CONTRACT NO.
45-5.1-7 #1A

PROJECT MANUAL

VOLUME 2 OF 3

FOR

Mirabel Fish Screen and Fish Ladder Replacement

SONOMA
COUNTY
WATER
AGENCY

MARCH 2014

DOCUMENT 00010

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STANDARD EDITION

(Volume 1 of 3)

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SPECIFICATIONS

DIVISION 1

GENERAL REQUIREMENTS

SECTION 01100

SUMMARY

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Summary of Work and Work Restrictions including:
      a. Summary
      b. Submittals
      c. Work Covered By Contract Documents
      d. Bid Items, Allowances, and Alternates
      e. Work Under Other Contracts
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1.2 SUBMITTALS

A. Work Plans:
   1. Utility Protection Plan

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. Work comprises construction of a vertical slot fish ladder, fish screen with 6 intake bays, and viewing gallery with 400 square feet of viewing windows at 10290 Westside Road, near the unincorporated town of Forestville, Sonoma County, California, including without limitation a temporary dam and rock fish passage upstream of the Wohler Bridge, pipe pile foundation system, fish screen cleaning system with a vertical traveling brush and controller, and dewatering of the river channel and groundwater as necessary to maintain dry working conditions. The Work covers approximately one acre of previously developed land requiring earthwork removal in the riverbank to create facility access and maintenance roads. Contract Documents fully describe the Work.

B. The Work of this Contract comprises construction of all the Work indicated, described in the Specifications, or otherwise required by the Contract Documents.

C. Unless provided otherwise in the Contract Documents, all risk of loss to Work covered by Contract Documents shall rest with Contractor until Final Acceptance of the Work.
D. Cost of maintenance of systems and equipment prior to Final Acceptance will be considered as included in prices Bid and no direct or additional payment will be made therefor.

1.4 BID ITEMS, ALLOWANCES, AND ALTERNATES

A. Any Bid item may be deleted from the Work and Contract Sum, in total or in part, prior to or after award of Contract without compensation in any form or adjustment of other Bid items or prices therefore.
B. Payment of all items is subject to provisions of Contract Documents, including without limitation Section 01200 (Price and Payment Procedures).
C. For all Bid items, furnish and install all Work, including connections to existing systems, indicated and described in Specifications and all other Contract Documents. Work and requirements applicable to each individual Bid item, or unit of Work, shall be deemed incorporated into the description of each Bid item (whether Lump Sum or Unit Price).
D. Bid item descriptions (listed by Bid item number):
   1. Bonds. The lump sum price paid under this item shall be full payment for furnishing bonds as required by Document 00700 (General Conditions).
   2. Insurance. The lump sum price paid under this item shall be full payment for furnishing insurance as required by Document 00700 (General Conditions).
   3. Safety Program and Implementation. The lump sum price paid under this item shall be full payment for furnishing and implementing the Safety Program as required by Section 01540 (Site Security and Safety) and Document 00700 (General Conditions).
   4. Construction Material Waste Management Plan and Implementation. The lump sum price paid under this item shall be full payment for furnishing and implementing the Construction Material Waste Management Plan as required by Section 01741 (Construction Material Waste Management Plan).
   5. Installation, Operation, and Maintenance Manuals. The lump sum price paid under this item shall be full payment for furnishing installation, operation, and maintenance manuals as required by Section 01330 (Submittal Procedures).
   6. Storm Water Pollution Prevention Plan and Implementation. The lump sum price paid under this item shall be full payment for furnishing and implementing the Storm Water Pollution Prevention Plan as required by Section 01500 (Temporary Facilities and Controls).
   7. Mobilization/Demobilization. The lump sum price paid under this item shall be full payment for initial mobilization at Project commencement (50% to be paid then), and cleanup and demobilization at Final Completion (50% to be paid then).
   8. Shoring and Bracing. The lump sum price paid under this item shall be full payment for providing and removing shoring and bracing.
   9. Demolition. The lump sum price paid under this item shall be full payment for clearing, grubbing, removal, and disposal of structures and utilities as required by Section 02072 (Demolition, Cutting, and Patching).
   10. Dewatering Plan and Implementation. The lump sum price paid under this item shall be full payment for the furnishing and implementing the dewatering plan, as required by Section 02240 (Dewatering). This item includes all measures necessary to provide a dry construction site including, but not limited to, well points, sumps, seal slabs, pumps, discharge pipes, temporary sheet piles or coffer dams for groundwater and surface

water exclusion or diversion; and excavation, stockpiling and replacement of compacted material for excavated diversion channels.

11. Driven Steel Pipe Piles. The lump sum price paid under this item shall be full payment for providing steel pipe piles, including concrete fill and reinforcement within pipe piles.
12. Sheet Pile Retaining Wall System. The lump sum price paid under this item shall be full payment for providing a permanent sheet pile retaining wall system to retain the embankment behind the improvements, including, but not limited to sheet piles, and soil anchors (tiebacks) and walers.
13. Fish Ladder Structure. The lump sum price paid under this item shall be full payment for providing the permanent vertical slot fish ladder including, but not limited to concrete foundations, structural concrete, reinforcing steel, concrete finishing, trash rack, railing, concrete diffuser, baffles, 36" attraction flow pipe, storm drainage piping, pipe fittings and appurtenances, concrete finishing, access grating, and guardrail.
14. Intake Fish Screen Structure. The lump sum price paid under this item shall be full payment for providing the intake structure including but not limited to concrete foundations, structural concrete, U-tube vault and piping, monitoring room and windows, water distribution piping, reinforcing steel, concrete finishing, trash rack, railing, concrete diffuser, baffles, sump pump, water distribution piping, intake piping, pipe fittings and appurtenances, manholes, shotcrete, concrete finishing, floor grating, guardrail and emergency pump piping modifications.
15. Fish Screen Equipment. The lump sum price paid under this item shall be full payment for providing the fish screen equipment, including, but not limited to stainless steel fish screens, blank aluminum panels, porosity plates, and guide slots.
16. Fish Screen Cleaner. The lump sum price paid under this item shall be full payment for providing the fish screen cleaning equipment, including, but not limited to brush cleaning system, monorail controls and motor.
17. Viewing Gallery. The lump sum paid under this item shall be the full payment for providing viewing gallery, including but not limited to concrete foundations, structural concrete, reinforcing steel, concrete finishing, viewing windows in the viewing gallery, and access stairs, railings, and landings.
18. Site Work. The lump sum price paid under this item shall be full payment for Site Work required to construct the facility. This item includes, but is not limited to preparatory Work, clearing and grubbing, disposal, grading, utility protection plan, utility potholing, utility relocations, utility repair, off-haul of surplus material, surface restoration, utility monitoring using sensory equipment to monitor and prevent utility damage, construction of access road, base rock, concrete paving, curbs, gutters, swales, reinforcing steel, and hydroseeding.
19. River Crossing Conduit. The lump sum price paid under this item shall be full payment for providing electrical conduits and air and water piping that are attached to the upstream face of the existing inflatable dam. This item includes, but is not limited to groundwater dewatering, river diversion, excavation, appurtenances, and testing.
20. Electrical Work and Instrumentation. The lump sum price paid under this item shall be full payment for providing electrical and communications systems between the Work and Owner's existing facilities. This item includes, but is not limited to distribution panel, circuit breakers, level transducers, conduit, pull boxes, outlet boxes, receptacles, lighting, and light poles.

21. Starting and Adjusting. The lump sum price paid under this item shall be full payment for starting and adjusting of motorized, electrical, and communications equipment as required by Section 01750 (Starting and Adjusting). This item includes, but is not limited to level transducers, pumps, screen cleaner, screen controls, gate valve controls, U-Tube, lighting, and testing.
22. Temporary Dam and Rock Fish Passage. The lump sum price paid under this item shall be full payment for seasonal construction and removal of the temporary dam and adjacent temporary rock fish passage upstream of Wohler Bridge as many times as necessary for the duration of the Project.
23. All Other Work. The lump sum price paid under this item shall be full payment for all Work of Contract Documents other than Work separately provided for under other Bid items.

E. Contingency Reserve.
1. Costs authorized to be paid from the Contingency Reserve:
   a. Cost to Contractor or Subcontractor for removal or avoidance, as directed by Owner, of unforeseen underground manmade structures or boulders that interfere with construction and that require special equipment or additional labor, time, or equipment as long as removal or avoidance of such structures or boulders would be a basis for adjustment in the Contract Sum pursuant to Article 13.4 of Document 00700 (General Conditions).
   b. Cost to Contractor or Subcontractor for relocation, avoidance, or repair, as directed by Owner, of unforeseen underground utilities as long as removal or avoidance of such utilities would be a basis for adjustment in the Contract Sum pursuant to Article 13.4 of Document 00700 (General Conditions).

