construction: One-piece pultruded fiberglass reinforced plastic, minimum 1/4 inch wall thickness, jamb-to-head joints mitered and reinforced with FRP clips and stainless steel fasteners; conforming to SDI requirements for performance equivalent to 16 gage steel frames.
2. Frame profile: 5-3/4 inches deep, 2 inches wide face; double rabbeted with 5/8 inch high stop.
4. Finish: Minimum 15 mil gel-coated smooth gloss surface with a minimum value 88 in accordance with ASTM D 523.
5. Color: To be selected from manufacturer’s standard colors.

C. Frame Anchors: Types recommended by manufacturer for project conditions.
D. Lites in Non-rated Doors:
   2. Glazing: Specified in Section 08800 Glass and Glazing.

E. Fiberglass Reinforced Plastic (FRP) Transoms:
   1. Match adjacent door construction and color.
   2. All transoms shall be removable.

F. Door Hardware: Specified in Section 08700 Finish Hardware.

2-4. FABRICATION.

A. Fiberglass Reinforced Plastic (FRP) Doors:
   1. Minimum glass fiber to resin ratio: 30 percent.
   2. Mortise for lockset, and recess for strike plate in lock stile.
   3. Embed steel reinforcement for hinges, door closers, locksets and other specified hardware in fiberglass matrix; provide for hinge leaf recesses in hinge stile.

B. Fiberglass Frames:
   1. Mortise for lock strike, and recess for strike plate in lock jamb.
   2. Reinforce for hinges and other indicated hardware.

PART 3 - EXECUTION

3-1. EXAMINATION.

A. Verification of Conditions:
   1. Openings are correctly prepared to receive doors and frames.
   2. Openings are correct size and depth in accordance with shop drawings.
B. Installer’s Examination:

1. Have installer examine conditions under which construction activities of this section are to be performed and submit written report if conditions are unacceptable.
2. Transmit two copies of installer's report to the Engineer within 24 hours of receipt.
3. Beginning construction activities of this section before unacceptable conditions have been corrected is prohibited.
4. Beginning construction activities of this section indicates installer's acceptance of conditions.

C. Verify that glazing has been factory-installed.

3-2. INSTALLATION.

A. Install door opening assemblies in accordance with shop drawings, SDI-100, and manufacturer's printed installation instructions, using installation methods and materials specified in installation instructions.

B. Installation of door hardware

1. Specified in Section 08710 Finish Hardware.
2. All hardware shall be installed at the door manufacturing plant.

C. Install door hardware in accordance with manufacturer's printed instructions, using through-bolts to secure surface applied hardware.

D. Site Tolerances: Maintain plumb and level tolerances specified in manufacturer's printed installation instructions.

3-3. ADJUSTING.

A. Adjust doors in accordance with door manufacturer's maintenance instructions to swing open and shut without binding, and to remain in place at any angle without being moved by gravitational influence.

B. Adjust door hardware to operate correctly in accordance with hardware manufacturer's maintenance instructions.

3-4. CLEANING.

A. Clean surfaces of door opening assemblies and sight-exposed door hardware in accordance with manufacturer's maintenance instructions.
3-5. **PROTECTION OF INSTALLED PRODUCTS.**

   A. Protect door opening assemblies and door hardware from damage by subsequent construction activities until final inspection.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This Section covers finish hardware for steel and FRP doors. All electric access control requirements shall be coordinated with the provided door hardware to confirm compatibility with the Owner’s security guidelines.

1-2. GENERAL. Items included in this section shall conform with the following:

   - International Building Code, with local amendments
   - NFPA 70, NFPA 80, NFPA 101
   - ANSI/BHMA Certified Product Standards – A156 Series

1-3. SUBMITTALS. Contractor shall submit a complete schedule of finish hardware in accordance with the requirements specified in the Submittals Procedures section. The schedule shall indicate each item of hardware required for each opening, manufacturer's name, manufacturer's number or symbol, and finish.

1-4. PACKAGING. Each item of hardware shall be packaged separately in an individual container complete with screws, keys, special wrenches, instructions, and installation templates necessary for accurately locating, setting, adjusting, and attaching the hardware. Each container shall be marked with the number of the opening to which the hardware item is to be applied.

1-5. COORDINATION.

1-5.01. Templates. Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

1-5.02. Door and Frame Preparation. Related Division 08 sections FRP Doors and Frames and Steel Doors and Frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1-6. WARRANTY.
1-6.01. **General Warranty.** Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

1-6.02. **Warranty Period.** Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

1-6.03. **Standard Warranty Period.** Three years from date of Substantial Completion, unless otherwise indicated.

1-6.04. **Special Warranty Periods.**

1. Seven years for heavy duty cylindrical (bored) locks and latches.
2. Five years for exit hardware.
3. Ten years for manual door closers.

**PART 2 - PRODUCTS**

2-1. **ACCEPTABLE MANUFACTURERS.** The catalog numbers which appear in the Hardware Schedule identify products of the listed manufacturers herein for each hardware item. Equivalent products of the other manufacturers listed herein will also be acceptable.

- **Hinges**
  - McKinney, Hager, Stanley

- **Locksets, Latch sets, and Cylinders**
  - Sargent, Yale, Corbin Russwin

- **Exit Devices**
  - Sargent, Yale, Corbin Russwin, Von Duprin

- **Closers**
  - Sargent, Norton, LCN, Corbin Russwin

- **Thresholds, Cast Abrasive**
  - Pemko, Wooster, American Abrasive or Stubbs.
Drip Caps, Extruded                      Pemko, Reese, Zero
Gasketing/Weatherstripping              Pemko, Reese, Zero
Kick Plates, Surface Bolts,             Rockwood, McKinney, Ives
   Overhead Holds, Bumpers,
   and Silencers

2-2. **FINISH.** The required finish shall be as indicated by the catalog number listed in the Hardware Schedule herein. Exterior surfaces of door closers shall be finish painted with shop-applied powder coated finish, plated finishes, or special coatings as indicated in the schedule. Machine screws, bolts, and other exposed attachments shall be finished to match hardware.

2-3. **KEYING.** All cylinder locks shall be keyed in groups. All cylinders shall be furnished with interchangeable cores. After the finish hardware submittals have been accepted by the Engineer, the Owner will meet with the Contractor and the hardware consultant to determine the keying groups. All locks in each group shall be keyed alike and each group shall be keyed differently. Two "Do Not Duplicate" keys shall be provided with each lock where required by the Owner.

Per the Owner’s security guidelines, all exterior doors shall be provided with electric access control. All electric access control requirements shall be coordinated with the provided door hardware to confirm compatibility with the Owner’s security guidelines.

**PART 3 - EXECUTION**

3-1. **INSTALLATION.** Hardware shall be accurately fitted, securely applied, carefully adjusted, and lubricated in accordance with the manufacturer's instructions.

3-1.01. **Location.** Unless otherwise directed by the Design Professional, the locations of hardware items shall be in accordance with DHI "Recommended Locations for Builders' Hardware for Standard Steel Doors and Frames".

3-1.02. **Thresholds.** The ends of thresholds shall be notched to fit the applicable door frame profile. Thresholds shall be field drilled to receive flush bolts where required. Thresholds shall be anchored to concrete by means of 5/16-inch diameter stainless steel flat head countersunk machine screws and expansion anchors spaced at 8-inch centers. Thresholds shall be set in asphalt roofing cement conforming to ASTM D4586, Type II.
3-2. **ADJUSTING.** Each supplier of finish hardware shall provide the services of a trained and experienced hardware consultant to service and adjust installed hardware.

3-3. **PROTECTION.** Special care shall be taken to protect finished surfaces of hardware during installation. Hardware on which the finish has been damaged prior to final acceptance of the work shall be replaced with new hardware at no additional cost to the Owner.

3-4. **HARDWARE SCHEDULE.** Hardware shall be furnished in accordance with the following schedule. Doors are listed by group number. A complete set of hardware is listed for each group, as follows:

<table>
<thead>
<tr>
<th>Set #1 (Exterior, 3’-0” x 7’-2”, Locked, Panic, Card Reader Access)</th>
<th>Doors 144-101B &amp; 144-102B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
<td># Req’d</td>
</tr>
<tr>
<td>Hinges</td>
<td>3</td>
</tr>
<tr>
<td>Exit Device</td>
<td>1</td>
</tr>
<tr>
<td>Closer</td>
<td>1</td>
</tr>
<tr>
<td>Threshold</td>
<td>1</td>
</tr>
<tr>
<td>Gasketing</td>
<td>1 set</td>
</tr>
<tr>
<td>Raindrrip</td>
<td>1</td>
</tr>
<tr>
<td>Bottom Sweep</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Set #2 (Exterior, Pair 3’-0” x 7’-2”, Locked, Panic, Card Reader Access)</th>
<th>Doors 144-101A &amp; 144-102A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
<td># Req’d</td>
</tr>
<tr>
<td>Hinges</td>
<td>6</td>
</tr>
<tr>
<td>Exit Device</td>
<td>1</td>
</tr>
<tr>
<td>Closer</td>
<td>1</td>
</tr>
<tr>
<td>Surface Bolts</td>
<td>2</td>
</tr>
<tr>
<td>Overhead Hold</td>
<td>1</td>
</tr>
<tr>
<td>Gasketing</td>
<td>1 set</td>
</tr>
<tr>
<td>Bottom Sweep</td>
<td>2</td>
</tr>
</tbody>
</table>
Install surface bolts and overhead hold on inactive leaf, closer and exit device on active leaf. Active leaf noted on architectural floor plan Drawings. Astragal and removable mullion provided by FRP door manufacturer.

**Set #3 (Interior, 3'-0" x 7'-2", Passage, Panic)**  
*Door 144-102C*

<table>
<thead>
<tr>
<th>Item</th>
<th># Req’d</th>
<th>Catalog No.</th>
<th>Finish</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hinges</td>
<td>3</td>
<td>T4A3386 4-1/2x4-1/2</td>
<td>32D</td>
<td>McKinney</td>
</tr>
<tr>
<td>Exit Device</td>
<td>1</td>
<td>8815 x ETL</td>
<td>630</td>
<td>Sargent</td>
</tr>
<tr>
<td>Closer</td>
<td>1</td>
<td>SRI 351 CPS</td>
<td>EN</td>
<td>Sargent</td>
</tr>
<tr>
<td>Gasketing</td>
<td>1 set</td>
<td>2891AS head &amp; 290AS jamb</td>
<td></td>
<td>Pemko</td>
</tr>
<tr>
<td>Bottom Sweep</td>
<td>1</td>
<td>18061CNB</td>
<td></td>
<td>Pemko</td>
</tr>
<tr>
<td>Silencers</td>
<td>3</td>
<td>608</td>
<td></td>
<td>Rockwood</td>
</tr>
</tbody>
</table>

**Set #4 (Exterior, Pair 3'-0" x 7'-10", Locked, Panic, Card Reader Access)**  
*Door 210-A101A*

<table>
<thead>
<tr>
<th>Item</th>
<th># Req’d</th>
<th>Catalog No.</th>
<th>Finish</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hinges</td>
<td>8</td>
<td>T4A3386 4-1/2x4-1/2 NRPxSSF</td>
<td>32D</td>
<td>McKinney</td>
</tr>
<tr>
<td>Exit Device</td>
<td>1</td>
<td>8874 x ETL Electrified per Tyco security.</td>
<td>630</td>
<td>Sargent</td>
</tr>
<tr>
<td>Closer</td>
<td>1</td>
<td>SRI 351 CPSH</td>
<td>EN</td>
<td>Sargent</td>
</tr>
<tr>
<td>Surface Bolts</td>
<td>2</td>
<td>585-12 &amp; 585-24</td>
<td>US26D</td>
<td>Rockwood</td>
</tr>
<tr>
<td>Overhead Hold</td>
<td>1</td>
<td>19000 Series</td>
<td>US32D</td>
<td>Rockwood</td>
</tr>
<tr>
<td>Gasketing</td>
<td>1 set</td>
<td>2891AS head &amp; 290AS jamb</td>
<td></td>
<td>Pemko</td>
</tr>
<tr>
<td>Bottom Sweep</td>
<td>2</td>
<td>18061CNB</td>
<td></td>
<td>Pemko</td>
</tr>
<tr>
<td>Threshold</td>
<td>1</td>
<td>252X2-A-FG</td>
<td></td>
<td>Pemko</td>
</tr>
<tr>
<td>Raindrip</td>
<td>1</td>
<td>346 C</td>
<td></td>
<td>Pemko</td>
</tr>
</tbody>
</table>

Install surface bolts and overhead hold on inactive leaf, closer and exit device on active leaf. Active leaf noted on architectural floor plan Drawings. Astragal and removable mullion provided by steel door manufacturer.

**Set #5 (Interior, 3'-0" x 7'-2", Passage)**
**Door 210-A101B**

<table>
<thead>
<tr>
<th>Item</th>
<th># Req’d</th>
<th>Catalog No.</th>
<th>Finish</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hinges</td>
<td>3</td>
<td>T4A3386 4-1/2x4-1/2</td>
<td>32D</td>
<td>McKinney</td>
</tr>
<tr>
<td>Mortise Latchset</td>
<td>1</td>
<td>8215-CEL</td>
<td>630</td>
<td>Sargent</td>
</tr>
<tr>
<td>Closer</td>
<td>1</td>
<td>SRI 351 CPS</td>
<td>EN</td>
<td>Sargent</td>
</tr>
<tr>
<td>Gasketing</td>
<td>1 set</td>
<td>2891AS head &amp; 290AS jamb</td>
<td></td>
<td>Pemko</td>
</tr>
<tr>
<td>Bottom Sweep</td>
<td>1</td>
<td>18061CNB</td>
<td></td>
<td>Pemko</td>
</tr>
<tr>
<td>Silencers</td>
<td>3</td>
<td>608</td>
<td></td>
<td>Rockwood</td>
</tr>
</tbody>
</table>

**Set #6 (Interior, 4'-0" x 7'-2", Locked)**

**Door 210-001A**

<table>
<thead>
<tr>
<th>Item</th>
<th># Req’d</th>
<th>Catalog No.</th>
<th>Finish</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hinges</td>
<td>3</td>
<td>T4A3386 4-1/2x4-1/2</td>
<td>32D</td>
<td>McKinney</td>
</tr>
<tr>
<td>Mortise Lockset</td>
<td>1</td>
<td>8227-CEL</td>
<td>630</td>
<td>Sargent</td>
</tr>
<tr>
<td>Closer</td>
<td>1</td>
<td>SRI 351 CPS</td>
<td>EN</td>
<td>Sargent</td>
</tr>
<tr>
<td>Gasketing</td>
<td>1 set</td>
<td>2891AS head &amp; 290AS jamb</td>
<td></td>
<td>Pemko</td>
</tr>
<tr>
<td>Bottom Sweep</td>
<td>1</td>
<td>18061CNB</td>
<td></td>
<td>Pemko</td>
</tr>
<tr>
<td>Silencers</td>
<td>3</td>
<td>608</td>
<td></td>
<td>Rockwood</td>
</tr>
</tbody>
</table>

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers glass and glazing for doors as indicated on the drawings and as stipulated herein.

1-2. GENERAL. Except as modified or supplemented herein, all glazing shall be in accordance with the recommendations of the Flat Glass Marketing Association (FGMA).

Laminated glass shall conform to the requirements for glazing materials for Category II products in accordance with the Safety Standard for Architectural Glazing Materials, 16 CFR 1201, January 6, 1977, as amended.

Glazing shall conform to all local codes.

1-3. SUBMITTALS. Complete specifications and data covering the items furnished under this section shall be submitted in accordance with the submittals section.

Provide samples of each type of glass used on the Project. Sample shall be in the form of 12 inch square units.

Provide a glazing schedule using the same designations as on the Drawings for glazed openings listing glass types and thickness used for each size and location.

1-4. LABELS. All glass shall be delivered to the work bearing the original manufacturer's labels. These labels shall not be removed until just prior to the final window cleaning.

1-5. PROTECTION AND CLEANING. All glass shall be protected against breakage during the construction period, and all broken or cracked glass shall be replaced at the time of completion of the work.

All glass shall be cleaned just before final inspection, and all stains and defects shall be removed. Care must be exercised to remove paint, labels, and glazing compound without scratching or marring the surface of the glass or metal work.
PART 2 - PRODUCTS

2-1. **PRODUCTS.** For purposes of indicating performance, quality, and color, products of Viracon are specified. Products of other manufacturers will be considered provided all requirements of the specification are met.

2-2. **MATERIALS.** Materials shall conform to the following:

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Specification Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate or Float Glass</td>
<td>Clear: 1/4 inch, ASTM C1036, Type I, Class 1, Q3. Tinted: Not Used</td>
</tr>
<tr>
<td></td>
<td>Laminated Glass: Not Used</td>
</tr>
<tr>
<td></td>
<td>Clear: ASTM C1172, Kind LA, clear.</td>
</tr>
<tr>
<td>Insulating Glass Units</td>
<td>Not Used</td>
</tr>
<tr>
<td>Curtain Wall Glazing</td>
<td>Not Used</td>
</tr>
<tr>
<td>Elastomeric Glazing Sealants</td>
<td>Glass manufacturer’s written recommendations.</td>
</tr>
<tr>
<td>Glazing Gaskets</td>
<td>Not Used</td>
</tr>
<tr>
<td>Glazing Compound</td>
<td>ASTM C669</td>
</tr>
<tr>
<td>Extruded Tape</td>
<td>Pecora &quot;B-44 Extru-Seal&quot;, Protective Treatments &quot;PTI 606&quot;, or Tremco &quot;440 Tape&quot;.</td>
</tr>
<tr>
<td>Acrylic Sealant</td>
<td>Pecora &quot;Unicrylic&quot; or Tremco &quot;Mono&quot;.</td>
</tr>
<tr>
<td>Setting Blocks</td>
<td>Soft lead or neoprene.</td>
</tr>
<tr>
<td>Spacers</td>
<td>Cork and rubber; Rhopac &quot;Adhesive Backed Spacer Blocks&quot;.</td>
</tr>
</tbody>
</table>
2-3. **GLAZING.**

2-3.01. **Sizes.** All glass sizes shall be obtained from measurements of the work at the site or from the manufacturer of the doors or frames in which the glass is to be set. In all cases, however, the Contractor shall be responsible for the correctness of the size of the glass.

2-3.02. **Locations.** Locations for each type of glass shall be as indicated in the schedules and details on the drawings.

**PART 3 - EXECUTION**

3-1. **INSTALLATION.** All glass shall be installed in accordance with the details shown on the drawings, these specifications, and the recommendations of the glass manufacturer.

Setting blocks shall be provided where recommended by the FGMA.

3-1.01 **Aluminum Entrance Doors.** Not used.

3-1.02. **Aluminum Curtain Wall.** Not used.

3-1.03 **Glazing Schedule:**

<table>
<thead>
<tr>
<th>Designation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GL-1</td>
<td>Monolithic, clear laminated glass: Class 1 (clear), annealed laminated glass, Kind LA, consisting of two lites of annealed float glass joined by a clear pvb interlayer, total thickness 7/16&quot;</td>
</tr>
</tbody>
</table>

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers the work necessary to furnish and install removable, translucent skylights.

1-2. GENERAL.

1-2.01. Translucent skylight shall be constructed in accordance with the dimensions, arrangements and materials indicated on the drawings and specified herein, complete with all accessories and appurtenances indicated, specified or required to give a complete, weather tight unit.

a. The items provided hereunder shall be the end product of one manufacturer in order to achieve standardization for appearance, maintenance and manufacturer's service.

1-3. SUBMITTALS. Before manufacturing of the unit is begun, the following drawings, certificates and samples shall be submitted in accordance with the Submittal section of the specification.

a. Shop Drawings: Submit shop drawings covering frame and panel conditions and complete anchorage details.

b. Color Section Card: Manufacturer's standard color chart for aluminum frame finish.

c. Manufacturer's Certificate of Compliance: Submit: manufacturer's certificate of compliance with performance criteria specified herein, and verification of compliance to CalOSHA requirements.

d. Erector's Affidavit: Submit erector's affidavit of qualification compliance.

e. Panel Sample: 6-inch square material sample.

1-4. QUALITY ASSURANCE.

1-4.01. Manufacturer's and Erector's Qualifications.

a. Quality control inspections and testing shall be conducted at least once each year. Inspections and testing shall include manufacturing facilities, sandwich panel components and production sandwich panel.

b. Material and products shall be manufactured by a company continuously and regularly employed in the manufacture of similar materials, for a
period of at least 10 consecutive years; and which can show evidence of these materials being satisfactorily used on at least six projects of similar size, scope and type within such a period. At least three of the projects shall have been in successful use for 5 years or longer.

c. Erection shall be by an installer who has been in the business of erecting similar materials for at least 5 consecutive years; and can show evidence of satisfactory completion of projects of similar size, scope and type.

1-4.02. Performance Requirements. The manufacturer shall be responsible for the configuration and fabrication of the complete panel and frame system including provision for removal by crane in one piece to provide for servicing of equipment in room below.

1-5. DELIVERY, STORAGE, AND HANDLING.

a. Deliver, store, and handle translucent skylight system in a manner to prevent damage, deterioration, and warping. Provide packaging such as cardboard or other containers, separators, banding, spreaders, and paper wrappings to protect all items.

b. Store translucent skylight system units on long edge, upright, in a protected dry area, at least 6 inches or more off the ground or floor and at least 1/4-inch between individual pieces. Follow special storage and handling requirements of manufacturer. Protect exposed finish surfaces of prefinished items.

PART 2 - PRODUCTS

2-1. MANUFACTURER.

a. Products of the following manufacturer shall be used:

   (1) Kalwall Corporation, Manchester, NH.
   (2) Or equal.

2-2. MATERIALS AND PERFORMANCE CRITERIA.

Skylight shall meet all CalOSHA requirements.

2-2.01. Framing Members. Structural framework shall be tubular aluminum sized by manufacturer to support system. A minimum of four lifting eyes shall be provided as part of the structural framework to facilitate the removal and replacement of the skylight during the installation and removal of pumps within the building. Related components to provide a complete system shall be
aluminum shapes designed by the manufacturer and fabricated in strict accordance with shop drawings.

2-2.02. Translucent Faces. Translucent faces shall be manufactured by insulated panel system fabricator specially for architectural use.

  a. Flammability: The interior face sheet shall have a flame-spread rating no greater than 25 and smoke development no greater than 300 when tested in accordance with ASTM E 84. Burn Extent by ASTM D 635 shall be no greater than 1 inch.

  b. Weatherability: The exterior face shall not change color more than 3.0 Adams Units (DELTA E by ASTM D 2244) after 5 years outdoor weathering in South Florida at 7 degrees facing south, determined by the average of at least three samples. The face sheet shall not darken any more than 0.2 Adams Units (DELTA L by ASTM D 2244) when exposed to 150 degrees F, for 2 weeks. The exterior faces shall have high performance thermoset acrylic protective surface (minimum thickness 1.2 mils), for maximum resistance to erosion and weather, applied in the factory under controlled temperature conditions; the surfacing shall be fully field repairable and refinishable if required.

  c. Appearance: The face sheets shall be uniform in color to prevent splotchy appearance. Exterior face sheets shall be .070-inch thick and white in color. Interior face sheets shall be .045-inch thick and white in color. Faces shall not vary more than ±10 percent in thickness. Faces shall be completely free of ridges and wrinkles which prevent proper surface contact in bonding to the aluminum grid core. Clusters of air bubbles and pinholes which collect moisture and dirt will not be acceptable.

  d. Strength: The exterior face sheet shall be uniform in strength and repel an impact equal to 60 ft/lbs in accordance with SPI Shatter Resistance Test.

2-2.03. Adhesive. The laminate adhesive shall be heat and pressure resin-type engineered for structural sandwich panel use. Adhesive shall pass testing requirements specified by the International Conference of Building Officials "Acceptance Criteria for Sandwich Panel Adhesive". Minimum strength shall be:

  a. 750 psi tensile strength by ASTM C 297 after two exposures to six cycles each of the aging conditions prescribed by ASTM D 1037.

  b. 500 psi shear strength average of five exposures by ASTM D 1002:

     (1) 50 percent relative humidity at 73 degrees F.
     (2) Accelerated aging by ASTM D 1183.
     (3) 182 degrees F.
     (4) Full cycle soak.
     (5) 500-hour oxygen bomb.
2-2.04. **Grid Core.** The aluminum I-beam shall be extruded 6063-T6, with provision for mechanical interlocking of muntin-mullion and perimeter to prevent high and low intersections which do not allow full bonding surface contact with face material. Width of I-beam shall be no less than 7/16 inch. Aluminum I-beam for the grid shall have complete surface contact with the skin material and shall have machined flanges to tolerances of not greater than +.002 inch. A welded or web interlocked grid core shall not be acceptable due to unevenness at muntin-mullion intersections.

2-2.05. **Battens and Perimeter Closures.**

a. Extruded 6063-T5 or 6063-T6 aluminum screw clamp-tight closure system.

b. All battens and perimeter closures to be supplied with 300 Series stainless steel screws (excluding fasteners to the building). Aluminum battens and cap plates shall be field installed.

c. All exposed aluminum shall be corrosion resistant finish in color to be selected from manufacturer's standards.

2-2.06. **Flexible Sealing Tape.** Sealing tape shall be manufacturer's standard pre-applied to closure system at the factory under controlled conditions.

2-2.07. **Fasteners.** Fasteners to the building shall be stainless steel screws or bolts in expansion anchors of size as required to support system and as recommended by the manufacturer.

2-2.08. **Isolation Paint.** Bituminous coating as specified in the Protective Coatings section.

2-2.09. **Ancillary Items.** Provide miscellaneous flashings as required for a complete assembly.

2-3. **PANEL CONSTRUCTION.**

a. Translucent panels shall have a thickness of 2-3/4 inches with a U-factor of .29; light transmission of 30 and shading coefficient of 0.31.

b. Translucent panels shall be a true sandwich panel of flat fiberglass sheet bonded to a grid core of mechanically interlocking aluminum I-beams and shall be laminated under a controlled process of heat and pressure. Tape bond systems are not allowed.

c. Translucent sandwich panel deflection shall not exceed 3.5 inches at 35-pound per square foot loading and shall not exceed 0.10 inches set deflection 5 minutes after load release per ASTM E 72 with a 12 feet clearspan, tested flat.
d. Grid pattern shall be nominal 8-inch by 20-inch (Shoji) and symmetrical about the horizontal centerline of each panel, for flat panel.

e. The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge. In order to insure bonding strength, white spots at intersections of muntins and mullions shall not exceed 4 of each 40 square feet of panel, or shall they be more than 3/64-inch in width.

f. Translucent panels and aluminum perimeter frame shall be preassembled where practical and sealed at the factory. Panels should be shipped to the jobsite in rugged shipping units and shall be ready for erection.

PART 3 - EXECUTION

3-1. PREPARATION.

a. The Contractor shall prepare openings including isolating dissimilar materials from aluminum system which may cause damage by electrolysis.

3-2. ERECTION.

a. The erector shall erect translucent skylight system in strict accordance with shop drawings as supplied by manufacturer. Fastening and sealing shall be in strict accordance with manufacturer's shop drawings. All aluminum shall be cleaned before sealants are applied.

b. After other trades have completed work on adjacent material, carefully inspect translucent skylight assembly and make adjustments necessary to insure proper installation and weather-tight conditions.

c. All staging, lifts, and hoists required for the complete translucent skylight system installation, including staging, etc., necessary for field measuring, shall be provided by, set up and maintained by the erector.

3-3. PROTECTION.

a. After erection, the Contractor shall protect exposed portions from damage by machines, paint, acid cement, or other harmful compounds. The Contractor shall be responsible for removal of protective materials and cleaning with plain water, water with soap, household detergent, or as recommended by the manufacturer.

End of Section
DIVISION 9 – Finishes
PART 1 - GENERAL

1-1. SCOPE. This section covers gypsum wallboard partitions and exterior gypsum sheathing board complete with metal furring, framing, and accessories, to be furnished and installed at the locations indicated on the drawings.

Steel studs are covered in the structural and miscellaneous metals section.

1-2. GENERAL. Gypsum wallboard construction shall be coordinated with other construction and electrical, heating, ventilating, air conditioning, and plumbing work.

Thicknesses and gages of sheet metal and wire used herein are the minimum required. Gages refer to US Standard gage.

1-3. SUBMITTALS. Complete specifications, data, and catalog cuts or drawings covering the items furnished under this section, including installation drawings showing ceiling suspension details, shall be submitted in accordance with the submittals section.

1-4. DELIVERY AND STORAGE. All materials shall be delivered in original packages bearing the name of the manufacturer and the brand name.

Materials shall be stored indoors under cover, with wallboard stacked flat and supported off the floor. Adhesives shall be stored in dry areas and protected against freezing. Metal components and hardware shall be protected against rusting.

PART 2 - PRODUCTS

2-1. MATERIALS.

Abuse/Moisture Resistant Panels

Cement Board Sheathing  Not used.

Partition Studs  As specified in the structural studs and miscellaneous metals section.

Corner Beads  ASTM C840, Type CB; galvanized steel, 1 by 1-1/4 inch perforated flanges.

Casing Beads  ASTM C840, Type LS; galvanized steel, with perforated flanges.

Control Joints

Wall  Zinc or galvanized steel, with 1/4 inch wide V-shaped opening and perforated flanges.

Joint Compound  ASTM C475; premixed paste.

Joint Tape  ASTM C475; perforated.

Wallboard Screws  ASTM C954; self-tapping screws for 16 gage metal studs.

Hangers  Galvanized steel wire, 8 gage.


Masonry Nails  Hardened steel, screw type, fabricated from 9 gage wire.

PART 3 - EXECUTION

3-1. INSTALLATION OF FRAMING. Unless otherwise specified, installation of wall framing members shall conform to ASTM C754 and ASTM C840 requirements that apply to framing installation.
3-1.01. **Main Runner Tees.** Main runner tees shall be spaced 48 inches apart and supported by hanger wires arranged not more than 48 inches on centers. Main runner tees shall be placed with lines parallel to the bordering walls. Locations and methods of splicing shall be as recommended by the manufacturer.

3-1.02. **Furring Cross Channels.** Furring cross channels shall be spaced 16 inches apart and shall be fitted between main runner tees and clipped thereto as recommended by the manufacturer. Each line of furring cross channels shall be straightened and aligned, and lines shall be perpendicular to main runner tees and parallel to each other.

3-1.03. **Partition Framing.** Tracks shall be aligned accurately according to the partition layout and anchored at 24 inch centers. Studs shall be vertical, spaced not more than 16 inches on centers. All studs adjacent to partition intersections and corners shall be anchored to the tracks with screws through each stud and track flange. Stud splices shall be lapped 8 inches and shall be fastened with two screws in each flange.

Partition studs which support ceramic tile shall be 6 inch deep, 16 gage, spaced not more than 16 inches on centers.