F. Allowances: (N/A)
G. Alternates: (N/A)

1.5 WORK UNDER OTHER CONTRACTS

A. A separate contractor will be on Site doing ground seismic improvements.
B. County of Sonoma, Department of Transportation and Public Works, will be performing seismic retrofit to Wohler Bridge. Wohler Bridge may be subject to interruptions in service during the construction of this project.

1.6 FUTURE WORK

A. None expected.

1.7 WORK SEQUENCE

A. Construct Work in stages and at times to accommodate Owner operation requirements during the construction period; coordinate construction schedule and operations with Owner.
B. Milestone 1: Milestone 1 is defined and shall be achieved by the deadline established in Article 3 of Document 00520 (Agreement). The date of Contractor's achievement of Milestone 1 will be memorialized in writing by Owner.
C. Milestone 2: Milestone 2 is defined and shall be achieved by the deadline established in Article 3 of Document 00520 (Agreement). The date of Contractor's achievement of Milestone 2 will be memorialized in writing by Owner.
D. Special operational constraints include the following:

1. The existing emergency pumps will provide a continuous supply of water for the Owner's infiltration pond system while the existing intake, fish ladder, and fish screen are demolished and reconstructed.
    a. Emergency pump shutdowns: Notify Owner in writing at least 2 Business Days prior to the need for a shutdown of the existing emergency pump system. Certify that all materials, equipment, and personnel are available to perform the Work requiring the shutdown. Owner may verify this certification. Owner forces will perform shutdowns of existing systems. Timing of shutdowns will be at Owner's discretion.
        1) The maximum allowable shutdown duration is 7 Days.

E. Special biological resources scheduling constraints include the following:
1. During dewatering activities, fish located within the dewatered area will be removed and relocated to appropriate habitat downstream of the Site. Owner will engage a qualified fisheries biologist(s) to perform the fish rescue and relocation, using methods approved by the National Marine Fisheries Service and California Department of Fish and Wildlife. Contractor shall permit and provide unrestricted access to the fisheries biologist(s) during fish relocation activities. Contractor shall notify Owner when fish are discovered. Owner may require Contractor to stop Work in the area during fish relocation activities.
2. For ground disturbing activities occurring during the breeding season (February 1 to August 31), Owner will engage a qualified wildlife biologist to conduct pre-construction surveys of the Site, within 14 Days of the start of construction activities, for nesting raptors within a 500-foot radius of construction activities and for other nesting birds within a 50-foot radius of construction activities. If active bird nests are found during pre-construction surveys, Contractor shall establish a 500-foot "no disturbance" buffer around active raptor nests during the breeding season. Establish a 50-foot buffer zone around the nests of other special status birds, or until Owner determines that all young have fledged. Install physical barriers such as fencing to establish the buffer zones to prevent construction equipment from disturbing the nest. Owner will monitor nests weekly during construction activities, and direct Contractor to modify protection measures or construction activities as necessary.

1.8 WORK DAYS AND HOURS

A. Work Days and hours: Monday-Saturday inclusive, 7:00 a.m.-7:00 p.m. local time.
B. Work at the Site on Sundays, holidays, or at night is not permitted, unless Contractor requests otherwise from Owner in writing at least 48 hours in advance and Owner approves in its sole discretion.
C. Contractor will not be permitted to commence utility shutdowns or schedule start-up activities or training on Fridays or Saturdays.

1.9 SHUTDOWN FOR DISCOVERY OF CULTURAL RESOURCES

A. If discovery is made of items of historical, archaeological, or paleontological interest, immediately cease all Work in the area of discovery. 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. After cessation of excavation, immediately contact Owner. Do not resume Work until authorization is received from Owner. When resumed, excavation or other activities shall be as directed by Owner.

1.10 COOPERATION OF CONTRACTOR AND COORDINATION WITH OTHER WORK

A. Coordinate with Owner and any Owner forces, or other contractors and forces, as required by Document 00700 (General Conditions), Article 6.
B. Employ a full-time coordinator to constantly review Contract Documents, submittals, changes, and prepare overlay drawings as necessary to avoid conflicts, errors, omissions and untimely construction.

1.11 PARTIAL OCCUPANCY/UTILIZATION REQUIREMENTS

A. Allow Owner to take possession of and use any completed or partially completed portion of the Work during the progress of the Work as soon as is possible without interference to the Work.
B. Possession, use of Work, and placement and installation of equipment by Owner shall not in any way evidence the completion of the Work or any part of it.
C. Contractor shall not be held responsible for damage to the occupied part of the Work resulting from Owner occupancy.
D. Make available, in areas occupied, on a 24-hour per day and 7-day per week basis if required, any utility services, heating, and cooling in condition to be put in operation at the time of occupancy.
   1. Responsibility for operation and maintenance of said equipment shall remain with Contractor.
   2. Make, and Owner shall certify, an itemized list of each piece of equipment so operated with the date operation commences.
   3. Itemized list noted above shall be basis for commencement of warranty period for equipment.
   4. Owner shall pay for utility cost arising out of occupancy by Owner during construction.
E. Use and occupancy by Owner prior to acceptance of Work does not relieve Contractor of its responsibility to maintain insurance and bonds required under the Contract until entire Work is completed and accepted by Owner.
F. Prior to date of Final Acceptance of the Work by Owner, all necessary repairs or renewals in Work or part thereof so used, not due to ordinary wear and tear, but due to Defective materials or workmanship or to operations of Contractor, shall be made at expense of Contractor, as required in Document 00700 (General Conditions).
G. Use by Owner of Work or part thereof as contemplated by this Section 01100 shall in no case be construed as constituting acceptance of Work or any part thereof. Such use shall neither relieve Contractor of any responsibilities under Contract, nor act as waiver by Owner of any of the conditions thereof.
H. Owner may specify in the Contract Documents that portions of the Work, including electrical and mechanical systems or separate structures, shall be substantially completed on dates described in paragraph 1.7 of this Section 01100, if any, prior to Substantial Completion of all of the Work. Notify Owner in writing when Contractor considers any such part of the Work ready for its intended use and Substantially Complete and request Owner to issue a Certificate of Substantial Completion for that part of the Work.

1.12 CONTRACTOR USE OF SITE

A. Confine operations at Site to areas permitted by Contract Documents, permits, ordinances, and laws.
B. Do not unreasonably encumber Site with materials or equipment.
C. Assume full responsibility for protection and safekeeping of products stored on premises.

D. Move any stored products that interfere with operations of Owner or other contractor.
E. Coordinate parking, storage, staging, and Work areas with Owner.
F. Owner will provide a storage area for Contractor's equipment and materials.
G. Do not store construction materials in the Drip line of any tree.
H. Access is available to the Site from Westside Road along the route indicated.
I. Owner will provide a keypad code to Contractor. Ensure that the entrance is locked at the end of each work day and at other times as may be necessary to control unauthorized entry.
J. Contractor shall contact Owner at least 2 Business Days prior to entering the building and performing Work to allow Owner to arrange access into the building.

1.13 AIR QUALITY STANDARDS

A. Ensure that all construction vehicles and equipment emission levels meet current air quality standards.
B. Ensure that idling time for all heavy equipment is minimized to reduce on-Site emissions.
C. Maintain equipment in good mechanical condition.
D. Cover trucks hauling dirt.
E. Limit dust emissions during periods of high winds (greater than 15 miles per hour).
F. Replace ground cover in disturbed areas as soon as possible.
G. Enclose, cover, water, or apply soil binders to exposed stockpiles.
H. Remove earth tracked onto neighboring paved roads at least once daily.
I. Limit equipment speed to 10 miles per hour in unpaved areas.

1.14 CONSTRUCTION STAKING AND MONUMENT PROTECTION

A. Owner will provide construction staking and other surveying, mapping, or computational activities that Owner deems necessary in its sole judgment, including that which may be used by the Owner to determine pay quantities, or other elements required by or provided for in the Contract Documents.
B. Contractor shall be responsible at its sole expense and direction for construction layout activities (as defined by Owner in its sole and exclusive judgment) and any surveying and/or mapping activities beyond that which will be performed by Owner in accordance with Paragraph A above, including that which may be required to establish and/or document as-built locations, alignments, elevations, grades or quantities required by or provided for in the Contract Documents.
C. Contractor shall be required to prepare and submit to Owner, not less than five Business Days before the Preconstruction Meeting, a Construction Staking Outline consisting of completed draft Construction Survey Request forms detailing the scope, extent, and anticipated schedule of the construction staking proposed by Contractor for each phase of the work and separate Construction Survey Request to be submitted by Contractor during the course of the contract. Owner will review Contractor's Construction Staking Outline and notify Contractor of required changes, modifications, or deletions to the Construction Staking Outline prior to commencement of Work.
D. Construction staking will be provided in accordance with the approved Construction Staking Outline. Modifications and alterations to the Construction Staking Outline must be submitted and approved by Owner not less than five Business Days in advance of the requested date that construction survey activities are to begin (see Construction Survey Request: Requested Start Date). Owner reserves the right to reject, require modification and/or deletions to any such subsequent submittal prior to acceptance.
E. Contractor shall be responsible at its sole expense to ready the area required for construction survey activities prior to the arrival of Owner's survey crews on Site. For the purposes of

construction surveying activities, readying includes clearing, grubbing and ensuring that the area required for construction surveys is clear of obstacles, debris, materials, equipment or hazards that would unreasonably interfere with or impede Owner's ability in Owner's reasonable judgment, to productively and effectively provide the construction survey requested, establish reliable, stable, survey points and stakes or markings on the ground. Owner reserves the right to delay, discontinue, or suspend construction surveys in areas and situations that in the sole judgment of Owner, are not sufficiently readied for such surveys. Owner is not responsible for delays resulting from the areas required for construction survey activities not being sufficiently readied prior to survey crew's arrival on Site.

F. Contractor is responsible at its sole expense to provide traffic control for construction surveying activities, and shall coordinate with Owner to ensure sufficient traffic control and or safety measures are in place, prior to the arrival of the survey crew on Site. Owner reserves the right to delay, discontinue or suspend construction surveys in areas and situations that in the sole judgment of Owner lack sufficient traffic control and/or safety measures to safely, productively and efficiently accommodate construction survey activities. Owner is not responsible for delays resulting from the areas required for construction survey activities lacking sufficient traffic control and/or safety measures in place prior to survey crew's arrival on Site.

G. Construction Survey Request(s) shall be submitted by Contractor not less than five Business Days prior to the date that the Site will be readied for construction surveying activities (hereafter referred to as the advanced notice period for Construction Survey Request(s)). Scheduling or time changes for a previously accepted Construction Survey Request shall be submitted to Owner not less than two Business Days in advance of the date that the Site will be readied. Requests submitted after 12:00 noon will be held over to the next Business Day for the purposes of beginning the advanced notice period for Construction Survey Requests.

H. Contractor is responsible to ensure that sufficient time is allowed to meet the advanced notice period for Construction Survey Request(s) requirements, to perform Site preparation requirements outlined above, to accommodate Owner's scheduling and resource availability, and for the Owner to complete construction survey activities. Contractor shall coordinate with Owner well in advance of the anticipated need, to ensure that sufficient resources are available to complete the construction surveys requested. No extension of time will be granted for delays resulting from construction survey activities.

I. Contractor shall not begin work on any element of construction until construction staking or related survey activity associated with a Construction Survey Request submitted by the Contractor has been completed. For the purposes of this section: Completion of construction staking or related survey activity shall be determined by Owner. Contractor will be notified by Owner.

J. Contractor shall protect and preserve stakes set by Owner in accordance with the above. Contractor shall be responsible at its sole expense for re-staking or verification of survey stakes, cut/fills or markings that are damaged, destroyed or otherwise made un-useful/reliable by activities within its control in the reasonable judgment of Owner. Owner will provide replacement stakes or verification surveys requested by Contractor at Contractor's expense in accordance with normal staff rates and charges associated with personnel, equipment and materials required to perform such activities.

K. Whenever Contractor knows or reasonably should know that any Work or construction-related activity required under this Contract may, or is likely to damage, destroy or cause <u>any</u> property or right of way monument(s), survey control point(s), or Bench Marks to

become unusable, Contractor shall notify Owner a minimum of five Business Days in advance of such work or activity. Owner will reference property or right of way monument(s) and survey control point(s) by survey, swing ties, or other appropriate means prior to their disturbance or destruction. Owner will replace or restore as appropriate property or right of way monuments and survey control point(s) disturbed, destroyed or otherwise made un-useful by Contractor's activities upon completion of the construction activities.

L. Contractor shall protect and preserve property or right of way monuments and survey control points, and shall be responsible at its sole expense for the cost replacing or restoring damaged or destroyed property or right of way monuments and survey control points, including the cost of preparing and filing a Corner Record or Record of Survey when required under Sec. 8771(b) of the Business and Professions Code of the State of California where sufficient notification to Owner was not provided in accordance with the above. Owner will perform such Surveying and Mapping activities required in Owner's sole judgment, to restore or replace property or right of way monuments and survey control point(s) disturbed, destroyed or otherwise made un-useful by Contractor's activities and required to comply Sec. 8771(b) of the Business and Professions Code of the State of California, in accordance with staff rates and charges in effect for the associated personnel, equipment and materials required to perform such activities.

1.15 PROTECTION OF EXISTING STRUCTURES AND UNDERGROUND FACILITIES

A. The Drawings may indicate existing above- and below-grade structures, drainage lines, storm drains, sewers, water lines, gas lines, electrical lines, and other similar items and Underground Facilities that are known to Owner.
   1. At least 2 Business Days, or as otherwise noted, prior to commencement of excavation, notify the owners of the following Underground Facilities:
      a. Water lines: Agency, Service Center, Phone: (707) 521-1892
      b. Chlorine line(s): "
      c. Fiber-optic lines: "
      d. Telephone conduit: AT&T

B. Where overhead service to a structure, known to receive service, does not exist, then underground service shall be assumed to exist.

C. Underground water supply lines exists as indicated. At least 3 Days prior to commencement of excavation, notify Owner to request the location of the lines. Protected water supply lines throughout the construction period. If construction equipment is to cross over any existing underground water supply line, place 1/2" thick steel plates over the line as directed by Owner.

D. A chlorine solution line(s) is indicated. Notify Owner at least 3 Days prior to commencement of excavation.

E. Attention is also directed to the existence of overhead power and telephone lines.

F. Perform potholing using hand or mechanical vacuum methods within 24 inches (in any direction) of the Underground Facilities. This may be done on an area-by-area basis, but shall be accomplished at least 7 Days in advance of the date of construction within such area.

G. In addition to reporting, if a utility is damaged, Contractor shall take appropriate action as provided in Document 00700 (General Conditions).

H. Additional compensation or extension of time on account of utilities not indicated or otherwise brought to Contractor's attention including reasonable action taken to protect or repair damage shall be determined as provided in Document 00700 (General Conditions).

I. Provide Utility Protection Plan, including:
   1. The methods to be used to locate utilities.
   2. Indication of all utilities that are expected to conflict with Work, including proposed pothole locations, utility type, conduit size, and other pertinent information.
   3. Schematic drawings and proposed measures to protect active utilities from damage, methods to be used to maintain services during construction, and removal of inactive utilities, as necessary.
   4. Proposed measures to be taken in the event an active utility is damaged or broken due to Contractor's activities.

1.16 PERMITS

A. Permits, agreements, or written authorizations that are known by Owner to apply to this Project are listed below:
   1. *US Department of the Army, Corps of Engineers nationwide permit*. Owner is in the process of obtaining this permit.
   2. *California Department of Fish and Wildlife 1601, Stream Alteration Agreement*. Owner is in the process of obtaining this permit.
   3. *North Coast Regional Water Quality Control Board (NCRWQCB), Clean Water Act, Section 401 Certification*. Owner is in the process of obtaining this permit.
   4. *State Water Resources Control Board (SWRCB), Order No. 2009-0009 – DWQ, National Pollutant Discharge Elimination System (NPDES), General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Construction General Permit).* The permit is available at Owner's office or is available online at http://www.swrcb.ca.gov/water_issues/programs/stormwater/constpermits.shtml. Owner will file a Notice of Intent with SWRCB to obtain coverage under the General Permit. Contractor shall provide the Storm Water Pollution Prevention Plan, as described in Section 01500 (Temporary Facilities and Controls), in support of the Notice of Intent. Owner has determined that this Project has a combined risk level 3 as defined by SWRCB.
   5. *Cal/OSHA Permit.* Obtain, as applicable, permit(s) as required by Cal/OSHA for the following:
      a. Construction of trenches or excavations that are five feet or more in depth and into which a person is required to descend.
      b. Construction or demolition of any building, structure, or scaffolding for falsework more than three stories high, or the equivalent height (36 feet).
      c. Erection or dismantling of vertical shoring systems more than three stories high, or the equivalent height (36 feet).