Studs shall be located not more than 2 inches from all door frame jambs, partition corners, and dissimilar construction. Studs shall be anchored to the jamb anchor clips of each door frame with bolts or screws. A section of track shall be installed in each door frame head, with the ends slit and the flanges overlapping the adjacent studs and attached with two screws at each end. Stud sections shall be installed over each door frame at the specified spacing.

Short lengths of metal studs or wood blocking shall be installed horizontally between studs wherever required for anchorage of wall-mounted items.

3-1.04. **Furring.** Furring channels shall be vertical, spaced not more than 24 inches on centers, and anchored with powder-actuated anchors driven through alternate flanges into the wall at 16 inch centers. Horizontal furring channels shall be installed at the floor and ceiling line, and as required for proper framing and support.

Furring channels shall be plumbed and aligned by shimming.

3-2. **INSTALLATION OF GYPSUM WALLBOARD.** Unless otherwise specified, installation shall conform to ASTM C840.

3-2.01. **Protection.** Areas where wallboard is to be installed shall have a temperature of **55**°F or higher for 24 hours prior to installation of wallboard. This
temperature shall be maintained until wallboard installation is complete and joints are completely dry.

Adequate ventilation shall be provided to eliminate excessive moisture during and following application of joint treatment.

Wallboard shall be of maximum practical length to reduce the number of end joints. Ends and sides shall be in contact but not forced into place. Wallboard shall be cut neatly to fit around all outlets, switch boxes, recessed light fixtures, diffusers, and similar devices.

For walls and partitions, gypsum wallboard shall be installed with the long dimension vertical. All side joints shall be made over framing members. Joints on opposite sides of partitions shall occur over different studs. End joints, if required, shall be neatly fitted and staggered. Boards shall be fastened to each framing member with screws spaced not more than 12 inches apart in the field and edges of boards.

For walls, cement board sheathing shall be installed with the long dimension horizontal. All end joints shall be staggered and shall be made over framing members. Joints on opposite sides of partitions shall occur over different studs. Boards shall be installed with 1/8 to 3/16 inch space between boards as recommended by the board manufacturer. Cement board sheathing shall be fastened to studs as recommended by the manufacturer.

Screws shall be driven not less than 3/8 inch nor more than 1/2 inch from ends and edges of boards. All screw heads shall be dimpled slightly below the surface of the board, with particular care taken not to break the face paper or otherwise damage the surface or core of the board.

Metal corner beads shall be installed at all exterior corners, and metal casing beads shall be installed at all exposed edges and where wallboard is in contact with other materials.

In general, all corners and exposed edges and openings through wallboard shall be protected with metal casings made accurately to size and dimension.

Control joints shall be provided in walls and ceilings at the locations indicated on the drawings.

3-3. **FINISHING.** Where gypsum wallboard is to be painted, all joints, fastener dimples, and other depressions shall be finished with tape and joint compound, with joint compound feathered and sanded smooth. Wallboard surfaces shall be left smooth, clean, and ready for painting or application of the wall covering.
Where cement board sheathing is covered with the lap seam metal panel system, all joints shall be finished with tape and joint compound, with joint compound feathered and toweled smooth. No sanding will be required. Dimples and depressions need not be filled. All wallboard surfaces and edges of cutouts shall be sealed, and all openings around pipes and fixtures shall be caulked flush, in conformity with ASTM C840. Wallboard surfaces shall be left smooth, clean, and ready for application of lap seam metal panel system.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing and installing of elastomeric high-solids urethane lining systems as indicated on the Drawings. This section covers surface preparation, furnishing and application of a urethane lining system suitable for each set of specified service conditions, the engineering field services from the Material Manufacturer and Applicator that are required, and any other appurtenances that are required to provide a completed corrosion protection system.

1-2. QUALITY ASSURANCE.

1-2.01. Manufacturer's Field Services. The field services provided by the material manufacturer shall include review of the project before surface preparation; certification of the manufacturer’s product for the application; approval of the applicator, the materials, and the procedure to be used; approval of the surface preparation; and approval of the application.

A representative of the corrosion protection system material manufacturer shall submit, through Contractor, written approvals/certification of the proposed protection system materials, application procedures, applicator, and surface preparation requirements. The representative shall be an employee of the material manufacturer.

Contractor shall notify the material manufacturer and Engineer at least 10 days prior to anticipated date of the commencement of corrosion protection system work.

1-2.02. Applicator Field Services. Contractor shall employ the services of a qualified corrosion protection system application contractor (Applicator). The Applicator of the corrosion protection system shall contact the corrosion protection system material manufacturer during the bidding phase of the project and shall include in the cost of this work and the estimated cost of the manufacturers engineering field services as specified.

The corrosion protection system Applicator shall submit a satisfactory experience record including references for previous application of the specified corrosion protection systems to concrete structures of similar design and complexity. The
material manufacturer shall approve the applicator in writing. After the application is complete, the applicator of the corrosion protection system shall certify that the corrosion protection system is free of pinholes and holidays.

The Applicator shall also perform and provide the adhesion testing and results to determine compliance with the specified minimum pull-off adhesion strength.

Following the application, the Applicator shall certify that the corrosion protection system is free of pinholes and holidays.

1-3. SUBMITTALS. In accordance with the Submittals section, complete specifications and data on the protection system, application instructions for the protection system, and material manufacturer's approvals for the protection system furnished under this section shall be submitted for Engineer review. The lining manufacturer shall submit acceptable lining termination details and metal accessories encapsulation details.

The corrosion protection system manufacturer shall provide a certification statement for each component of the corrosion protection system that it will provide corrosion resistance for the specified service conditions.

Submittals shall include instructions on the treatment of bolted connections of equipment to concrete when applied before and/or after surface is coated.

1-4. DELIVERY, STORAGE, AND HANDLING. The material shall be delivered to the jobsite in original unopened containers with labels intact. Protection system components shall be stored indoors in an appropriate location and environment in accordance with the manufacturer's recommendations and shall be protected against freezing.

Shipping shall be in accordance with the Shipping section. Handling and storage shall be in accordance with the Handling and Storage section.

1-5. WARRANTY. Material manufacturer shall warrant the chemical resistance of each corrosion protection system (products and labor) for a period one year from the date of installation when exposed to the customer's normal operating conditions as stated in the specification. This warranty shall not cover wear and tear such as abrasion resistance or mechanical abuse.

PART 2 - PRODUCTS

2-1. SERVICE CONDITIONS. The lining system shall protect the concrete and metal accessories from damage when exposed to the service indicated. The
lining system shall withstand exposure to sunlight and outdoor atmospheric conditions for unlimited duration.

Lining systems required to be compliant with ANSI/NSF 61 shall be certified as compliant in writing by the lining material manufacturer.

2-2. MATERIALS. Each corrosion protection system specified herein is a product of the indicated manufacturer. Equivalent protection systems of other manufacturers regularly producing high quality concrete corrosion protection systems and materials including providing the required material manufacturer's engineering field services may be furnished subject to review and acceptance by Engineer. Coatings and applications shall meet all Federal, State and local regulations including VOC limits.

2-2.01. RO Permeate Surfaces. (Not Used)

2-2.02. Finished Product Water (FPW) Channel and Decarbonator Tank Special Areas. All surfaces of the Decarbonator Tank and Finished Product Water Channel Interior (area 710) in contact with RO Permeate and which must be surface protected during the short plant shut down period shall be coated with a special polyurethane elastomeric coating system configured and designed by one of the following coating manufacturers without exception: Dudick, Inc., Sherwin Williams, or Tnemec.

System shall be selected for compatibility with existing polyurethane elastomeric system, for fast cure times, and for compatibility with the concrete placed less than 72 hours prior to the prime coat surface application.

2-2.03. Coatings for MF Membrane Basins. The interior surface of the MF Membrane Basins and floor sumps (2) located at Train E and F shall receive a corrosion protection system as specified below. The total system will consist of three coats of an epoxy coating system, applied in accordance with the manufacturer’s latest written data. The coating system shall be:

Two coats of Sherwin Williams Duraplate UHS ultra high solids epoxy (minimum DFT 10 to 12 mils per coat) and one primer coat of Sherwin Williams Corobond 100 epoxy primer/sealer (minimum DFT of 4 to 6 mils).

One finish coat of Tnemec H.S. Epoxy Series 104 (minimum DFT 6 to 10 mils), one intermediate coat of Tnemec H.S. Epoxy Series 104 (minimum DFT 6 to 10 mils), and one primer coat of Tnemec H.S. Epoxy Series 104 (minimum DFT 4 to 6 mils).
PART 3 - EXECUTION

3-1. GENERAL. All details, methods, and procedures of mixing, surface preparation, bonding, application, finishing, curing, and protection of the lining shall be in strict accordance with the recommendations of the material manufacturer. The applicator shall comply with the recommendations of the material manufacturer’s engineering field representative.

3-1.01. Coordination. The Contractor shall be responsible for providing dewatering, ventilation and humidity control, confined space entry, cleaning, inspection, supervision, dust control and equipment protection as specified herein and related sections, and as stipulated and recommended by the lining manufacturer.

3-2. SURFACE PREPARATION. All surfaces shall be free of objectionable substances and shall meet the recommendations of the coating manufacturer for surface preparation. Any other surface preparation recommended by the lining material manufacturer shall be brought to Engineer’s attention and may be incorporated into the work if acceptable to Engineer.

All surfaces shall be dry when coated or lined, and shall be free from dirt, dust, sand, mud, oil, grease, rust, mill scale, and other objectionable substances. Oil and grease shall be completely removed as recommended by the material manufacturer before mechanical cleaning is started.

3-2.01. Concrete Surfaces. Concrete surfaces shall be prepared in accordance with SSPC-SP13/NACE 6 and the lining material manufacturer’s recommendation. Surfaces shall be free of cracks, pits, projections, or other imperfections that would interfere with the formation of a smooth, unbroken coating film.

New concrete shall be cured for at least 28 days before lining is applied and shall be ready to receive the lining as determined by the Applicator and material manufacturer. Concrete surfaces shall be tested for capillary moisture in the concrete in accordance with ASTM D4263. There shall be no capillary moisture migration after 24 hours as determined by the test method. If moisture is observed, the corrosion protection system shall include a vapor barrier that is recommended by the protection system manufacturer.

All concrete surfaces to be lined shall be cleaned in accordance with ASTM D4258 and abrasive blasted in accordance with ASTM D4259. Before the lining is applied, the surfaces shall be thoroughly washed or cleaned by air blasting to remove all dust and residue. The Contractor shall repair all concrete surfaces that have spalls, voids, and cracks and shall remove all fins and other surface projections to produce a flush surface for application of the protection system.
Surface profile shall be at least 4 mils for a coating protection system and at least 22 mils for a lining protection system, but shall not be less than 25 percent of the dry film thickness specified for the corrosion protection system or 40-60 grit sandpaper unless recommended otherwise by the material manufacturer.

Concrete surfaces shall be pinhole free as using an epoxy concrete filler or as recommended by the material manufacturer and acceptable to Engineer.

3-2.01.01. Existing Concrete. Existing concrete shall have all existing lining products completely removed before the application of a new corrosion protection system. For existing concrete, unless it can be verified that existing concrete has a vapor retarder, applied beneath it, the application shall include a surface-applied vapor barrier product before the lining system is applied.

If any repairs to existing concrete are required, they shall be made as part of the surface preparation in accordance with the Concrete Surface Repair section prior to the application of lining products.

3-2.01.02. Adhesion Testing. Adhesion testing shall be conducted, by the Applicator, at each application area, after the concrete surfaces has been prepared and approved by the Applicator and lining material manufacturer. Adhesion strength test results shall exceed 400 psi or a higher value if recommended by material manufacturer. Adhesion test results shall be presented to and approved by Owner/Engineer, Applicator, and lining material manufacturer.

The test area shall be at least 2 square feet to allow a minimum of three tests to be conducted. Pull-off strength adhesion tests shall be conducted by the Applicator in accordance with ASTM D7234 for concrete surfaces using an Elcometer tensile adhesion tester. At least three adhesion tests shall be conducted and the results averaged. Adhesion strength shall equal or exceed the minimum adhesion strength specified herein and by the material manufacturer.

3-2.02. Metal Surfaces. Metal surfaces shall be prepared in accordance with the following: All sharp edges, and corners are to be ground smooth, Welds are to be ground smooth, in accordance with NACE standard RP0 178, Appendix C, Designation C, shall have all weld slag and splatter removed and be free of all defects. The surfaces shall be abrasive blasted in conformance with SSPC SP-10 and shall be at least a 3 mil surface profile.

3-3. MIXING AND THINNING. Liner material shall be thoroughly mixed each time any is withdrawn from the container. Liner material containers shall be kept tightly closed except while the material is being withdrawn.
Liner components shall be mixed to proper consistency and viscosity in accordance with the manufacturer's recommendations. Thinning will not be permitted. No adulterant, unauthorized thinner, or other material not included in the formulation, shall be added to the protection system components for any purpose.

In no case shall the wet film thickness of applied lining be reduced below the thickness recommended by the liner manufacturer.

3-4. APPLICATION. Coating shall be spray-applied in accordance with the material manufacturer's recommendations. Coating shall be applied in a neat manner, with finished surfaces free of runs, sags, ridges, laps, and brush marks as recommended by the material manufacturer.

Each coat shall be applied over the previous coat in accordance with the recommendations of the material manufacturer. Each coat shall be applied in a manner that will produce an even film of uniform and proper thickness. In no case shall coating be applied at a rate of coverage which is greater than the maximum rate recommended by the material manufacturer.

Recoating shall be in accordance with the material manufacturer's recommendations.

Alternate coats shall be of contrasting colors to assist in obtaining complete coverage. The first coat on concrete surfaces shall be a dark color.

Lining showing checks, blisters, excessive sags, teardrops, or fat edges will not be accepted and shall be entirely removed and the surface recoated. The lining shall be free of pinholes and holidays.

Lining shall be applied when surface temperature is at least 50°F and at least 5°F above dew point, and relative humidity is 85 percent or lower. Coatings shall not be applied in direct sunlight or when the temperature of the concrete is rising. Preferably the coating shall be applied when the temperature of the concrete is dropping.

When applying high build coatings with a roller or brush and where a dry film thickness of at least 4 mils [100 µm] per coat is required, two or more coats shall be applied to achieve the recommended dry film thickness equal to a spray applied coating.

For conventional spray equipment, each coat shall be applied over the previous coat only when acceptable to the material manufacturer.
For plural spray equipment, the topcoat shall be applied in multiple passes to achieve the required DFT.

3-4.01. Elastomeric Modified Urethane Lining Systems. The concrete surface lining shall be applied in four coats, not including concrete filler when used. The lining shall consist of one prime coat and three finish coats. Prime coat thickness shall be 5 mils. The dry film thickness of each final coat shall be 25 mils.

3-4.02. High Solids Epoxy Systems. The concrete surface lining shall be applied in three coats as specified herein. Minimum thickness of the prime coat shall be 4 to 6 mils. The dry film thickness of the system shall be no less than 25 mils.

3-5. FIELD QUALITY CONTROL. The surfaces shall be cleaned and prepared as needed to properly conduct the visual inspection, spark testing, and adhesion testing. All inspection and testing shall be witnessed by the Applicator and Material Manufacturer. Repairs shall be acceptable to Engineer.

3-5.01. Visual Inspection. The surface of the liner shall be visually inspected for areas defects, air inclusion, pinholes, or other imperfections in the system that may prevent a complete seal of the surfaces.

3-5.02. Spark Testing. All detected holidays and pinholes shall be marked and repaired as recommended by the material manufacturer.

3-5.02.01. Concrete Surfaces. After liners are installed, the material manufacturer shall spark-test all concrete surfaces covered with lining using an acceptable high-voltage electrical spark tester in accordance with ASTM D4787 and set at the recommended voltage, or as a minimum at 100 volts per mil of liner thickness. The material manufacturer shall verify the testing equipment is working properly before beginning the spark testing of the lining. The electrode movement shall be continuous and shall proceed in a systematic manner that will cover 100 percent of the lining surface. A carbon fiber brush shall be used on the sensor electrode.

3-5.03. Adhesion Testing. The Owner/Engineer reserves the right to require adhesion testing of any finished corrosion protection system application specified herein. Adhesion testing shall be conducted as specified in Paragraph 3-2.01.01 above by the Applicator. Adhesion strength test results shall exceed 300 psi or a higher value. Finished system adhesion test results shall be presented to and approved by Owner/Engineer, Applicator, and lining material manufacturer. Following adhesion testing, the area(s) tested shall be repaired by the Applicator with the specified products and methods specified herein.
If the finished system fails an adhesion test, the cause of the failure shall be determined and corrected before the test is repeated on a new test area. If the adhesion test fails a second time, the Owner/Engineer reserves the right to require the entire surface to be completely removed and reapplied at no cost to the Owner/Engineer.

3-5.04. **Film Thickness.** Coating film thickness shall be verified by measuring the wet film thickness of each coat as it is applied and the dry film thickness of the entire system. Wet film thickness shall be measured with a gauge that will measure the wet film thickness within an accuracy of ±0.5 mil. Dry film thickness for concrete shall be measured using a Defelsko Positector 200 series or equal, in accordance with SSPC-PA9 (concrete) and PA2 (steel). At the discretion of the Owner/Engineer, core samples could be obtained for measuring dry film thickness.

3-6. **STORAGE AND SAFETY.** Store all materials only in area or areas designated by the District solely for this purpose. Confine mixing, thinning, clean-up and associated operations, and storage of coating materials related debris before authorized disposal, to these areas. All materials are to be stored on pallets or similar storage handling skids off the ground.

All pertinent governmental, industry, and in-house regulations and standards, including, but not limited to those concerning painting, flammable/combustible liquids, eye protection, head protection, skin protection, respiratory protection, scaffolding, lighting, ventilation, working in enclosed or confined spaces, air and water quality, VOC emissions, dust, blasting residues and paint particulate, as well as the containment, handling and disposal of hazardous or toxic substances or waste, shall be carefully observed and shall supersede any guidelines herein. Material Safety Data Sheets (MSDS) shall be made available at job-site to all workers who may come in contact with the products used.

3-7. **PROTECTION.** Care shall be taken to prevent the lining material from being dropped or spilled on adjacent surfaces, buildings, structures, or facilities. All surfaces so damaged shall be cleaned, repaired, replaced, or painted as acceptable to Engineer.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers architectural field painting of surfaces for appearance, including surface preparation, protection of surfaces, and other appurtenant work. Regardless of the number of coats previously applied, at least two field coats, in addition to any shop or field prime coats, shall be applied to all surfaces unless otherwise specified.

Field applied protective coatings, heavy duty maintenance coatings, and pipe color coding are covered in another section.

Dampproofing of concrete surfaces not in contact with treated or raw water, water repellent for masonry surfaces, elastomeric deck coverings, protective coatings for equipment and surfaces with severe service conditions that have been designated to be coated with a heavy-duty maintenance coating, and coating of the elevated steel tank, steel water storage reservoir are covered in other sections.

1-2. GENERAL. Cleaning, surface preparation, coating application, and thickness shall be as specified herein and shall meet or exceed the coating manufacturer's recommendations. When the manufacturer's minimum recommendations exceed the specified requirements, Contractor shall comply with the manufacturer's minimum recommendations. When equivalent products are acceptable to Engineer, Contractor shall comply with this specification and the coating manufacturer's recommendations.

1-2.01. Governing Standards. All cleaning, surface preparation, coating application, thickness, testing, and coating materials (where available) shall be in accordance with the referenced standards of the following American Water Works Association (AWWA), American National Standard Institute (ANSI), NACE International (NACE), SSPC: The Society for Protective Coating (SSPC), NSF International (NSF), and ASTM requirements.

1-3. SUBMITTALS. Contractor shall submit color cards for all coatings proposed for use, together with complete descriptive specifications and the completed Coating System Data Sheets, to Engineer for review and color selection. Requests for review submitted directly to Engineer by coating suppliers will not be considered.
For the epoxy enamel, aliphatic polyurethane, and satin gloss latex emulsion finish coatings, a total of not more than 15 custom colors may be required. The manufacturer’s standard colors will be acceptable for all other coatings.

1-4. QUALITY ASSURANCE.

1-4.01. Coating System Data Sheet Certifications. The coating applicator and coating manufacturer shall review and approve in writing the proposed coating manufacturer’s written recommendations for the proposed coating system and the intended service. Any variations from the specifications or the coating manufacturers published recommendations shall be submitted in writing and approved by the coating manufacturer. The coating manufacturer shall observe the surface preparation, mixing, and application of the coating systems and submit a written report of what has been observed and any additional recommendations.

1-5. DELIVERY AND STORAGE. All coating products shall be received and stored in accordance with the coating manufacturer’s recommendations.

PART 2 - PRODUCTS

2-1. ACCEPTABLE MANUFACTURERS.

2-1.01. Alternative Manufacturers. In addition to the coatings listed herein, equivalent coatings of the following manufacturers will also be acceptable:

    ICI Devoe      MAB
    PPG           Rust-Oleum

2-1.02. Equivalent Coatings. Whenever a coating is specified by the name of a proprietary product or of a particular manufacturer or vendor, the specified coating shall be understood as establishing the type and quality of coating desired. Other manufacturers’ coatings will be accepted, provided that sufficient information is submitted to enable Engineer to determine that the proposed coatings are equivalent to those named. Information on proposed coatings shall be submitted for review in accordance with the submittals section. Requests for review of equivalency will be accepted only from Contractor and will be considered only after the contract has been awarded.

2-2. MATERIALS. All coatings shall be delivered to the job in original unopened containers with labels intact. Coatings shall be stored indoors and shall be protected against freezing. No adulterant, unauthorized thinner, or other material not included in the coating formulation shall be added to the coating for any purpose.
All coatings shall conform to the air quality regulations applicable at the location of use. Coating materials which cannot be guaranteed by the manufacturer to conform, whether or not specified by product designation, shall not be used.

The coatings specified have been selected on the basis of the manufacturer's statement that the VOC content of the product is 2.8 pounds per gallon or less in the thinned condition, unless otherwise indicated herein; however, it shall be Contractor's responsibility to use only coating materials that are in compliance with the requirements of all regulatory agencies. Local regulations may permit some coatings to have a higher VOC concentration than specified herein.

The coatings specified may meet the VOC limits in the unthinned (as shipped) condition, but may exceed the limits if thinned according to the manufacturer's recommendations. Under these conditions, the coatings shall not be thinned beyond the 2.8 pounds per gallon limit, and if the product cannot be thinned to suit the application method or temperature requirements, another manufacturer's coating shall be used, subject to acceptance by Engineer. Some of the architectural coatings specified contain VOCs in excess of 2.8 pounds per gallon, however, the coatings may be acceptable if supplied in containers of 1 quart or less.

Contractor shall be responsible for ensuring the compatibility of field coatings with each other or with the coatings on shop coated or previously coated surfaces. Coatings used in successive field coats shall be produced by the same manufacturer. Coatings used in the first field coat over shop coated or previously coated surfaces shall cause no wrinkling, lifting, or other damage to underlying coats.

2-2.01. Primers.

Universal Primer
- Ameron "Amercoat 385 Epoxy"
- Carboline "Carboguard 888 Primer"
- Sherwin Williams "Macropoxy 646"
- or Tnemec "Series 27 F.C. Typoxy"

Epoxy Concrete Block Filler
- Ameron "Amerlock 400BF Epoxy Block Filler"
- Plasite "9029 Filler"
- Sherwin Williams "Kem Caticoat HS"
- or Tnemec "54-660"
2-2.02. **Intermediate and Finish Coatings.**

### Epoxy Enamel

<table>
<thead>
<tr>
<th>Surface Type</th>
<th>Coating Options</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Concrete Floors</strong></td>
<td>Ameron &quot;Amercoat 385 Epoxy&quot;, Carboline &quot;Carboguard 890&quot;, Sherwin Williams &quot;Armorseal 1000 HS&quot;, or Tnemec &quot;Series N69 Hi-Build Epoxoline II&quot;; nonskid.</td>
</tr>
<tr>
<td><strong>Ferrous Metal Surfaces, and Masonry or Concrete Surfaces Other Than Floors.</strong></td>
<td>Ameron &quot;Amercoat 385 Epoxy&quot;, Carboline &quot;Carboguard 890&quot;, Tnemec &quot;Series N69 Hi-Build Epoxoline II&quot;, or Sherwin Williams &quot;Macropoxy 646&quot;.</td>
</tr>
<tr>
<td><strong>Aliphatic Polyurethane</strong></td>
<td>Ameron &quot;Amercoat 450 HS&quot;, Carboline &quot;Carbothane 134HG&quot;, Tnemec &quot;Series 1074 Endura-Shield&quot; or Sherwin Williams &quot;Acrolon 218HS&quot;.</td>
</tr>
<tr>
<td><strong>Latex Emulsion</strong></td>
<td>Acrylic containing at least 50 percent by weight nonvolatile solids.</td>
</tr>
<tr>
<td><strong>Flat</strong></td>
<td>Carboline &quot;Carbocrylic 600 &quot;, Sherwin-Williams &quot;Weather Perfect Acrylic Latex Series B-36&quot;, or Tnemec &quot;Series 6 Tneme-Cryl&quot;.</td>
</tr>
<tr>
<td><strong>Traffic Marking Paint</strong></td>
<td>Fed Spec TT-P-115, yellow; ICI Devoe &quot;Glidden Traffic Marking Paint 667355&quot; or Sherwin-Williams &quot;ProMar Alkyd Traffic Marking Paint&quot;.</td>
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</table>
PART 3 - EXECUTION

3-1. SURFACE PREPARATION. All surfaces to be coated shall be clean and dry and shall meet the recommendations of the coating manufacturer for surface preparation. Freshly coated surfaces shall be protected from dust and other contaminants. Oil and grease shall be completely removed by use of solvents or detergents before mechanical cleaning is started. The gloss of previously coated surfaces shall be dulled if necessary for proper adhesion of topcoats.

Surfaces shall be free of cracks, pits, projections, or other imperfections that would interfere with the formation of a smooth, unbroken coating film, except for concrete block construction where a rough surface is an inherent characteristic.

When applying touchup coating or repairing previously coated surfaces, the surfaces to be coated shall be cleaned as recommended by the coating manufacturer and the edges shall be sanded or wire brushed and feathered or otherwise smoothed so that they will not be noticeable after they are coated. All coatings made brittle or otherwise damaged by heat of welding shall be completely removed.

3-1.01. Galvanized Surfaces. Galvanized surfaces shall be prepared for coating in conformity with the instructions of the manufacturer of the epoxy enamel. Any chemical treatment of galvanized surfaces shall be followed by thorough rinsing with clean water.

3-1.02. Ferrous Metal Surfaces. Ungalvanized ferrous metal surfaces shall be prepared for coating by cleaning using one or more of the following methods as specified: solvents (SSPC-SP1); blasting (SSPC-SP5, -SP6, -SP7, or -SP10); power tools (SSPC-SP3); or hand tools (SSPC-SP2). Oil and grease shall be completely removed in accordance with SSPC-SP1 before beginning any other cleaning method. Surfaces of welds shall be scraped and ground as necessary to remove all slag and weld spatter. Tools which produce excessive roughness shall not be used.

All ferrous metal surfaces which are specified to be coated with epoxy enamel shall have all welds ground smooth and blended and sharp edges ground smooth, if not previously prepared in the shop.

The cleaning methods and profiles specified herein are minimums, and if the requirements printed in the coating manufacturer's data sheets exceed the limits specified, the value printed on the data sheets shall become the minimum requirement.

3-1.02.01. Ferrous Metal Surfaces - Nonimmersion Service. Ferrous metal surfaces, including fabricated equipment, in nonimmersion service shall be cleaned to the degree recommended by the coating manufacturer for surfaces to
be coated with epoxy enamel, except galvanized surfaces. Blast cleaning to at least SSPC-SP6 shall be used where recommended by the coating manufacturer, and may be used elsewhere at the option of Contractor, provided that no dust is permitted to settle on adjacent wet coating. Surface profile shall be at least 15 percent of the dry film thickness specified for the coating system.

3-1.03. **Concrete Surfaces.** All concrete surfaces shall be free of objectionable substances and shall meet the coating manufacturer's recommendations for surface preparation. Any other surface preparation recommended by the coating material manufacturer shall be brought to Engineer’s attention and may be incorporated into the work if acceptable to Engineer.

All concrete surfaces shall be dry when coated and free from dirt, dust, sand, mud, oil, grease, and other objectionable substances. Oil and grease shall be completely removed by use of solvents or detergents before mechanical cleaning is started.

New concrete shall have cured for at least 28 days before coating is applied as recommended by the material manufacturer. Concrete surfaces shall be tested for capillary moisture in accordance with ASTM D4263. There shall be no capillary moisture when coatings are applied on concrete.

All surfaces to be coated shall be cleaned in accordance with ASTM D4258 and abraded in accordance with ASTM D4259. Prior to application of the coating, the surfaces shall be thoroughly washed or cleaned by air blasting to remove all dust and residue. Spalled areas, voids, and cracks shall be repaired in accordance with the concrete section and as acceptable to Engineer. Fins and other surface projections shall be removed to provide a flush surface before application of coating.

Except where indicated otherwise, the concrete surfaces, including those with bug holes less than 1 inch in any dimension, shall be prepared when required and as recommended by the manufacturer, using an epoxy concrete block filler.

3-1.04. **Concrete Block Surfaces.** Voids and openings in concrete block surfaces shall be pointed. Interior surfaces to be coated with latex coating shall not be filled. All exposed exterior surfaces and surfaces to be coated with epoxy enamel, including the joints, shall be filled so that a continuous unbroken coating film is obtained.

3-1.05. **Wood Surfaces.** Not used.

3-1.06. **Plastic Surfaces.** All wax and oil shall be removed from plastic surfaces that are to be coated, including PVC and FRP, by wiping with a solvent compatible with the specified coating.
3-1.07. Hardware. Hardware items such as bolts, screws, washers, springs, and grease fittings need not be cleaned prior to coating if there is no evidence of dirt, corrosion, or foreign material.

3-2. MIXING AND THINNING. Coating shall be thoroughly mixed each time any is withdrawn from the container. Coating containers shall be kept tightly closed except while coating is being withdrawn.

Coating shall be factory mixed to proper consistency and viscosity for hot weather application without thinning. Thinning will be permitted only as necessary to obtain recommended coverage at lower application temperatures. In no case shall the wet film thickness of applied coating be reduced, by addition of coating thinner or otherwise, below the thickness recommended by the coating manufacturer. Thinning shall be done in compliance with all applicable air quality regulations.

3-3. APPLICATION. Coating shall be applied in a neat manner that will produce an even film of uniform and proper thickness, with finished surfaces free of runs, sags, ridges, laps, and brush marks. Each coat shall be thoroughly dry and hard before the next coat is applied. In no case shall coating be applied at a rate of coverage greater than the maximum rate recommended by the coating manufacturer.