      The local Cal/OSHA district office is located at:

      1221 Farmers Lane, Suite 300
      Santa Rosa, CA 95405
      Phone: (707) 576-2388
   6. *County of Sonoma, Ordinance 3836R*, which regulates prescribed activities in rivers or streams that decrease clarity of water. The necessary permit from PRMD under Ordinance 3836R will be obtained by Owner for Contractor prior to the commencement

of Work, and a copy will be provided to Contractor. A copy of the ordinance that regulates this type of Work is available for review at Owner's Office.

B. All other permits that may be required, including, but not limited to, electrical, mechanical, fire prevention, irrigation, grading, slope protection, tree cutting, dechlorinated water discharge, and flushing water discharge have not been applied for and shall be obtained by Contractor.

C. Applicable permit fees, if specifically listed in Document 00700 (General Conditions), will be reimbursed by Owner to the extent specified therein. All other permit fees shall be paid by Contractor.

D. Furnish copies of Contractor-obtained permits to Owner.

1.17 ACTUAL DAMAGES

A. Owner may incur actual damages, including fines imposed by any regulatory agency, resulting from turbidity increases in river, a toxic spill in river, contaminated aquifer, or from violation of legal or regulatory requirements resulting from Contractor's acts or omissions. Violations or threatened violations may subject Owner to fines of more than $25,000 per Day or per occurrence in addition to other costs and civil liabilities. Contractor shall be liable for and shall pay Owner the amount of any such actual losses in addition to liquidated damages and any other remedies provided by the Contract Documents. This paragraph shall not limit any other remedies Owner may have in law or equity.

1.18 PROTECTION OF WATER QUALITY

A. Contractor shall ensure that the water quality of Owner's water supply and storage facilities located at the Site are protected from contamination at all times during construction. Protective measures shall include, but not be limited to, securing covers on storage facilities and securing or removing containers for contaminants from the Site when Contractor's forces are not present and at the end of each Day.

1.19 GROUND WATER PROTECTION

A. Owner's water supply consists of the Russian River, the river diversion structure, sedimentation ponds, infiltration ponds, and an extremely permeable aquifer. Once the river water enters the aquifer it moves freely with a significant hydraulic gradient toward three Ranney type collectors located on the Mirabel facility site. Contractor shall ensure that the groundwater quality of Owner's water supply facility are protected from contamination at all times. Protective measures shall include, but not limited to, preventing sediment laden runoff from entering the Russian River and storing fuel, chemicals, and other contaminants in a separate location from Work to prevent an accidental release into Work area where groundwater may be exposed to the atmosphere.

1.20 RIGHTS-OF-WAY

A. Owner owns the property as indicated.

1.21 DOCUMENT TRACKING

A. Owner will maintain a computerized document control system to monitor the generation, status, and filing of documents. Documents such as, but not limited to, Contracts, Cost Proposals, Change Orders (proposed and approved), Meeting Minutes, Schedules and Reports, Payment Applications, certificates of insurance, Safety Reports, Requests for Information, Requests for Substitutions, correspondence, communications, notices, Submittals, transmittals, and logs shall be submitted electronically for Owner to control the

documents using the computerized system. Owner will use the computerized system to track and manage all documents on the Project, after Notice to Proceed, to the greatest extent possible.

B. Provide all Project documents to Owner in electronic format. If file size prohibits electronic transmittal, submit to Owner on compact disk (CD).

C. Provide electronic format documents in searchable portable document format (PDF), unless otherwise required by the Contract Documents or directed in writing by Owner.

PART 2 PRODUCTS

2.1 PRODUCTS ORDERED IN ADVANCE

A. As provided in Section 01200 (Price and Payment Procedures), paragraph 1.5E, and subject to all other provisions of the Contract Documents, Owner will pay for the following materials and equipment prior to incorporation into the Work:
   1. Materials:
      a. None.
   2. Equipment:
      a. None.

2.2 OWNER-FURNISHED PRODUCTS

A. Owner-Furnished Products:
   1. None.

B. Owner's Responsibilities:
   1. Arrange for and deliver Owner-reviewed Shop Drawings, Product Data, and Samples, to Contractor.
   2. Arrange and pay for delivery to Site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, Defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

C. Contractor's Responsibilities:
   1. Review Owner-reviewed Shop Drawings, Product Data, and Samples.
   2. Receive and unload products at Site; inspect for completeness or damage jointly with Owner.
   3. Handle, store, install, and finish products.
   4. Repair or replace items damaged after receipt.
   5. Install into Project per Contract Documents.

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01200

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Description of requirements and procedures for determining amount of Work performed and for obtaining payment for Work performed.
   2. Contingency Reserve

1.2 REFERENCES

A. California Public Contract Code
B. Code of Civil Procedure

1.3 SCOPE OF WORK

Work under Contract Documents, or under any Bid item, allowance, or Alternate, shall include all labor, materials, taxes, transport, handling, storage, supervision, administration, and all other items necessary for the satisfactory completion of Work, whether or not expressly specified or indicated.

1.4 DETERMINATION OF QUANTITIES

Quantity of Work to be paid for under any item for which a unit price is fixed in Contract Documents shall be number, as determined by Owner, of units of Work satisfactorily completed in accordance with Contract Documents or as directed by Owner. Unless otherwise provided, determination of number of units of Work so completed will be based, so far as practicable, on actual measurement or count within prescribed or ordered limits, and no payment will be made for Work done outside of limits. Measurements and computations will be made by methods set forth in Contract Documents, including without limitation this Section 01200. If methods are not so set forth, measurements shall be made in any manner which Owner considers appropriate for class of Work measured (e.g., pre-assigned values, percentage completion, units completed or incremental Milestones). Contractor must immediately inform Owner of any disputes regarding quantity measurements and shall immediately supply Owner with any documentation supporting the disputed measurements.

1.5 SCOPE OF PAYMENT

A. Except as otherwise expressly stated in Section 01100 (Summary), payment to Contractor at the unit price or other price fixed in Contract Documents for performing Work required under any item, or (if the Contract is on a single lump sum price basis) at the lump sum price fixed in the Contract Documents for performing all Work required under Contract Documents, and as either may be adjusted pursuant to any approved Change Order or Construction Change Directive, shall be full compensation for completing, in accordance with Contract Documents, all Work required under the item or under Contract Documents, and for all expense incurred by Contractor for any purpose in connection with the performance and completion of said Work, including all incidental Work necessary for completion of the Work.
B. The Contract Sum, whether lump sum, unit price or otherwise, shall be deemed to include all costs necessary to complete required Work, all costs (if any) for loss or damage arising

from nature of Work or prosecution of the Work, and from action of elements. Unless Contract Documents expressly provide otherwise, the Contract Sum shall be deemed to include:

1. Any and all costs arising from any unforeseen difficulties which may be encountered during, and all risks of any description connected with, prosecution of Work or prosecution of Bid item (whether lump sum or unit price) until acceptance by Owner;
2. All expenses incurred due to suspension, or discontinuance of Work or discontinuance of Bid item (whether lump sum or unit price) as provided in Contract Documents;
3. Escalation to allow for cost increases between time of Contract Award and completion of Work or completion of Bid item (whether lump sum or unit price).

C. Whenever it is specified herein that Contractor is to do Work or furnish materials of any class for which no price is fixed in Contract Documents, it shall be understood that Contractor is to do such Work or furnish such materials without extra charge or allowance or direct payment of any sort, and that cost of doing Work or furnishing materials is to be included in price Bid, unless it is expressly specified herein, in particular cases, that Work or material is to be paid for as extra Work.

D. Unit Prices shall apply to Work covered by unit prices so long as actual quantities performed on the Project are not less than 75 percent or greater than 125 percent of the estimated quantities contained in Document 00400 (Bid Form) or otherwise referenced in Section 01100 (Summary). If actual quantities exceed these parameters, then the unit price shall be adjusted by an amount to reflect the Contractor's incremental cost differential resulting from increased or decreased economies of scale. For quantities reduced to less than 75 percent of the estimated Bid quantity, the payment for the total pay quantity of such item of Work will in no case exceed the payment that would have been made for the performance of 75 percent of the estimated Bid quantity for such item at the original Contract unit price.