Coating failures will not be accepted and shall be entirely removed and the surface recoated. Failures include but are not limited to sags, checking, cracking, teardrops, fat edges, or delaminations.

3-3.01. Priming. Edges, corners, crevices, welds, and bolts shall be given a brush coat of primer before application of the primer coat. Special attention shall be given to filling all crevices with coating.

Abraded and otherwise damaged portions of shop-applied coating shall be cleaned and recoated as recommended by the manufacturer of the finish coating. Welded seams and other uncoated surfaces, heads and nuts of field-installed bolts, and surfaces where coating has been damaged by heat shall be given a brush coat of the specified primer. Before the specified spot or touchup coating of metal surfaces, edges, corners, crevices, welds, and bolts in the area of the spot or touchup coating shall be given a brush coat of primer. This patch, spot, or touchup coating shall be completed, and the paint film shall be dry and hard, before additional coating is applied.

3-3.02. Latex Coating. Latex coating shall be applied by brushing or rolling; spraying will not be permitted. Latex coating shall not be thinned excessively.
3-3.03. **Epoxy Enamel.** Epoxy enamel shall be applied in accordance with the coating manufacturer's recommendations, including temperature limitations and protection from sunlight until topcoated.

Coatings shall not be applied to concrete surfaces in direct sunlight or when the temperature of the concrete is rising. Preferably the coating shall be applied when the temperature of the concrete is dropping.

When applying high build epoxy coatings with a roller or brush and where a dry film thickness of at least 4 - 6 mils per coat is required, two or more coats shall be applied to achieve the recommended dry film thickness equal to a spray applied coating.

3-3.04. **Film Thickness.** The total coating film thickness, including prime coat (if any), intermediate coats, and finish coat, shall be not less than the following:

<table>
<thead>
<tr>
<th>Type of Coating</th>
<th>Minimum Dry Film Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latex</td>
<td>3 mils</td>
</tr>
<tr>
<td>Clear varnish</td>
<td>2 mils</td>
</tr>
<tr>
<td>Epoxy enamel</td>
<td></td>
</tr>
<tr>
<td>Floors</td>
<td>5 mils</td>
</tr>
<tr>
<td>Surfaces with first coat of epoxy</td>
<td>7 mils</td>
</tr>
<tr>
<td>enamel and final coat of aliphatic</td>
<td></td>
</tr>
<tr>
<td>polyurethane</td>
<td></td>
</tr>
<tr>
<td>Other surfaces (two coats)</td>
<td>10 mils</td>
</tr>
<tr>
<td>All other finishes</td>
<td>5 mils</td>
</tr>
</tbody>
</table>

3-3.05. **Weather Conditions.** Coatings shall not be applied, except under shelter, during wet, damp, or foggy weather, or when windblown dust, dirt, debris, or insects will collect on freshly applied coating. Coatings shall not be applied at temperatures lower than the minimum temperature recommended by the coating manufacturer, or to metal surfaces such as tanks or pipe containing cold water, regardless of the air temperature, when metal conditions are likely to cause condensation. When necessary for proper application, a temporary enclosure shall be erected and kept heated until the coating has fully cured.

3-4. **REPAIRING FACTORY FINISHED SURFACES.** Factory finished surfaces damaged prior to acceptance by OWNER shall be spot primed and recoated with materials equivalent to the original coatings. If, in the opinion of Engineer, spot repair of the damaged area is not satisfactory, the entire surface or item shall be recoated.
3-5. **PROTECTION OF SURFACES.** Throughout the work Contractor shall use drop cloths, masking tape, and other suitable measures to protect adjacent surfaces. Contractor shall be responsible for correcting and repairing any damage resulting from its or its subcontractors’ operations. Coatings spilled or spattered on adjacent surfaces which are not being coated at the time shall be immediately removed. Exposed concrete or masonry not specified to be coated which is damaged by coatings shall be either removed and rebuilt or, where authorized by OWNER, coated with two coats of masonry coating.

3-6. **FIELD PRIMING SCHEDULE.** In general, surfaces of steel, cast iron, and equipment are specified to be shop primed. Any such surfaces which have not been shop primed shall be field primed. Damaged or failed shop coatings which have been determined unsuitable by Engineer shall be removed and the surfaces shall be field primed. Galvanized, aluminum, stainless steel, wood, and insulated surfaces shall be field primed. Primers used for field priming, unless otherwise required for repair of shop primers, shall be:

<table>
<thead>
<tr>
<th>Surface To Be Primed</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel and cast iron, surfaces to be coated with:</td>
<td></td>
</tr>
<tr>
<td>Epoxy enamel</td>
<td>Same as finish coats</td>
</tr>
<tr>
<td>Galvanized</td>
<td>Epoxy enamel</td>
</tr>
<tr>
<td>Plastic surfaces, including PVC and FRP</td>
<td>Same as finish coats</td>
</tr>
<tr>
<td>Insulated piping</td>
<td>As recommended by manufacturer of finish coats</td>
</tr>
<tr>
<td>Concrete, surfaces to be coated with epoxy enamel</td>
<td>Epoxy concrete block filler</td>
</tr>
<tr>
<td>Concrete block to be coated with epoxy enamel</td>
<td>Epoxy concrete block filler</td>
</tr>
</tbody>
</table>

Surfaces specified to be field coated with clear finish coats need not be primed. Unless otherwise recommended by the coating manufacturer or specified herein, priming will not be required on concrete, concrete block, plaster or gypsum wallboard surfaces specified to be coated with latex coating, nor on metal surfaces specified to be coated with epoxy enamel coatings. Priming will not be required on surfaces to be marked with traffic marking paint. Concrete surfaces to be coated with epoxy enamel shall be filled with epoxy concrete block filler so that a continuous film is obtained, except where indicated otherwise.

3-7. **COATING SCHEDULE.** The following schedule lists coatings for intermediate and finish coats. All exposed surfaces, including sides and edges, shall be coated.
Surface To Be Coated

3-7.01. **Metal Surfaces.**

Structural and miscellaneous steel exposed to view inside buildings. (Galvanized surfaces are not to be coated unless otherwise specified)

- **Material:** Epoxy enamel (one finish coat)

Steel Doors and Frames

- **Intermediate coat:** Universal Primer
- **Finish Coat:** Aliphatic polyurethane

Ductwork exposed to view inside buildings, after proper priming

- **Adjacent to ceilings:** Flat latex emulsion
- **Adjacent to walls:** Satin gloss latex emulsion

Heating and air conditioning units, convector covers, electrical equipment cabinets, and similar items and equipment (unless factory finished) exposed to view

- **Intermediate coat:** Universal primer
- **Finish coat:** Aliphatic polyurethane

Electrical conduit exposed to view inside buildings (except banks of conduits in multiple layers hung from ceilings), including fittings, boxes, supports, and accessories, after proper priming

- **Adjacent to ceilings:** Flat latex emulsion
- **Adjacent to walls:** Satin gloss latex emulsion
3-7.02. Concrete and Masonry Surfaces.
All concrete and concrete block (except floors and surfaces scheduled to receive other coatings) which are exposed to view in interior locations (two coats).

- Walls and columns. Satin gloss latex emulsion
- Ceilings and overhead construction. Flat latex emulsion
- Underside of concrete canopies (two coats). Flat latex emulsion
- Concrete block where scheduled. Epoxy enamel

3-7.03. Miscellaneous Surfaces.
Gypsum wallboard surfaces (two coats).

- Walls. Satin gloss latex emulsion
- Ceilings. Flat latex emulsion
- Wood doors and trim. Painted. Satin gloss latex emulsion
- Interior wood doors. Varnished. Wood stain plus two coats of clear satin varnish
- Insulated piping (except aluminum jacketed insulation). Satin gloss latex emulsion

Plastic surfaces, including PVC and FRP.

- Indoors. Epoxy enamel
- Outdoors.
  - First coat. Epoxy enamel
  - Finish coat. Aliphatic polyurethane

Pavement marking (one coat). Traffic marking paint

3-7.04. Surfaces Not To Be Coated. Unless otherwise specified, the following surfaces shall be left uncoated:

- Exposed aluminum, except ductwork.
- Polished or finished stainless steel. Unfinished stainless steel, except flashings and counterflashings, shall be coated.
- Nickel or chromium.
- Galvanized surfaces, except piping, conduit, ductwork, and other items specifically noted.
Piping concealed in inaccessible plumbing chases and above suspended ceilings.
Rubber and plastics, except as specified.
Acoustical panel ceilings.
Face brick.
Exterior concrete.
Surfaces specified to be factory finished.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers field applied protective coatings, including surface preparation, protection of surfaces, inspection, and other appurtenant work for equipment and surfaces designated to be coated with heavy-duty maintenance coatings. Regardless of the number of coats previously applied, at least two field coats in addition to any shop coats or field prime coats shall be applied to all surfaces unless otherwise specified.

1-2. GENERAL. Cleaning, surface preparation, coating application, and thickness shall be as specified herein and shall meet or exceed the coating manufacturer's recommendations. When the manufacturer's minimum recommendations exceed the specified requirements, Contractor shall comply with the manufacturer's minimum recommendations. When equivalent products are acceptable to Engineer, Contractor shall comply with this Specification and the coating manufacturer's recommendations.

1-2.01. Governing Standards. All cleaning, surface preparation, coating application, thickness, testing, and coating materials (where available) shall be in accordance with the referenced standards of the following AWWA, ANSI, NACE, SSPC, NSF, and ASTM.

1-2.02. Delivery and Storage. All coating products shall be received and stored in accordance with the coating manufacturer's recommendations.

1-2.03. Coatings, Painting, and Linings Covered in Other Sections.

Architectural painting.

Elastomeric high solids urethane lining systems for corrosion protection and waterproofing.

Steel tank lining.

1-3. SUBMITTALS. Contractor shall submit color cards for all coatings proposed for use, together with complete descriptive specifications, manufacturer's product data sheet and the completed Coating System Data Sheets, to Engineer for review and color selection. Each product data sheet shall include application temperature limits including recoat time requirements for the ambient conditions at the site, including temperatures up to 130°F. Requests for review submitted directly to Engineer by coating suppliers will not be considered.
When the proposed products will be in contact with treated or raw water in potable water treatment facilities, Contractor shall submit certifications that the proposed systems are in compliance with ANSI/NSF 61.

Contractor shall submit a Coating System Data Sheet for each separately identified surface in the Metal Surfaces Coating Schedule, Concrete and Masonry Surfaces Coating Schedule, and the Miscellaneous Surfaces Coating Schedule that will be used in the Project, using the appropriate Coating System Data Sheet forms (Figures 1-09940 and 2-09940) at the end of this section. Each field coating system shall be acceptable to the coating material manufacturer.

Coating System Data Sheets shall be assigned a unique number with a prefix letter based on the following:

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Surfaces</th>
<th>Fig. 09940</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Iron and steel (coated entirely in field)</td>
<td>1 or 2</td>
</tr>
<tr>
<td>A</td>
<td>Iron and steel (shop primed)</td>
<td>2</td>
</tr>
<tr>
<td>C</td>
<td>Concrete and concrete block</td>
<td>1</td>
</tr>
<tr>
<td>E</td>
<td>Equipment - submerged</td>
<td>1</td>
</tr>
<tr>
<td>E</td>
<td>Equipment – nonsubmerged</td>
<td>2</td>
</tr>
<tr>
<td>F</td>
<td>Nonferrous metal</td>
<td>1</td>
</tr>
<tr>
<td>G</td>
<td>Galvanized</td>
<td>1</td>
</tr>
<tr>
<td>H</td>
<td>High temperature</td>
<td>1</td>
</tr>
<tr>
<td>P</td>
<td>PVC and FRP</td>
<td>1</td>
</tr>
</tbody>
</table>

Each coating system that will be applied entirely in the field shall be assigned only a prefix letter and no suffix letter. Fig.1-09940 shall be submitted for each surface coated entirely in the field.

Each shop-applied coating system that includes one or more field applied coats shall be assigned both a prefix letter and suffix letter “F”. Fig.2-09940 shall be submitted for each surface having a shop applied coating and one or more field applied finish coats.

A separate Coating System Data Sheet shall be developed and submitted for each surface scheduled to be coated or variation or change in a coating system. The number identifying the surface and coating system shall be of the form A11 or A12-F. The subscript number shall be assigned by the Contractor so that each surface and coating system combination is uniquely identified. For example:
A11-F may be assigned to “Epoxy – one coat to metal curbs for skylights and power roof ventilators that have been shop primed”.

A21 may be assigned to “Epoxy – two coats to non-galvanized structural and miscellaneous steel exposed to view inside buildings”.

C21 may be assigned to “Epoxy – two coats to all concrete and concrete block in corrosive area (Except floors and surfaces scheduled to receive other coatings) which are exposed to view”.

C22 may be assigned to “Epoxy – two coats to walls, floors, and curbed areas, adjacent to corrosive chemical storage and feed equipment as indicated on the Drawings”.

The manufacturer’s standard colors will be acceptable for all coatings.

1-4. QUALITY ASSURANCE.

1-4.01. Coating System Data Sheet Certifications. The coating applicator and coating manufacturer shall review and approve in writing the coating manufacturer's written recommendations for the coating system and the intended service. Any variations from the Specifications or the coating manufacturers published recommendations shall be submitted in writing and approved by the coating manufacturer.

1-4.02. Special Interior Coating Systems. Specialty coatings in the Microfiltration Area shall be in accordance with the Elastomeric High Solids Urethane and Epoxy Lining Systems Section.

In addition to the requirements for all coating systems, the coating applicator and coating manufacturer shall develop and submit, in writing, the proposed detailed procedures for handling, storing, surface preparation, mixing, and application to verify compliance with this Specification and the coating manufacturer's written recommendations. The procedures shall include copies of the coating manufacturer's published recommendations and the proposed method for complying with these recommendations and these Specifications. Contractor, coating applicator, and coating manufacturer shall review and approve, in writing, the proposed detail procedures before they are submitted for review.

Contractor and coating manufacturer shall inspect coating application of the appropriate application methods.
PART 2 - PRODUCTS

2-1. ACCEPTABLE MANUFACTURERS.

2-1.01. Alternative Manufacturers. In addition to the coatings listed herein, equivalent products of other manufacturers that distribute globally will also be acceptable.

Sigma
Rust-Oleum

2-1.02. Equivalent Coatings. Whenever a coating is specified by the name of a proprietary product or of a particular manufacturer or vendor, it shall be understood as establishing the desired type and quality of coating. Other manufacturers' coatings will be accepted, provided that sufficient information is submitted to enable Engineer to determine that the proposed coatings are equivalent to those named. Information on proposed coatings shall be submitted for review in accordance with the Submittals Procedures section. Requests for review of equivalency will be accepted only from Contractor, and will be considered only after the contract has been awarded.

2-2. MATERIALS. All coatings shall be delivered to the job in original, unopened containers, with labels intact. Coatings shall be stored indoors and shall be protected against freezing. No adulterant, unauthorized thinner, or other material not included in the coating formulation shall be added to the coating for any purpose.

All coatings shall conform to the Southern California Air Quality Management District regulations. Coating materials that cannot be guaranteed by the manufacturer to conform, whether or not specified by product designation, shall not be used.

With the exception of heat resistant coatings, the coatings specified have been selected on the basis of the manufacturer's statement that the VOC content of the product is 0.8 lbs per gallon or less; however, it shall be the Contractor's responsibility to use only coating materials that are in compliance with the requirements of all regulatory agencies. Local regulations may require some coatings to have a lower VOC content than specified herein. The coatings specified may meet the VOC limits in the unthinned (as shipped) condition, but may exceed the limits if thinned according to the manufacturer's recommendations. In such case, the coatings shall not be thinned beyond the 0.8 lbs per gallon limit, and if the product cannot be thinned to suit the application method or temperature limits, another manufacturer's coating shall be used, subject to acceptance by Engineer.
Contractor shall be responsible for ensuring the compatibility of field coatings with each other or with any previously applied coatings. Coatings used in successive field coats shall be produced by the same manufacturer. The first field coat over shop coated or previously coated surfaces shall cause no wrinkling, lifting, or other damage to underlying coats.

All coatings used on surfaces that will be in contact with potable or treated water shall be certified as being in compliance with ANSI/NSF 61. Coatings that cannot be so certified, whether or not specified by manufacturer and by product designation, shall not be used.

All intermediate and finish coating materials that will be in contact with wastewater atmosphere shall be guaranteed by the manufacturer to be fumeproof and suitable for wastewater plant atmosphere that contains hydrogen sulfide. Coatings that cannot be so guaranteed shall not be used. Lead-free, chromium-free, and mercury-free coatings shall be used.

2-2.01. Primers.

<table>
<thead>
<tr>
<th>Universal Primer</th>
<th>PPG Amerlock 2/400VOC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tnemec “Series 27 F.C Typoxy”,</td>
</tr>
<tr>
<td></td>
<td>Carboline &quot;Rustbond&quot;, ICI Devoe &quot;Devran</td>
</tr>
<tr>
<td></td>
<td>224HS&quot; International Paint Interseal 1100,</td>
</tr>
<tr>
<td></td>
<td>or Sherwin-Williams &quot;Macropoxy 646&quot;.</td>
</tr>
<tr>
<td>Zinc Primer</td>
<td>PPG Dimetcote 21-5 (Inorganic) PPG</td>
</tr>
<tr>
<td></td>
<td>Amercote 68HSVOC (Epoxy), Carboline</td>
</tr>
<tr>
<td></td>
<td>&quot;859 VOC Zinc Primer&quot;, ICI Devoe &quot;Catha-Coat 302V&quot;,</td>
</tr>
<tr>
<td></td>
<td>or Sherwin-Williams &quot;Zinc Clad II Series&quot;.</td>
</tr>
<tr>
<td>Epoxy Concrete Block Filler</td>
<td>PPG Amercoat 114A, Carboline &quot;Sanitile 100&quot; or</td>
</tr>
<tr>
<td></td>
<td>« Carboguard 954HB », ICI Devoe &quot;Truglaze 4015&quot;,</td>
</tr>
<tr>
<td></td>
<td>Tnemec &quot;Series 130 Envirofill&quot;, or Sherwin-Williams</td>
</tr>
<tr>
<td></td>
<td>&quot;Heavy Duty Block Filler B42W46&quot;.</td>
</tr>
<tr>
<td>Epoxy Concrete Filler and Surfacer</td>
<td>Tnemec &quot;Series 218 MortarClad&quot;, PPG</td>
</tr>
<tr>
<td></td>
<td>Amercoat 114A, Carboline &quot;Carboguard 510&quot;, Devoe</td>
</tr>
<tr>
<td></td>
<td>« Trueglaze 4015 », or Sherwin-Williams &quot;Heavy Duty Block Filler B42W46&quot;.</td>
</tr>
</tbody>
</table>

Epoxy (NSF Certified systems)

Ferrous Metal Surfaces and Concrete Surfaces in Contact with Treated or Raw Water in Potable Water Facilities

- PPG Amercoat "Amerlock 2/400VOC"
- Carboline "Phenoline 341 100% Solids Epoxy"
- ICI Devoe "233H3502 Low VOC Envirole 230 NSF"
- Tnemec "Series L140F Pota-Pox Plus"
- Sherwin-Williams "Macropoxy 646 NSF"

Epoxy Enamel

Concrete Floors

- PPG Amercoat "Amerlock 2/400VOC"
- Carboline "Carboguard 890VOC"
- International Paint Interseal 2100 Devoe 235V
- Tnemec "Series L69 Hi-Build Epoxoline II"
- Sherwin-Williams "Macropoxy 646 NSF"

Ferrous Metal Surfaces and Masonry or Concrete Surfaces Other Than Floors

- PPG Amercoat "Amercoat 2/400VOC"
- Carboline "Carboguard 890VOC"
- ICI Devoe International Paint Interseal 2100 Devoe 235V
- Tnemec "Series L69 Hi-Build Epoxoline II"
- Sherwin-Williams "Macropoxy 646"

Flake-Filled Epoxy

ICI Devoe “International Interline 984/985Carboline "Plasite 4500"
Sherwin-Williams "Sher-Glass FF"

Aliphatic Polyurethane

- PPG Amercoat “Amershield VOC”
- Carboline “Carboethan 134MC”
- ICI Devoe “Devthane 379H”
- International Interthane 2100
- Tnemec “Series 740 Endura-Shield II”
- Sherwin Williams “High Solids Polyurethane B65”

Coal Tar Epoxy

Sherwin-Williams "Targuard Coal Tar Epoxy B69"

Vinyl Ester

Tnemec "Series 120 Vinester"
Carboline "Plasite 4110" or Sherwin-Williams "Magnaplate Vinyl Ester"
Ceilcote 232
Heat-Resistant Suitable for temperatures up to 400°F; PPG Amercoat "Amerlock 2/400VOC", International Intertherm 228 Carboline "Thermaline 450", or Sherwin-Williams "Kem Hi-Temp Heatflexll 450 »".

High Heat-Resistant Suitable for temperatures up to 1000°F; Carboline "Thermaline 4700 VOC", or Sherwin-Williams "Flame Control".

PART 3 - EXECUTION

3-1. SURFACE PREPARATION. All surfaces to be coated shall be clean and dry and shall meet the recommendations of the coating manufacturer for surface preparation. Freshly coated surfaces shall be protected from dust and other contaminants. Oil and grease shall be completely removed by use of solvents or detergents before mechanical cleaning is started. The gloss on previously coated surfaces shall be dulled if necessary for proper adhesion of topcoats.

Surfaces shall be free of cracks, pits, projections, or other imperfections that would interfere with the formation of a smooth, unbroken coating film, except for concrete block construction where a rough surface is an inherent characteristic.

When applying touchup coating or repairing previously coated surfaces, the surfaces to be coated shall be cleaned as recommended by the coating manufacturer, and the edges of the repaired area shall be feathered by sanding or wire brushing to produce a smooth transition that will not be noticeable after the coating is applied. All coatings made brittle or otherwise damaged by heat of welding shall be completely removed.

3-1.01. Galvanized Surfaces. Galvanized surfaces shall be prepared for coating according to the instructions of the manufacturer of the epoxy. Any chemical treatment of galvanized surfaces shall be followed by thorough rinsing with clean water.

3-1.02. Ferrous Metal Surfaces. Ungalvanized ferrous metal surfaces shall be prepared for coating by using one or more of the following cleaning procedures specified here-in: solvents (SSPC-SP1); abrasive blasting (SSPC-SP5, -SP10, -SP6, or -SP7) power tools (SSPC-SP3 or -SP11); or hand tools (SSPC-SP2). Oil and grease shall be completely removed in accordance with SSPC-SP1 before beginning any other cleaning method. Surfaces of welds shall be scraped and ground as necessary to remove all slag and weld spatter. Tools which produce excessive roughness shall not be used.
All components of equipment that can be properly prepared and coated after installation shall be installed prior to surface preparation. Components that will be inaccessible after installation shall have the surfaces prepared and coated before installation. Motors, drive trains, and bearings shall be protected during surface preparation in accordance with the equipment manufacturer’s recommendations.

All cut or sheared edges shall be ground smooth to a 1/8 inch minimum radius for all material 1/4 inch thickness and larger. For material thickness less than 1/4 inch all cut or sheared edges shall be ground smooth to a radius equal to 1/2 the material thickness. Grinding of rolled edges on standard shapes with a minimum radius of the 1/16 inch will not be required.

All ferrous metal surfaces shall have all welds ground smooth and free of all defects in accordance with NACE Standard SP0178, Appendix C, Designation C and sharp edges ground smooth, if not previously prepared in the shop. Instead of blending of the weld with the base metal as required by the NACE standard, it will be acceptable to furnish a welded joint that has a smooth transition of the weld to the base metal. All welds shall be ground smooth to ensure satisfactory adhesion of paint.

The cleaning methods and surface profiles specified herein are minimums, and if the requirements printed in the coating manufacturer's data sheets exceed the limits specified, the value printed on the data sheets shall become the minimum requirement.

3-1.02.01. Ferrous Metal Surfaces – Non-immersion Service. Ferrous metal surfaces, including fabricated equipment, in non-immersion service shall be cleaned to the degree recommended by the coating manufacturer for surfaces to be coated with coal tar epoxy, epoxy, and heat-resistant coatings, except galvanized surfaces. Surface preparation of ferrous metal surfaces in non-immersion service shall consist of abrasive blast cleaning to SSPC-SP6, and the first application of coating shall be performed on the same day. If more surface area is prepared than can be coated in one day, the uncoated area shall be blast cleaned again to the satisfaction of Engineer. Surface profile shall be as recommended by coating manufacturer, but not less than 2.0 mils.

3-1.02.02. Ferrous Metal Surfaces - Immersion Service. Surface preparation of ferrous metal surfaces in immersion service shall consist of abrasive blast cleaning to at least SSPC-SP10 and the first application of coating shall be performed on the same day. If more surface area is prepared than can be coated in one day, the uncoated area shall be blast cleaned again to the satisfaction of Engineer. Surface profile shall be as recommended by coating manufacturer, but not less than 3.5 mils.
3-1.03. **Concrete Surfaces.** All concrete surfaces shall be free of objectionable substances and shall meet the coating manufacturer's recommendations for surface preparation. Concrete surfaces shall be prepared in accordance with SSPC-SP13/NACE 6. Any other surface preparation recommended by the coating material manufacturer shall be brought to Engineer's attention and may be incorporated into the work if acceptable to Engineer.

All concrete surfaces shall be dry when coated and free from dirt, dust, sand, mud, oil, grease, and other objectionable substances. Oil and grease shall be completely removed by use of solvents or detergents before mechanical cleaning is started.

New concrete shall have cured for at least 4 weeks before coating is applied as recommended by the material manufacturer. Concrete surfaces shall be tested for capillary moisture in accordance with ASTM D4263. There shall be no capillary moisture when coatings are applied on concrete.

All surfaces to be coated shall be cleaned in accordance with ASTM D4258 and abraded in accordance with ASTM D4259. Surface profile shall be at least 25 percent of the dry film thickness specified for the coating system. Prior to application of the coating, the surfaces shall be thoroughly washed or cleaned by air blasting to remove all dust and residue. Spalled areas, voids, and cracks shall be repaired in accordance with the Concrete section and as acceptable to the Engineer. Fins and other surface projections shall be removed to provide a flush surface before application of coating.

Except where epoxy is applied as damp-proofing, the concrete surfaces, including those with bug holes less than 1 inch [25 mm] in any dimension, shall be prepared as recommended by the manufacturer, using an epoxy concrete filler and surfacer. Where coating with a vinyl ester the concrete filler and surfacer shall be as recommended by the manufacturer to be compatible with vinyl ester.

3-1.04. **Concrete Block Surfaces.** Voids and openings in concrete block surfaces shall be pointed. All exposed exterior surfaces and surfaces to be coated with epoxy, including the joints, shall be filled so that a continuous unbroken coating film is obtained.

3-1.05. **Copper Tubing.** All flux residue shall be removed from joints in copper tubing. Immediately before coating is started, tubing shall be wiped with a clean rag soaked in xylol.

3-1.06. **Plastic Surfaces.** All wax and oil shall be removed from plastic surfaces that are to be coated, including PVC and FRP, by wiping with a solvent compatible with the specified coating.
3-1.07. **Hardware.** Hardware items such as bolts, screws, washers, springs, and grease fittings need not be cleaned prior to coating if there is no evidence of dirt, corrosion, or foreign material.

3-1.08. **Aluminum.** When a coating system is required, remove all oil or deleterious substance with neutral detergent or emulsion cleaner or blast lightly with fine abrasive.

3-1.09. **Stainless Steel.** When a coating system is required, surface preparation shall conform to the coating manufacturer's recommendations.

3-2. **MIXING AND THINNING.** Coating shall be thoroughly mixed each time any is withdrawn from the container. Coating containers shall be kept tightly closed except while coating is being withdrawn.

Coating shall be factory mixed to proper consistency and viscosity for hot weather application without thinning. Thinning will be permitted only as necessary to obtain recommended coverage at lower application temperatures. In no case shall the wet film thickness of applied coating be reduced, by addition of coating thinner or otherwise, below the thickness recommended by the coating manufacturer. Thinning shall be done in compliance with all applicable air quality regulations.

3-3. **APPLICATION.** Coating shall be applied in a neat manner that will produce an even film of uniform and proper thickness, with finished surfaces free of runs, sags, ridges, laps, and brush marks. Each coat shall be thoroughly dry and hard before the next coat is applied. Each coat shall be a different color, if available. In no case shall coating be applied at a rate of coverage greater than the maximum rate recommended by the coating manufacturer.

Coating failures will not be accepted and shall be entirely removed down to the substrate and the surface recoated. Failures include but are not limited to sags, checking, cracking, teardrops, fat edges, fisheyes, or delamination.

3-3.01. **Priming.** Edges, corners, crevices, welds, and bolts shall be given a brush coat (stripe coat) of primer before application of the primer coat. The stripe coat shall be applied by a brush and worked in both directions. Special attention shall be given to filling all crevices with coating. When using zinc primers the stripe coat shall follow the initial prime coat.

Abraded and otherwise damaged portions of shop-applied coating shall be cleaned and recoated as recommended by the manufacturer of the finish coating. Welded seams and other uncoated surfaces, heads and nuts of field-installed bolts, and surfaces where coating has been damaged by heat shall be given a brush coat of the specified primer. Before the specified spot or touchup coating of metal surfaces, edges, corners, crevices, welds, and bolts in the area of the
spot or touchup coating shall be given a brush coat of primer. This patch, spot, or touchup coating shall be completed, and the paint film shall be dry and hard, before additional coating is applied.

3-3.02. **Epoxy.** When used, epoxy shall be applied in accordance with the coating manufacturer's recommendations, including temperature limitations and protection from sunlight until top-coated.

When concrete is to be coated, coatings shall not be applied to concrete surfaces in direct sunlight or when the temperature of the concrete is rising. Preferably the coating shall be applied when the temperature of the concrete is dropping.

When applying high build epoxy coatings with a roller or brush and where a dry film thickness of at least 4-6 mils per coat is required, two or more coats shall be applied to achieve the recommended dry film thickness equal to a spray applied coating.

3-3.03. **Coal Tar Epoxy.** When used, the application of coal tar epoxy, including time limits for recoating, shall conform to the recommendations of the coating manufacturer.

When concrete is to be coated, coatings shall not be applied to concrete surfaces in direct sunlight or when the temperature of the concrete is rising. Preferably the coating shall be applied when the temperature of the concrete is dropping.

3-3.04. **Vinyl Ester.** When used, the application of vinyl ester coating system, including time limits for recoating and temperature requirements of the materials, shall conform to the recommendations of the coating manufacturer.