E. No payment shall be made for materials or equipment not yet incorporated into the Work, except as specified in Section 01100 (Summary).

F. For any materials and equipment referenced in Section 01100 (Summary) as subject to payment prior to incorporation into the Work, where Contractor requests payment on the basis of such materials and equipment not incorporated in the Work, Contractor must satisfy the following conditions:

1. The materials and/or equipment shall be delivered and suitably stored at the Site or at another local location agreed to in writing, for example, a mutually acceptable warehouse;
2. Full title to the materials and/or equipment shall vest in Owner at the time of delivery to the Site, warehouse or other storage location;
3. Obtain a negotiable warehouse receipt, endorsed over to Owner for materials and/or equipment stored in an Off Site warehouse. No payment will be made until such endorsed receipts are delivered to Owner;
4. Stockpiled materials and/or equipment shall be available for Owner inspection, but Owner shall have no obligation to inspect them and its inspection or failure to inspect shall not relieve Contractor of any obligations under the Contract Documents. Materials and/or equipment shall be segregated and labeled or tagged to identify these specific Contract Documents;
5. After delivery of materials and/or equipment, if any inherent or acquired defects are discovered, Defective materials and/or equipment shall be removed and replaced with suitable materials and/or equipment at Contractor's expense;

6. At Contractor's expense, insure the materials and/or equipment against theft, fire, flood, vandalism, and malicious mischief, as well as any other coverages required under the Contract Documents;
7. Contractor's Application for Payment shall be accompanied by a bill of sale, invoice or other documentation warranting that Owner has received the materials and equipment free and clear of all liens and evidence that the materials and equipment are covered by appropriate property insurance and other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner. This documentation shall include, but not be limited to, conditional releases of mechanics' liens and stop notices from all those providing materials and equipment as to which the Application for Payment relates, as well as unconditional releases of the same from the same as to the previous Application for Payment for which they have not already been provided.

G. Amounts previously paid for materials and equipment prior to incorporation into the Work shall be deducted from amounts otherwise due Contractor as they are incorporated.

1.6 BASIS OF PAYMENT

A. Unit Price Quantities: When estimated quantity for specific portions of Work is listed in Document 00400 (Bid Form), quantity of Work to be paid for shall be actual number of units satisfactorily completed, as determined by Owner and certified by Contractor, in accordance with Contract Documents.
B. Lump Sum: When estimated quantity for specific portion of Work is not indicated and unit is designated as lump sum, payment will be on a lump sum basis for Work satisfactorily completed in accordance with Contract Documents.
C. Allowances: Allowance items (if any) will be paid for as provided in Section 01100 (Summary). Funds authorized for Allowance Work will not be released for Contract payments unless Owner has authorized Allowance Work in writing.
D. Owner does not expressly, or by implication, agree, warrant, or represent in any manner, that actual amount of Work will correspond with amount shown or estimated and reserves right to increase or decrease amount of any class or portion of Work, to leave out entire Bid item or items, or to add work not originally included in Bid or Contract Documents, when in its judgment such change is in best interest of Owner. No change in Work shall be considered a waiver of any other condition of Contract Documents. No claim shall be made for anticipated profit, for loss of profit, for damages, or for extra payment whatever, except as otherwise expressly provided for in Contract Documents, because of any differences between amount of Work actually done and estimated amount as set forth herein, or for elimination of Bid items.

1.7 PROGRESS PAYMENTS

A. Owner's General Manager is authorized to approve progress payments in conformance with Contract Documents and the Auditor/Controller of the County of Sonoma is authorized to process such payments upon their submission by the General Manager.
B. If requested by Contractor, progress payments will be made monthly.
C. Schedule of Values:
   1. Within the time set forth in Document 00700 (General Conditions), submit a detailed breakdown of Contractor's Bid by scheduled Work items and/or activities, including coordination responsibilities and Project Record Documents responsibilities. Where more than one Subcontractor comprises the work of a Work item or activity, the Schedule of Values shall show a separate line item for each subcontract. Furnish such breakdown of the total Contract Sum by assigning dollar values (cost estimates) to each

applicable Progress Schedule network activity, which cumulative sum equals the total Contract Sum. The format and detail of the breakdown shall be as directed by Owner to facilitate and clarify future progress payments to Contractor for direct Work under Contract Documents. This breakdown shall be referred to as the Schedule of Values.

2. Contractor's overhead, profit, insurance, cost of bonds (except to the extent expressly identified in a Bid item) and/or other financing, as well as "general conditions costs," (e.g., Site cleanup and maintenance, temporary roads and access, off-Site access roads, temporary power and lighting, security, and the like), shall be prorated through all activities so that the sum of all the Schedule of Values line items equals Contractor's total Contract Sum, less any allowances designated by Owner. Scheduling, record documents and quality assurance control shall be separate line items.
3. Owner will review the breakdown in conjunction with the Progress Schedule to ensure that the dollar amounts of this Schedule of Values are, in fact, fair market cost allocations for the Work items listed. Upon favorable review by Owner, Owner will accept this Schedule of Values for use. Owner shall be the sole judge of fair market cost allocations.
4. Owner will reject any attempt to increase the cost of early activities, i.e., "front loading," resulting in a complete reallocation of moneys until such "front loading" is corrected. Repeated attempts at "front loading" may result in suspension or termination of the Work for default, or refusal to process progress payments until such time as the Schedule of Values is acceptable to Owner.

D. Monthly Report Sheets and Applications for Payment: Contractor shall establish and maintain records of cost of the Work in accordance with generally accepted accounting practices; reconcile the amount of Work completed monthly with Owner, and sign Owner's monthly report sheet certifying the Work is done. Monthly report sheets shall be considered the true record of the Cost of the Work and Contractor shall submit in a form acceptable to Owner an itemized cost breakdown of Contractor's record of Cost of the Work together with supporting data and any certification required by Owner. In addition:

1. On or before the sooner of (a) the 20th Day of each month and (b) receipt of Owner's approval of the updated Schedule as required by Section 01320 (Progress Schedules and Reports), Owner and Contractor will reconcile any differences in the field, based on the reconciled monthly report sheets, and Contractor shall submit to Owner an Application for Payment for the cost of the Work put in place during the period from the 15th Day of the previous month to the 15th Day of the current month, along with the Owner-approved updated Schedule. Such Applications for Payment shall be for the total value of activities completed or partially completed, including approved activity costs, based upon Schedule of Values prices (or Bid item prices if unit price) of all labor and materials incorporated in the Work up until midnight of the last Day of that one month period, less the aggregate of previous payments. Accumulated retainage shall be shown as separate item in payment summary. If Contractor is late submitting its Application for Payment, that Application may be processed at any time during the succeeding one-month period, resulting in processing of Contractor's Application for Payment being delayed for more than a Day for Day basis.
2. Applications for Payment may include, but are not necessarily limited to the following:
   a. Material, equipment, and labor incorporated into the Work, less any previous payments for the same.
   b. Up to 75 percent of the cost of equipment identified in paragraph 1.5F of this Section 01200 (if any), if purchased and delivered to the Site or stored off Site, as may be approved by Owner.

c. Up to 50 percent of the cost of materials identified in paragraph 1.5F of this Section 01200 (if any), specifically fabricated for the Project that are not yet incorporated into the Work.

3. At the time any Application for Payment is submitted, certify in writing the accuracy of the Application and that Contractor has fulfilled all scheduling requirements of Document 00700 (General Conditions) and Section 01320 (Progress Schedules and Reports), including updates and revisions. A responsible officer of Contractor shall execute the certification.
4. No progress payment will be processed prior to Owner receiving all requested, acceptable schedule update information. Failure to submit a schedule update complying with Section 01320 justifies denying the entire Application for Payment, or in Owner's discretion withholding amounts as described in paragraph 1.7E.11 of this Section 01200.
5. Each Application for Payment shall list each Change Order and Construction Change Directive ("CCD") executed prior to date of submission, including the Change Order/CCD Number, and a description of the Work activities, consistent with the descriptions of original Work activities. Submit a monthly Change Order/CCD status log to Owner.
6. If Owner requires substantiating data, submit information requested by Owner, with cover letter identifying Project, Application for Payment number and date, and detailed list of enclosures.
7. If Contractor fails or refuses to participate in monthly Work reconciliations or other construction progress evaluation with Owner, Contractor shall not receive current payment until Contractor has participated fully in providing construction progress information and schedule update information to Owner.