3-3.05. **Film Thickness.** The total coating film thickness including intermediate coats and finish coat, shall be not less than the following:

<table>
<thead>
<tr>
<th>Type of Coating</th>
<th>Minimum Dry Film Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium consistency coal tar</td>
<td>20 mils.</td>
</tr>
<tr>
<td>Coal tar epoxy (two coats)</td>
<td>20 mils.</td>
</tr>
<tr>
<td>Epoxy</td>
<td></td>
</tr>
<tr>
<td>Floors (two coats)</td>
<td>10 mils.</td>
</tr>
<tr>
<td>Surfaces with first coat of epoxy and final coat of aliphatic polyurethane</td>
<td>7 mils (5 mils DFT for epoxy plus 2 mils DFT for aliphatic polyurethane).</td>
</tr>
<tr>
<td>Surfaces with first and second coat of epoxy and final coat of aliphatic polyurethane</td>
<td>12 mils (10 mils DFT for epoxy plus 2 mils DFT for aliphatic polyurethane).</td>
</tr>
</tbody>
</table>
### Type of Coating
- Other surfaces (two coats)
- Immersion service (three coats)
- Flake-filled epoxy (two coats)
- Vinyl ester
- Zinc, epoxy, polyurethane
  - Surfaces with first coat of zinc, intermediate coat of epoxy, and final coat of aliphatic polyurethane
- Heat-resistant (silicone)
- High heat-resistant (silicone)
- Other (one coat)
- Other (two coats)

### Minimum Dry Film Thickness
- 10 mils.
- 15 mils.
- 30 mils.
- 30 mils.
- 10 mils, 3 mils zinc, 5 mils epoxy, plus 2 mils for aliphatic polyurethane.
- 3 mils.
- 3 mils.
- 5 mils.
- 10 mils.

#### 3-3.06. Weather Conditions
Coatings shall not be applied, except under shelter, during wet, damp, or foggy weather, or when windblown dust, dirt, debris, or insects will collect on freshly applied coating.

Coatings shall not be applied at temperatures lower than the minimum temperature recommended by the coating manufacturer, or to metal surfaces such as tanks or pipe containing cold water, regardless of the air temperature, when metal conditions are likely to cause condensation. When necessary for proper application, a temporary enclosure shall be erected and kept heated until the coating has fully cured.

Coatings shall not be applied at temperatures higher than the maximum temperature recommended by the coating manufacturer. Where coatings are applied during periods of elevated ambient temperatures, Contractor and the coatings manufacturer shall be jointly responsible to ensure that proper application is performed including adherence to all re-coat window requirements. Precautions shall be taken to reduce the temperature of the surface application, especially for metal, at elevated temperatures above 100°F including shading application area from direct sunlight, applying coating in the evening or at night, and ventilating the area to reduce the humidity and temperature,

Vinyl ester coating materials, when required, shall be maintained during transportation, storage, mixing, and application at the temperature required by the coating manufacturer, 35°F to 90°F.

#### 3-4. REPAIRING FACTORY FINISHED SURFACES
Factory finished surfaces damaged prior to acceptance by Owner shall be spot primed and recoated with
materials equivalent to the original coatings. If, in the opinion of Engineer, spot repair of the damaged area is not satisfactory, the entire surface or item shall be recoated.

3-5. **PROTECTION OF SURFACES.** Throughout the work Contractor shall use drop cloths, masking tape, and other suitable measures to protect adjacent surfaces. Contractor shall be responsible for correcting and repairing any damage resulting from its or its subcontractors' operations. Coatings spilled or spattered on adjacent surfaces which are not being coated at the time shall be immediately removed. Exposed concrete or masonry not specified to be coated which is damaged by coatings shall be either removed and rebuilt or, where authorized by Owner, coated with two coats of masonry coating.

3-6. **FIELD QUALITY CONTROL.** The following inspection and testing shall be performed: surface profile, visual inspection, and wet and dry film thickness testing. All inspection and testing shall be witnessed by Engineer.

3-6.01. **Surface Profile Testing.** The surface profile for ferrous metal surfaces shall be measured for compliance with the specified minimum profile. The surface profile for concrete shall comply with SSPC 13/NACE 6 Table 1 for severe service.

3-6.02. **Visual Inspection.** The surface of the protective coatings shall be visually inspected.

3-6.03. **Film Thickness.** Coating film thickness shall be verified by measuring the film thickness of each coat as it is applied and the dry film thickness of the entire system. Wet film thickness shall be measured with a gauge that will measure the wet film thickness within an accuracy of ±0.5 mil. Dry film thickness shall be measured in accordance with SSPC-PA 2.

3-6.04. **Spark Testing.** Not required.

3-6.05. **Adhesion Testing.** Not required.

3-7. **FIELD PRIMING SCHEDULE.** In general, steel and cast iron surfaces of equipment are specified to be shop primed. Any such surfaces which have not been shop primed shall be field primed. Damaged or failed shop coatings which have been determined unsuitable by Engineer shall be removed and the surfaces shall be field coated, including prime coat (if any). Galvanized, aluminum, stainless steel, and insulated surfaces shall be field primed. Primers used for field priming, unless otherwise required for repair of shop primers, shall be:
<table>
<thead>
<tr>
<th>Surface To Be Primed</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment, surfaces to be coated with</td>
<td>Universal primer.</td>
</tr>
<tr>
<td>Aliphatic polyurethane</td>
<td>Same as finish coats.</td>
</tr>
<tr>
<td>Epoxy</td>
<td>Same as finish coats.</td>
</tr>
<tr>
<td>Coal tar coating</td>
<td>Same as finish coats.</td>
</tr>
<tr>
<td>Vinyl ester</td>
<td>Same as finish coats.</td>
</tr>
<tr>
<td>Steel and cast iron, surfaces to be coated with</td>
<td></td>
</tr>
<tr>
<td>Epoxy</td>
<td>Same as finish coats or inorganic zinc.</td>
</tr>
<tr>
<td>Coal tar coating</td>
<td>Same as finish coats.</td>
</tr>
<tr>
<td>Aluminum</td>
<td>Epoxy.</td>
</tr>
<tr>
<td>Galvanized</td>
<td>Epoxy.</td>
</tr>
<tr>
<td>Copper</td>
<td>Epoxy.</td>
</tr>
<tr>
<td>Stainless steel</td>
<td>Epoxy.</td>
</tr>
<tr>
<td>Plastic surfaces, including PVC and FRP</td>
<td>Same as finish coats.</td>
</tr>
<tr>
<td>Insulated piping</td>
<td>As recommended by manufacturer of finish coats.</td>
</tr>
<tr>
<td>Concrete, surfaces to be coated with epoxy</td>
<td></td>
</tr>
<tr>
<td>For damp-proofing</td>
<td>Epoxy.</td>
</tr>
<tr>
<td>For all other surfaces</td>
<td>Epoxy concrete filler and surfacer.</td>
</tr>
<tr>
<td>Concrete block exposed in exterior locations</td>
<td>Epoxy concrete block filler.</td>
</tr>
<tr>
<td>Concrete block to be coated with epoxy</td>
<td>Epoxy concrete block filler.</td>
</tr>
</tbody>
</table>

Unless otherwise recommended by the coating manufacturer or specified herein, priming will not be required on concrete, or concrete block, nor on metal surfaces specified to be coated with coal tar epoxy, and heat-resistant coatings. Concrete surfaces to be coated with epoxy shall be filled with epoxy concrete filler and surfacer so that a continuous film is obtained, except where concrete is damp-proofed with epoxy.

3-8. FINISH COATING SYSTEMS. The following schedule lists coatings systems and coating surface designations. See Article1-3 for a definition of the surface designations.
<table>
<thead>
<tr>
<th>No.</th>
<th>Finish Coating Systems</th>
<th>Coating Surface Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>1.</td>
<td>Epoxy – One coat</td>
<td>x</td>
</tr>
<tr>
<td>2.</td>
<td>Epoxy – Two coats</td>
<td>x</td>
</tr>
<tr>
<td>3.</td>
<td>Epoxy / NSF – Two coats</td>
<td>x</td>
</tr>
<tr>
<td>4.</td>
<td>Epoxy – Three coats</td>
<td>x</td>
</tr>
<tr>
<td>5.</td>
<td>Epoxy / NSF – Three coats</td>
<td>x</td>
</tr>
<tr>
<td>6.</td>
<td>Epoxy – First coat</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>Aliphatic polyurethane – Finish coat</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Epoxy – First and second coat</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>Aliphatic polyurethane – Finish coat</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Universal primer – First coat</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>Aliphatic polyurethane – Finish coat</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Medium consistency coal tar – Two coats</td>
<td>x</td>
</tr>
<tr>
<td>10.</td>
<td>Coal tar epoxy – Two coats</td>
<td>x</td>
</tr>
<tr>
<td>11.</td>
<td>Vinyl ester – Two coats</td>
<td>x</td>
</tr>
<tr>
<td>12.</td>
<td>Heat resistant – Two coats</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>High heat resistant – Two coats</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Zinc primer – First coat</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Epoxy – Intermediate coat</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aliphatic polyurethane – Final coat</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Flake-filled epoxy</td>
<td>x</td>
</tr>
</tbody>
</table>

3-8.01. **Surfaces Not To Be Coated.** Unless otherwise specified, the following surfaces shall be left uncoated:

- Exposed aluminum, except ductwork.
- Polished or finished stainless steel. Unfinished stainless steel, except flashings and counter flashings, shall be coated.
- Nickel or chromium.
- Galvanized surfaces, except piping, conduit, ductwork, and other items specifically noted.
Rubber and plastics, except as specified.
Exterior concrete.
FRP wastewater troughs.
Surfaces specified to be factory finished.

3-8.02. **Shop Finishing.** Items to be shop finished include the following. Shop finishing shall be in accordance with the coating manufacturer's recommendations.

a. All slide gates.
b. All conveyors.
c. Other surfaces where blast cleaning cannot be or is not recommended to be performed in the field.
d. Other items as otherwise specified.

3-8.03. **Field Coating.** Items to be field coated include the following. Field coating shall be in accordance with the field priming schedule, the coating schedule, and the manufacturer's recommendations.

a. Surfaces not indicated to be shop finished and surfaces where blast cleaning can be performed in the field.
b. Other items as otherwise specified.

3-9. **METAL SURFACES COATING SCHEDULE.**

<table>
<thead>
<tr>
<th>Surface To Be Coated</th>
<th>Finish Coating System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-galvanized structural and miscellaneous steel exposed to view or to the elements in exterior locations.</td>
<td>A6</td>
</tr>
<tr>
<td>Non-galvanized structural and miscellaneous steel exposed to view inside buildings.</td>
<td>A2</td>
</tr>
<tr>
<td>Unless otherwise specified, pumps, motors, speed reducers, and other machines and equipment exposed to view.</td>
<td>E8</td>
</tr>
<tr>
<td>Actuator surfaces for sluice gates, slide gates, control weirs, unless factory finished.</td>
<td>Outdoor – E8</td>
</tr>
<tr>
<td>Metal curbs for skylights and power roof ventilators.</td>
<td>A1</td>
</tr>
<tr>
<td>Surface To Be Coated</td>
<td>Finish Coating System</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Exterior of elevator car, car frame, and enclosure.</td>
<td>A1</td>
</tr>
<tr>
<td>Interior of elevator car, car gates, and hoistway doors and frames.</td>
<td>A1</td>
</tr>
<tr>
<td>Elevator guiderails and structural steel in hoistway.</td>
<td>A2</td>
</tr>
<tr>
<td>Heating and air conditioning units, convector covers, electrical equipment cabinets, and similar Items and equipment (unless factory finished) exposed to view.</td>
<td>E8</td>
</tr>
<tr>
<td>Surfaces of cranes and hoists exposed to view indoors.</td>
<td>E2</td>
</tr>
<tr>
<td>Surfaces of cranes and hoists exposed to the elements outdoors.</td>
<td>E6</td>
</tr>
<tr>
<td>Steel yard lighting poles exposed to view or to the elements.</td>
<td>A8</td>
</tr>
<tr>
<td>Cast Iron and steel piping inside buildings, including piping to be insulated, valves, fittings, flanges, bolts, supports, and accessories, and galvanized surfaces after proper priming.</td>
<td>A2</td>
</tr>
<tr>
<td>Cast Iron and steel piping in immersion service including inside buildings, including valves, fittings, flanges, bolts, supports, and accessories, and galvanized surfaces after proper priming.</td>
<td>A4</td>
</tr>
<tr>
<td>Cast Iron and steel piping above grade exposed to the elements and to view outdoors, including piping to be insulated, valves, fittings, flanges, bolts, supports, and accessories, and galvanized surfaces after proper priming.</td>
<td>A6</td>
</tr>
<tr>
<td>Copper pipe and tubing, including fittings and valves.</td>
<td>F2</td>
</tr>
<tr>
<td>Copper pipe and tubing, including fittings and valves exposed to view in exterior locations.</td>
<td>F6</td>
</tr>
<tr>
<td>Surface To Be Coated</td>
<td>Finish Coating System</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Enclosed type screw pumping equipment, all iron and steel exterior surfaces exposed to UV except stainless steel, motors, and speed reducers.</td>
<td>E7</td>
</tr>
<tr>
<td>Open type screw pumping equipment, all iron and steel exterior surfaces exposed to UV except stainless steel, motors, and speed reducers.</td>
<td>E7</td>
</tr>
<tr>
<td>Open type screw pumping equipment, all iron and steel interior surfaces including the screw surfaces except stainless steel, motors, and speed reducers.</td>
<td>E4</td>
</tr>
<tr>
<td>Basin launders, troughs, weir plates, and accessories.</td>
<td>A4</td>
</tr>
<tr>
<td>Rapid mix equipment, all iron and steel surfaces except stainless steel, motors, and speed reducers.</td>
<td>E5</td>
</tr>
<tr>
<td>Surface aeration equipment, all iron and steel surfaces except stainless steel, motors, and speed reducers.</td>
<td>E4</td>
</tr>
<tr>
<td>All metal surfaces, unless otherwise specified, which will be submerged or buried, all or in part, including valves, and scum baffles, and cast iron slide gates, but excluding piping laid in the ground.</td>
<td>E4 or A10</td>
</tr>
<tr>
<td>All fully or partially submerged surfaces of screening, grit removal, aeration mixing, and sludge mixing equipment.</td>
<td>E4 or A10</td>
</tr>
<tr>
<td>Miscellaneous castings, including manhole rings and covers, and manhole steps. (One coat, if not shop coated).</td>
<td>E2 or A10</td>
</tr>
<tr>
<td>Cast iron and steel piping in manholes, wetwells, grit basin, aeration basin, and similar locations, including valves fittings, flanges, bolts, supports, and accessories.</td>
<td>A10</td>
</tr>
<tr>
<td>All metal harness anchorage for buried piping.</td>
<td>A10</td>
</tr>
<tr>
<td>Exterior surfaces of extension hoppers and accessories for chemical feeders.</td>
<td>Outdoor - E6, Indoor - E2</td>
</tr>
<tr>
<td>Surface To Be Coated</td>
<td>Finish Coating System</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Supports and miscellaneous metal for equipment handling corrosive chemicals.</td>
<td>Outdoor - A6, Indoor - A2</td>
</tr>
<tr>
<td>Aluminum in contact with concrete.</td>
<td>F1</td>
</tr>
<tr>
<td>Boiler breeching and other surfaces which will be hot during operation.</td>
<td>H13</td>
</tr>
<tr>
<td>Pneumatic conveyor piping.</td>
<td>H12</td>
</tr>
<tr>
<td>Aluminum and galvanized ductwork and conduit indoors.</td>
<td>F1 or G1</td>
</tr>
<tr>
<td>Aluminum and galvanized ductwork and conduit exposed to elements outdoors.</td>
<td>F6 or G6</td>
</tr>
<tr>
<td>Aluminum materials exposed to the elements outdoors.</td>
<td>F6</td>
</tr>
</tbody>
</table>

3-10. **CONCRETE AND MASONRY SURFACES COATING SCHEDULE.**

<table>
<thead>
<tr>
<th>Surface To Be Coated</th>
<th>Finish Coating System</th>
</tr>
</thead>
<tbody>
<tr>
<td>All concrete and concrete block in corrosive area (Except floors and surfaces scheduled to receive other coatings) which are exposed to view.</td>
<td>Indoor – C2, Outdoor – C7</td>
</tr>
<tr>
<td>Where indicated on the Drawings, walls, floors, and curbed areas, adjacent to corrosive chemical storage and feed equipment.</td>
<td>C2</td>
</tr>
</tbody>
</table>

3-11. **MISCELLANEOUS SURFACES COATING SCHEDULE.**

<table>
<thead>
<tr>
<th>Surface To Be Coated</th>
<th>Finish Coating System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastic Surfaces, including PVC and FRP.</td>
<td>Outdoor – P6, Indoor – P2</td>
</tr>
<tr>
<td>Piping Insulation</td>
<td>Outdoor – P6, Indoor – P2</td>
</tr>
</tbody>
</table>

3-12. **PIPING IDENTIFICATION SCHEDULE.** Exposed piping and piping in accessible chases shall be identified with lettering or tags designating the service of each piping system, marked with flow directional arrows, and color coded.