E. Progress Payments

1. Owner will review Contractor's Application for Payment following receipt. If adjustments need to be made to percent of completion of each activity, Owner will make appropriate notations and return to Contractor. Contractor shall revise and resubmit. All parties shall update percentage of completion values in the same manner, i.e., express value of an accumulated percentage of completion to date.
2. Each Application for Payment may be reviewed by Owner and/or inspectors to determine whether the Application for Payment is proper, and shall be rejected, revised, or approved by Owner pursuant to the Schedule of Values prepared in accordance with paragraph 1.7C of this Section 01200.
3. If it is determined that the Application for Payment is not proper and suitable for payment, Owner will return it to the Contractor as soon as practicable, but no later than seven Days after receipt, together with a document setting forth in writing the reasons why the Application for Payment is not proper. If Owner determines that portions of the Application for Payment are not proper or not due under the Contract Documents, then Owner may approve the other portions of the Application for Payment, and in the case of disputed items or Defective Work not remedied, may withhold up to 150 percent of the disputed amount from the progress payment.
4. Pursuant to California Public Contract Code Section 20104.50, if Owner fails to make any progress payment within 30 Days after receipt of an undisputed and properly submitted Application for Payment from Contractor, Owner shall pay interest to the Contractor equivalent to the legal rates set forth in subdivision (a) of Section 685.010 of the Code of

Civil Procedure. The 30-Day period shall be reduced by the number of Days by which Owner exceeds the seven-Day return requirement set forth herein.

5. As soon as practicable after approval of each Application for Payment for progress payments, Owner will pay to Contractor in manner provided by law, an amount equal to 95 percent of the amounts otherwise due as provided in the Contract Documents, or a lesser amount if so provided in Contract Documents, provided that payments may at any time be withheld if, in judgment of Owner, Work is not proceeding in accordance with Contract, or Contractor is not complying with requirements of Contract, or to comply with stop notices or to offset liquidated damages accruing or expected.
6. Before any progress payment or final payment is due or made, Contractor shall submit satisfactory evidence that Contractor is not delinquent in payments to employees, Subcontractors, suppliers, or creditors for labor and materials incorporated into Work. This specifically includes, without limitation, conditional lien release forms for the current progress payment and unconditional release forms for past progress payments.
7. Owner reserves and shall have the right to withhold payment for any equipment and/or specifically fabricated materials that, in the sole judgment of Owner, are not adequately and properly protected against weather and/or damage prior to or following incorporation into the Work.
8. Owner reserves and shall have the right to withhold payment if, in the sole judgment of Owner, Contractor has not adequately and properly performed obligations associated with Federal funding requirements, including but not limited to all requirements set forth in Document 01415 (Regulatory Requirements - Funding).
9. Granting of progress payment or payments by Owner, or receipt thereof by Contractor, shall not be understood as constituting in any sense acceptance of Work or of any portion thereof, and shall in no way lessen liability of Contractor to replace unsatisfactory Work or material, though unsatisfactory character of Work or material may have been apparent or detected at time payment was made.
10. When Owner shall charge sum of money against Contractor under any provision of Contract Documents, amount of charge shall be deducted and retained by Owner from amount of next succeeding progress payment or from any other moneys due or that may become due Contractor under Contract. If, on completion or termination of Contract, such moneys due Contractor are found insufficient to cover Owner's charges against it, Owner shall have right to recover balance from Contractor or Sureties.
11. If Contractor fails to submit an acceptable Progress Schedule update, or fails to bring an acceptable Project Record Drawings update to Progress Payment Meeting, Owner may retain 5% of each Progress Payment amount thereafter (in addition to any other retention) until Owner's acceptance of a Progress Schedule or Project Record Drawings update. This retention shall apply cumulatively.

1.8 FINAL PAYMENT

A. As soon as practicable after all required Work is completed in accordance with Contract Documents, including punchlist, testing, record documents and Contractor maintenance after Final Acceptance, Owner will pay to Contractor, in manner provided by law, unpaid balance of Contract Sum of Work (including without limitation retentions), or whole Contract Sum of Work if no progress payment has been made, determined in accordance with terms of Contract Documents, less sums as may be lawfully retained under any provisions of Contract Documents or by law.

B. Prior progress payments shall be subject to correction in the final payment. Owner's determination of amount due as final payment shall be final and conclusive evidence of amount of Work performed by Contractor under Contract Documents and shall be full measure of compensation to be received by Contractor.
C. Contractor and each assignee under an assignment in effect at time of final payment shall execute and deliver at time of final payment, and as a condition precedent to final payment, Document 00650 (Agreement and Release of Any and All Claims).

1.9 EFFECT OF PAYMENT

A. Payment will be made by Owner, based on Owner's observations at the Site and the data comprising the Application for Payment. Payment will not be a representation that Owner has:
   1. Made exhaustive or continuous on-Site inspections to check the quality or quantity of Work;
   2. Reviewed construction means, methods, techniques, sequences, or procedures;
   3. Reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by Owner to substantiate Contractor's right to payment; or
   4. Made examination to ascertain how or for what purpose Contractor has used money previously paid on account of the Contract Sum.

1.10 CONTINGENCY RESERVE

A. Owner will authorize and direct Contractor regarding provisions in this paragraph 1.10.
B. Contingency Reserve Amount: as listed in Document 00520 (Agreement).
C. Cost shall be determined for CCD Work as provided in Section 01250 (Modification Procedures) or on a time-and-materials basis if agreed by Contractor and Owner.
D. Prior to final payment, an appropriate Change Order will be issued to reflect actual amounts due Contractor on account of Work covered by this Contingency Reserve, and the Contract Sum will be correspondingly adjusted.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01250

MODIFICATION PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
   1. Description of general procedural requirements for alterations, Modifications, and extras.

1.2 GENERAL

A. Any change in scope of Work or deviation from Contract Documents including, without limitation, extra Work, or alterations or additions to or deductions from the original Work, shall not invalidate the original Contract, and shall be performed under the terms of the Contract Documents.
B. Only Contractor or Owner may initiate changes in scope of Work or deviation from Contract Documents.
   1. Contractor may initiate changes by submitting RFIs, Notice of Differing Site Conditions, or Notice of Hazardous Waste or Materials Conditions.
      a. RFIs shall be submitted to seek clarification of or request changes in the Contract Documents.
      b. Notices of Differing Site Conditions shall be submitted in accordance with Document 00700 (General Conditions).
      c. Notices of Hazardous Waste or Materials Conditions shall be submitted in accordance with Document 00700 (General Conditions).
   2. Contractor shall be responsible for its costs to implement and administer RFIs throughout the Contract duration. Regardless of the number of RFIs submitted, Contractor shall not be entitled to additional compensation for administrative costs. Contractor shall be responsible for both Owner and its Engineer's administrative costs for answering RFIs where the answer could reasonably be found by reviewing the Contract Documents, as determined by Owner; at Owner's discretion, such costs may be deducted from progress payments or final payment.
   3. Owner may initiate changes by issuing a Supplemental Instruction, which may revise, add to or subtract from the Work.
   4. Owner may initiate changes in the Work or Contract Time by issuing RFPs to Contractor. Such RFPs will detail all proposed changes in the Work and request a quotation of changes in Contract Sum and Contract Time from Contractor.
   5. Owner may also, by Construction Change Directive ("CCD"), order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly. A CCD shall be used in the absence of total agreement on the terms of a Change Order and may, upon notice, consist of a Change Order executed by Owner only.

1.3 PROCEDURES

A. Cost Proposal and Procedures: Whenever Contractor is required in this Section 01250 to prepare a Cost Proposal, and whenever Contractor is entitled to submit a Cost Proposal and elects to do so, Contractor shall prepare and submit to Owner for consideration a Cost Proposal using the form attached to this Section 01250. All Cost Proposals must contain a

complete breakdown of costs of credits, deducts, and extras; and itemizing materials, labor, taxes, overhead and profit. All Subcontractor Work shall be so indicated. Individual entries on the Cost Proposal form shall be determined as provided in paragraphs 1.4 and 1.5 of this Section 01250. After receipt of a Cost Proposal with a detailed breakdown, Owner will act promptly thereon.

1. If Owner accepts a Cost Proposal, Owner will prepare Change Order for Owner and Contractor signatures.
2. If Cost Proposal is not acceptable to Owner because it does not agree with cost and/or time included in Cost Proposal, Owner will submit in a response what it believes to be a reasonable cost and/or adjustment, if any. Except as otherwise provided in this Section 01250, Contractor shall have seven Days in which to respond to Owner with a revised Cost Proposal.
3. When necessity to proceed with a change does not allow the Owner sufficient time to conduct a proper check of a Cost Proposal (or revised Cost Proposal), Owner may order Contractor to proceed on basis to be determined at earliest practical date. In this event, value of change, with corresponding equitable adjustment to Contract, shall not be more than increase or less than decrease proposed.

B. Request for Information (RFI): Whenever Contractor requires information regarding the Project or Contract Documents, or receives a request for information from a Subcontractor, Contractor may prepare and deliver an RFI to Owner, using the Contractor interface for Owner's project management software. Contractor must submit time critical RFIs at least 30 Days before scheduled start date of the affected Work activity. Contractor shall reference each RFI to an activity of Progress Schedule and shall note time criticality of the RFI, indicating time within which a response is required. Contractor's failure to reference RFI to an activity on the Progress Schedule and note time criticality on the RFI shall constitute Contractor's waiver of any claim for time delay or interruption to the Work resulting from any delay in responding to the RFI.

1. Owner will respond within 15 Days from receipt of RFI with a written response to Contractor. Contractor shall distribute response to all appropriate Subcontractors.
2. If Contractor is satisfied with the response and does not request change in Contract Sum or Contract Time, then the response shall be executed without a change.
3. If Contractor believes the response is incomplete, Contractor shall issue another RFI to Owner clarifying original RFI. Additionally, Owner may return RFI requesting additional information should original RFI be inadequate in describing condition.
4. If Contractor believes that the response results in change in Contract Sum or Contract Time, Contractor shall notify Owner in writing within 15 Days after receiving the response. If Owner disagrees with Contractor, then Contractor may give notice of intent to submit a Claim as described in Article 12 of Document 00700 (General Conditions), and submit its Claim within 30 Days. If Owner agrees with Contractor, then Contractor must submit a Cost Proposal within 21 Days of receiving the response to the RFI. Contractor's failure to deliver either the foregoing notice and Claim or Cost Proposal by the respective deadlines stated in the foregoing sentences shall result in waiver of the right to file a Cost Proposal or Claim.

C. Supplemental Instruction: Owner may issue Supplemental Instruction to Contractor.

1. If Contractor is satisfied with Supplemental Instruction and does not request change in Contract Sum or Contract Time, then Supplemental Instruction shall be executed without a Change Order.

2. If Contractor believes that Supplemental Instruction results in change in Contract Sum or Contract Time, then Contractor must submit a Cost Proposal to Owner within 21 Days of receiving the Supplemental Instruction.

D. Construction Change Directives: If at any time Owner believes in good faith that a timely Change Order will not be agreed upon using the foregoing procedures, Owner may issue a CCD with its estimated cost and/or time adjustment. Upon receipt of CCD, Contractor shall promptly proceed with the change of Work involved and concurrently respond to Owner's CCD within 10 Days.
   1. Contractor's response must be any one of following:
      a. Return CCD signed, thereby accepting Owner's response, time, and cost.
      b. Submit a (revised if applicable) Cost Proposal with supporting documentation (if applicable, reference original Cost Proposal number followed by letter A, B, etc. for each revision), if Owner so requests.
      c. Give notice of intent to submit a Claim as described in Article 12 of Document 00700 (General Conditions), and submit its Claim within 30 Days.
   2. If the CCD provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:
      a. Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation.
      b. Unit prices stated in the Contract Documents or subsequently agreed upon.
      c. Cost to be determined in a manner agreed.
   3. CCD signed by Contractor indicates the agreement of Contractor therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.
   4. If Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the method and the adjustment shall be determined by Owner on the basis of reasonable expenditures and savings of those performing the Work attributable to the change including, in case of an increase in the Contract Sum, a reasonable allowance for overhead and profit. If the parties still do not agree on the price for a CCD, Contractor may file a Claim per Article 12 of Document 00700 (General Conditions). Contractor shall keep and present, in such form as Owner may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this paragraph shall be limited to those provided in paragraphs 1.4 and 1.5 of this Section 01250.
   5. Pending final determination of cost to Owner, amounts not in dispute may be included in Applications for Payment. The amount of credit to be allowed by Contractor to Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by Owner. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

E. Owner Requested RFP: Contractor shall furnish a Cost Proposal within 21 Business Days of Owner's RFP. Upon approval of Cost Proposal, Owner will issue a Change Order directing Contractor to proceed with extra Work. If the parties do not agree on the price, Owner may either issue a CCD or decide the issue per Article 12 of Document 00700 (General Conditions). Contractor shall perform the changed Work notwithstanding any claims or disagreements of any nature.

F. Differing Site Conditions: Contractor shall submit Notices of Differing Site Conditions to resolve problems regarding differing underground Site conditions encountered in the

execution of the Work pursuant to paragraph 13.4 of Document 00700 (General Conditions), which shall govern. If Owner determines that a change in Contract Sum or Contract Time is justified, Owner will issue RFP or CCD.

G. Hazardous Waste Conditions: Contractor shall submit Notices of Hazardous Waste or Materials Conditions to resolve problems regarding hazardous materials encountered in the execution of the Work pursuant to paragraph 13.5 of Document 00700 (General Conditions), which shall govern. If Owner determines that a change in Contract Sum or Contract Time is justified, Owner will issue RFP or CCD.

H. All Changes:
   1. Documentation of Change in Contract Sum and Contract Time:
      a. Contractor shall maintain detailed records of Work performed on a time-and-material basis.
      b. Contractor shall document each proposal for a change in cost or time with sufficient data to allow evaluation of the proposal.
      c. Contractor shall, on request, provide additional data to support computations for:
         1) Quantities of products, materials, labor, and equipment.
         2) Taxes.
         3) Justification for any change in Contract Time and new Progress Schedule showing revision due, if any.
         4) Credit for deletions from Contract, similarly documented.
      d. Contractor shall support each claim for additional costs, and for Work performed on a cost-and-percentage basis, with additional information including:
         1) Credit for deletions from Contract, similarly documented.
         2) Origin and date of claim.
         3) Dates and times Work was performed and by whom.
         4) Time records and wage rates paid.
         5) Invoices and receipts for products, materials, equipment, and subcontracts, similarly documented.

I. Correlation of Other Items:
   1. Contractor shall revise Schedule of Values and Application for Payment forms to record each authorized Change Order or CCD as a separate line item and adjust the Contract Sum as shown thereon prior to the next monthly pay period.
   2. Contractor shall revise the Progress Schedules prior to the next monthly pay period.
   3. Contractor shall enter changes in Project Record Documents prior to the next monthly pay period.

J. Responses: For all responses for which the Contract Documents, including without limitation this Section 01250, do not provide a specific time period, recipients shall respond within a reasonable time.

1.4 COST DETERMINATION

A. Total cost of extra Work or of Work omitted shall be the sum of labor costs, material costs, equipment rental costs, and specialist costs as defined herein plus overhead and profit as allowed herein. This limit applies in all cases of claims for extra Work, whether calculating Cost Proposals, Change Orders or CCDs, or calculating claims of all types, and applies even in the event of fault, negligence, strict liability, or tort claims of all kinds, including strict liability or negligence. Contractor may recover no other costs arising out of or connected with the performance of extra Work, of any nature. No special, incidental or consequential damages may be claimed or recovered against Owner, its representatives or agents, whether

arising from breach of Contract, negligence, or strict liability, unless specifically authorized in the Contract Documents.

B. Markup for Overhead and Profit: (Overhead shall be as defined in paragraph 1.8 of this Section 01250)
   1. Markup for overhead and profit on labor for extra Work shall not exceed 15 percent.
   2. Markup for overhead and profit on materials for extra Work shall not exceed 15 percent.
   3. Markup for overhead and profit on owner-operated equipment for extra Work shall not exceed 15 percent.
   4. Markup for overhead and profit on equipment for extra Work shall not exceed 10 percent.
   5. When extra Work is performed by a first tier Subcontractor, Contractor shall receive a 5 percent markup on Subcontractors' total costs of extra Work. First tier Subcontractor's markup on its Work shall not exceed percentages listed in paragraphs 1.4B.1, 1.4B.2, 1.4B.3, and 1.4B.4 immediately above.
   6. When extra Work is performed by a lower tier Subcontractor, Contractor, first tier Subcontractors, and lower tier Subcontractors shall divide (as mutually agreed) a total of 5 percent markup on the lower tier Subcontractors' total costs of extra Work.
   7. Notwithstanding the foregoing, in no case shall the total markup on any extra Work exceed 20 percent of the direct cost, notwithstanding the actual number of Contract tiers.
   8. On proposals covering both increases and decreases in Contract Sum, markup for overhead and profit shall be included on the net amount as determined in this paragraph 1.4.
   9. The markup shall include profit, small tools, cleanup, engineering, supervision, warranties, cost of preparing the cost proposal, jobsite overhead, and home office overhead.