Piping scheduled to be color coded shall be completely coated with the indicated colors, except surfaces specified to remain uncoated shall include sufficiently

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Final Expansion Issued for Bid
long segments of the specified color to accommodate the lettering and arrows. All other piping shall be coated to match adjacent surfaces, unless otherwise directed by Engineer.

3-12.01. Location. Lettering and flow direction arrows shall be provided on pipe near the equipment served, adjacent to valves, on both sides of wall and floor penetrations, at each branch or tee, and at least every 50 feet in straight runs of pipe. If, in the opinion of Engineer, this requirement will result in an excessive number of labels or arrows, the number required shall be reduced as directed.

3-12.02. Metal Tags. Where the outside diameter of pipe or pipe covering is 5/8 inch or smaller, aluminum or stainless steel tags shall be provided instead of lettering. Tags shall be stamped as specified and shall be fastened to the pipe with suitable chains. Pipe identified with tags shall be color coded as specified.

3-12.03. Lettering. Lettering shall be painted or stenciled on piping or shall be applied as snap-on markers. Snap-on markers shall be plastic sleeves, Brady "Bradysnap-On B-915", Seton "Setmark", or equal. Letter size shall be as follows:

<table>
<thead>
<tr>
<th>Outside Diameter of Pipe or Covering</th>
<th>Minimum Height of Letters</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/8 inch and smaller</td>
<td>Metal tags -1/4 inch</td>
</tr>
<tr>
<td>3/4 to 4 inches</td>
<td>3/4 inch</td>
</tr>
<tr>
<td>5 inches and larger</td>
<td>2 inches</td>
</tr>
</tbody>
</table>

3-12.04. Color Coding and Lettering. All piping for the following services shall be color coded. Bands shall be 6 inches wide spaced along the pipe at 5 foot intervals. For services not listed, the color coding and lettering shall be as directed by the Engineer.

<table>
<thead>
<tr>
<th>Piping Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Service</strong></td>
</tr>
<tr>
<td>Ammonia</td>
</tr>
<tr>
<td>Chilled Water (supply or return)</td>
</tr>
<tr>
<td>Citric Acid</td>
</tr>
<tr>
<td>Compressed Air</td>
</tr>
<tr>
<td>Distilled Water</td>
</tr>
<tr>
<td>Service</td>
</tr>
<tr>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Drain</td>
</tr>
<tr>
<td>Filtrate</td>
</tr>
<tr>
<td>Fire Protection Water</td>
</tr>
<tr>
<td>Fuel Oil</td>
</tr>
<tr>
<td>Gasoline</td>
</tr>
<tr>
<td>Grease</td>
</tr>
<tr>
<td>Grey Water</td>
</tr>
<tr>
<td>Heating Water (supply or return)</td>
</tr>
<tr>
<td>Instrument Air</td>
</tr>
<tr>
<td>Laboratory Vacuum</td>
</tr>
<tr>
<td>Low Pressure Air (aeration supply)</td>
</tr>
<tr>
<td>Natural Gas or Propane Gas</td>
</tr>
<tr>
<td>Nonpotable Water (downstream of backflow preventer)</td>
</tr>
<tr>
<td>Odor Control – Indoors</td>
</tr>
<tr>
<td>Odor Control – Outdoors</td>
</tr>
<tr>
<td>Oil – Hydraulic</td>
</tr>
<tr>
<td>Plumbing Vents</td>
</tr>
<tr>
<td>Polyaluminum Chloride</td>
</tr>
<tr>
<td>Polymer</td>
</tr>
<tr>
<td>Potable Water (hot or cold)</td>
</tr>
<tr>
<td>Sample</td>
</tr>
<tr>
<td>Service Water</td>
</tr>
</tbody>
</table>
### Piping Identification

<table>
<thead>
<tr>
<th>Service</th>
<th>Color of Pipe</th>
<th>Color of Letters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Settled Sewage Service Water</td>
<td>Dark blue with orange bands</td>
<td>White</td>
</tr>
<tr>
<td>Sodium Bisulfite</td>
<td>Light brown with orange bands</td>
<td>White</td>
</tr>
<tr>
<td>Sodium Hydroxide (caustic)</td>
<td>Yellow with green bands</td>
<td>Black</td>
</tr>
<tr>
<td>Sulfuric Acid</td>
<td>Yellow with red bands</td>
<td>Black</td>
</tr>
<tr>
<td>Vacuum Pump Discharge</td>
<td>Aluminum</td>
<td>Black</td>
</tr>
</tbody>
</table>

Notes:

1. Lettering shall read, “CAUTION: NONPOTABLE WATER, DO NOT DRINK”.
2. Lettering shall be on a yellow background and shall read, “CAUTION: NONPOTABLE WATER, DO NOT DRINK”. Each outlet on the nonpotable water line shall be similarly labeled.
3. Lettering shall read, “CAUTION: RECLAIMED WATER, DO NOT DRINK”.
4. Lettering shall be on a light green background.

Electrical conduit shall be coated to match adjacent ceiling or wall surfaces as directed by Engineer. Vent lines shall be coated to match surfaces they adjoin.

In addition, special coating of the following items will be required:

<table>
<thead>
<tr>
<th>Item</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve handwheels and levers</td>
<td>Red</td>
</tr>
<tr>
<td>Hoist hooks and blocks</td>
<td>Yellow and black stripes</td>
</tr>
</tbody>
</table>

Numerals at least 2 inches high shall be painted on or adjacent to all accessible valves, pumps, flowmeters, and other items of equipment which are identified on the Drawings or in the Specifications by number.

End of Section
## Surface Description

<table>
<thead>
<tr>
<th>System No. -</th>
<th></th>
</tr>
</thead>
</table>

## Surface Preparation Description

- Solvent SSPC-SP1
- Ferrous Metal Nonimmersion SSPC-SP6
- Ferrous Metal Immersion
  - SSPC-SP10
  - SSPC-SP-5
- Other

## Coating

<table>
<thead>
<tr>
<th>Coating</th>
<th>DFT (mils)</th>
<th>Manufacturer and Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Coat (Primer)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Second Coat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Third Coat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total System</td>
<td>Not less than minimum thickness specified.</td>
<td></td>
</tr>
</tbody>
</table>

## Notes

(Attached if needed.)

### Project Information

<table>
<thead>
<tr>
<th>Coatings Manufacturer:</th>
<th>Initials _____</th>
</tr>
</thead>
<tbody>
<tr>
<td>Painting Applicator:</td>
<td>Initials _____</td>
</tr>
</tbody>
</table>

**BLACK & VEATCH**

<table>
<thead>
<tr>
<th>Coating System Data Sheet</th>
<th>Fig 1-09940</th>
</tr>
</thead>
</table>
### SHOP PRIMED SURFACE DESCRIPTION

<table>
<thead>
<tr>
<th>SYSTEM NO.</th>
<th>-F</th>
</tr>
</thead>
</table>

### SURFACE PREPARATION DESCRIPTION

- Solvent SSPC-SP1
- Other:

### COATING

<table>
<thead>
<tr>
<th>COATING</th>
<th>DFT mils</th>
<th>MANUFACTURER AND PRODUCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shop (Primer)</td>
<td></td>
<td>(Identify Product/Type)</td>
</tr>
<tr>
<td>Touchup</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermediate Coat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finish Coat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total System</td>
<td></td>
<td>Not less than minimum thickness specified.</td>
</tr>
</tbody>
</table>

### Notes

(Attached if needed.)

---

**Project:**

- Coatings Manufacturer: Initials ______
- Painting Applicator: Initials ______

**BLACK & VEATCH**

COATING SYSTEM DATA SHEET

Fig 2-09940
PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing and installation of stationary type weather louvers. Combination louver/dampers, control dampers, fire dampers, adjustable louvers, penthouses, and smoke vents are covered in other sections.

1-2. GENERAL. Louvers shall be furnished and installed as specified herein and in accordance with the details, louver schedule, or arrangements indicated on the Drawings.

Louvers shall be of the sizes required for opening sizes indicated on the Drawings. Actual opening sizes for louvers scheduled for insertion within existing construction shall be field verified. Actual louver sizes shall allow for shim and caulk space.

1-3. SUBMITTALS. Complete specifications and detailed drawings covering arrangement, dimensions, hardware, accessories, and details of construction and installation of the louvers shall be submitted in accordance with the Submittals Procedures section.

1-4. COLOR SELECTION. Colors of louvers will be selected from the manufacturer's full line of colors by Engineer. Procedures for selecting colors shall be as indicated in the Submittals Procedures section.

1-5. DELIVERY, STORAGE, AND HANDLING. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements section.

Materials shall be handled, transported, and delivered in a manner which will prevent bends, dents, scratches, or damages of any kind. Damaged materials shall be promptly replaced. Materials shall be stored off the ground and protected from the weather.
PART 2 - PRODUCTS

2-1. PERFORMANCE AND DESIGN CRITERIA.

2-1.01. Governing Standard. Except as modified or supplemented herein, all stationary louvers shall be certified to meet the performance criteria specified and outlined by AMCA Standard 500.

2-1.02. Finishes. Louvers shall have a Kynar paint finish.

70% Kynar paint finishes shall meet the AAMA specification 2605-11 with 1.2 mils total dry film thickness. 50% Kynar paint finishes shall meet the AAMA specification 2604-05 with 1.2 mils (50% Kynar has a much larger standard color selection).

2-1.03. Construction. Louvers shall be of aluminum construction and shall be the product of one manufacturer. Louvers shall be furnished complete with all hardware and appurtenances necessary for a satisfactory installation. The louvers shall have extended sills as shown on the Drawings.

Stationary type weather louvers shall be architectural style continuous blades with concealed Mullions.

2-1.04. Performance Requirements.

2-1.04.01. Stationary Type. The velocity at which the beginning point of water penetration occurs for stationary type weather louvers shall be at least 790 fpm. The minimum free area for a 48 inches x 48 inches louver shall be 54 percent. The maximum static pressure loss at 600 fpm shall be 0.08 inches wc.

2-1.04.02. Acoustical Type. Not used.

2-2. ACCEPTABLE PRODUCTS.

2-2.01. Stationary Type Weather Louvers. Subject to the requirements specified herein, stationary type weather louvers shall be equivalent to the following:

Ruskin "ELF-375XH"

Arrow United Industries "EA-410"

2-2.02. Acoustical Louvers. Not used.

2-2.03. Brick Vents. Not used.
2-2.04. **Accessories.** Not used. Stationary type louvers shall have aluminum removable bird screens.

2-3. **MATERIALS.**

<table>
<thead>
<tr>
<th>Material</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum Extrusions</td>
<td>ASTM B221, Alloy 6063-T5, minimum 0.125 inch thick.</td>
</tr>
<tr>
<td>Bird Screen</td>
<td>0.051 inch expanded, 0.50 inch flattened bird screen.</td>
</tr>
</tbody>
</table>

**PART 3 - EXECUTION**

3-1. **GENERAL.** Products shall be installed in accordance with this section, the manufacturer's instructions, and as indicated on the Drawings.

Complete specifications and detailed drawings covering arrangement, dimensions, hardware, accessories, and details of construction and installation of the louvers and vents will be made available to the louver and vent installer.

3-2. **INSTALLATION.** The louvers shall be installed with anchors suitable for the adjacent material and shall be caulked as specified in the caulking section. When required, bird screens or insect screens shall be installed on the louvers.

Where aluminum work is to be attached to steel supporting members or other dissimilar metal, the aluminum shall be kept from direct contact with such metals by a heavy coat of epoxy enamel in accordance with the Architectural Painting section. Aluminum surfaces which will be in contact with concrete or masonry when installed shall be given a heavy coat of epoxy enamel. All paint shall be dry and hard when the coated parts are installed.

End of Section
PART 1 - GENERAL

1-1. SCOPE. This section covers the miscellaneous items of work not covered in other sections.

1-2. GENERAL. Miscellaneous specialties shall be furnished and installed as specified herein and in accordance with the details, arrangements, and dimensions indicated on the drawings. Where not specifically indicated or specified, fasteners, gaskets, and other accessories shall be provided as required and as recommended by the manufacturer of the specific item.

1-3. SUBMITTALS. Complete specifications, detailed drawings, and setting or erection drawings covering miscellaneous specialties shall be submitted in accordance with the submittals section.

PART 2 - PRODUCTS

2-1. PRODUCTS.

2-1.01. Fire Extinguishers. Portable fire extinguishers of the all-purpose, nitrogen-pressured, dry chemical type shall be provided as scheduled herein. The fire extinguishers shall be UL-approved for Class A, B, and C fires and shall have a 10 pound capacity, such as Badger "10ABC", Buckeye "10H-ABC", or Kidde "10TAS". Finish of shell shall be red with all metal handle and valve.

Wall-mounted fire extinguishers shall be mounted on suitable wall brackets at the specific locations designated by the Designer. Extinguishers indicated as cabinet-mounted shall be placed in cabinets as specified.

The following fire extinguishers shall be provided:

<table>
<thead>
<tr>
<th>Location</th>
<th>Quantity</th>
<th>Mounting</th>
</tr>
</thead>
<tbody>
<tr>
<td>MF Building, Electrical Room</td>
<td>2</td>
<td>Cabinet/surface</td>
</tr>
<tr>
<td>Pump Station</td>
<td>4</td>
<td>surface</td>
</tr>
</tbody>
</table>

2-1.02. Fire Extinguisher Cabinets. Fire extinguisher cabinets shall be provided and installed at the locations indicated in the above schedule. Cabinets shall be Larson Architectural Series, full-glass style, "Model AL-2712-R". Cabinets shall be surface type with trim. Trim and door shall be finished in anodized aluminum.
The box shall be finished in white baked enamel. Designer will select anodized finish from manufacturer's standard range.

2-1.03. **Splash Blocks.** Precast reinforced concrete splash blocks shall be provided at the locations indicated on the drawings.

The blocks shall be approximately 16 inches wide by 30 inches long by 5 inches high, with curbs on three sides. The splash portion shall be sloped from not less than 1 inch depth at the inlet end to not less than 2 inches at the outlet end. The block shall be reinforced with not less than WWF4X4-W4XW4 welded wire fabric.

**PART 3 - EXECUTION**

3-1. **INSTALLATION.** All products herein shall be installed as recommended by the manufacturer and as indicated on the drawings. All moving parts shall be properly lubricated and adjusted as required for proper operation.

End of Section