C. Taxes:
   1. All State sales tax, use tax, and Sonoma County and applicable City sales taxes shall be included.
   2. Federal and Excise tax shall not be included.

D. Owner-Operated Equipment: When owner-operated equipment is used to perform extra Work, Contractor will be paid as follows:
   1. Payment for cost of equipment will be made at no more than rates of such equipment established in paragraph 1.5C of this Section 01250.
   2. Payment for cost of labor will be made at no more than rates of such labor established by collective bargaining agreements for type of worker and location of Work, whether or not owner-operator is actually covered by such an agreement.
   3. Invoices for owner-operated equipment need not itemize labor and equipment costs, unless specifically requested by Owner. In any event, the total rate for owner-operated equipment shall not exceed the combined rates for labor and equipment listed in paragraphs 1.4D.1 and 1.4D.2 above.

E. Accord and Satisfaction: Every Change Order and accepted CCD shall constitute a full accord and satisfaction, and release, of all Contractor (and if applicable, Subcontractor) claims for additional time, money or other relief arising from or relating to the subject matter of the change including, without limitation, impacts of all types, cumulative impacts, inefficiency, overtime, delay, and any other type of claim. Contractor may elect to reserve its rights to disputed claims arising from or relating to the changed Work at the time it signs a Change Order or accepts a CCD, but must do so expressly in a writing delivered concurrently with the executed Change Order or approved CCD, and must also submit a

Claim for the reserved disputed items pursuant to Article 12 of Document 00700 (General Conditions) no later than 30 Days of Contractor's first written notice of its intent to reserve rights.

1.5 COST BREAKDOWN

A. Labor: Contractor will be paid cost of labor for workers (including forepersons when authorized by Owner) used in actual and direct performance of extra Work. Labor rate, whether employer is Contractor, Subcontractor or other forces, will be sum of following:
   1. Actual Wages: Actual wages paid shall include any employer payments to or on behalf of workers for health and welfare, pension, vacation, and similar purposes.
   2. Labor surcharge: Payments imposed by local, county, state, and federal laws and ordinances, and other payments made to, or on behalf of, workers, other than actual wages as defined in paragraph 1.5A.1 of this Section 01250, such as taxes and insurance. Labor surcharge shall be and shall not exceed that set forth in Caltrans official labor surcharges schedule which is in effect on date upon which extra Work is accomplished and which schedule is incorporated herein by reference as though fully set forth herein.

B. Material: Only materials furnished by Contractor and necessarily used in performance of extra Work will be paid for. Cost of such materials will be cost, including sales tax, to purchaser (Contractor, Subcontractor or other forces) from supplier thereof, except as the following are applicable:
   1. If cash or trade discount by actual supplier is offered or available to purchaser, it shall be credited to Owner notwithstanding fact that such discount may not have been taken.
   2. For materials salvaged upon completion of extra Work, salvage value of materials shall be deducted from cost, less discounts, of materials.
   3. If cost of a material is, in opinion of Owner, excessive, then cost of material shall be deemed to be lowest current wholesale price at which material is available in quantities concerned delivered to Site, less any discounts as provided in paragraph 1.5B.1 of this Section 01250.

C. Equipment: For Contractor- or Subcontractor-owned equipment, payment will be made at rental rates listed for equipment in Caltrans official equipment rental rate schedule which is in effect on date upon which extra Work is accomplished and which schedule is incorporated herein by reference as though fully set forth herein. If there is no applicable rate for an item of equipment, then payment shall be made for Contractor- or Subcontractor-owned equipment at rental rate listed in the most recent edition of the Association of Equipment Distributors (AED) book. For rented equipment, payment will be made based on actual rental invoices. Equipment used on extra Work shall be of proper size and type. If, however, equipment of unwarranted size or type and cost is used, cost of use of equipment shall be calculated at rental rate for equipment of proper size and type, as determined by Owner. Rates paid shall be deemed to cover cost of fuel, oil, lubrication, supplies, small tools, necessary attachments, repairs and maintenance of any kind, depreciation, storage, insurance, and all incidentals. Unless otherwise specified, manufacturer's ratings, and manufacturer-approved modifications, shall be used to classify equipment for determination of applicable rates. Individual pieces of equipment or tools not listed in said publication and having a replacement value of $100 or less, whether or not consumed by use, shall be considered to be small tools and no payment will be made therefor as payment is included in payment for labor. Payment will not be made for time in which equipment is inoperative due to breakdowns.

1. For Contractor or Subcontractor –owned equipment on Site, payment for equipment use will be for time equipment is in operation on extra Work being performed or on standby as approved by Owner.
2. For rented equipment on Site, the following shall be used in computing rental time of equipment:
   a. When hourly rates are listed, less than 30 minutes of operation shall be considered to be ½ hour of operation.
   b. When daily rates are listed, less than four hours of operation shall be considered to be ½ Day of operation.
3. For equipment that must be brought to Site to be used exclusively on extra Work, cost of transporting equipment to Site and its return to its original location shall be determined as follows:
   a. Owner will pay for costs of loading and unloading equipment.
   b. Cost of transporting equipment in low bed trailers shall not exceed hourly rates charged by established haulers.
   c. Cost of transporting equipment shall not exceed applicable minimum established rates of California Public Utilities Commission.
   d. Owner will not make any payment for transporting and loading and unloading equipment if equipment is used on Work in any other way than upon extra Work.
4. For rented equipment, rental period may begin at time equipment is unloaded at Site of extra Work and terminate at end of the performance of the extra Work or Day on which Owner directs Contractor to discontinue use of equipment, whichever first occurs. Excluding Saturdays, Sundays, and Owner's legal holidays, unless equipment is used to perform extra Work on such Days, rental time to be paid per Day shall be four hours for zero hours of operation, six hours for four hours of operation and eight hours for eight hours of operation, time being prorated between these parameters. Hours to be paid for equipment that is operated less than eight hours due to breakdowns, shall not exceed eight less number of hours equipment is inoperative due to breakdowns.

D. Work Performed by Special Forces or Other Special Services: When Owner and Contractor, by agreement, determine that special service or item of extra Work cannot be performed by forces of Contractor or those of any Subcontractors, service or extra Work item may be performed by specialist. Invoices for service or item of extra Work on basis of current market price thereof may be accepted without complete itemization of labor, material, and equipment rental costs when it is impracticable and not in accordance with established practice of special service industry to provide complete itemization. In those instances wherein Contractor is required to perform extra Work necessitating a fabrication or machining process in a fabrication or machine shop facility away from Site, charges for that portion of extra Work performed in such facility may, by agreement, be accepted as a specialist billing. Owner must be notified in advance of all off-Site Work. In lieu of overhead and profit provided in paragraph 1.4B of this Section 01250, 15 percent will be added to specialist invoice price, after deduction of any cash or trade discount offered or available, whether or not such discount may have been taken.

1.6 FORCE-ACCOUNT WORK

A. If it is impracticable because of nature of Work, or for any other reason, to fix an increase or decrease in price definitely in advance, the Contractor may be directed to proceed at a not-to-exceed (NTE) maximum price which shall not under any circumstances be exceeded. Subject to such limitation, such extra Work shall be paid for at actual necessary cost for

Force-Account Work or at the negotiated cost, as determined by Owner. The cost for Force-Account Work shall be determined pursuant to paragraphs 1.4 and 1.5 of this Section 01250.

B. Force-Account Work shall be used when it is not possible or practical to price out the changed Work prior to the start of that Work. In these cases, Force-Account Work will be utilized during the pricing and negotiation phase of the change. Once negotiations have been concluded and a bilateral agreement has been reached, the tracking of the Work under Force-Account is no longer necessary. Force-Account Work shall also be used when negotiations between Owner and Contractor have broken apart and a bilateral agreement on the value of the changed Work cannot be reached. Owner may approve other uses of Force-Account Work.

C. Whenever any Force-Account Work is in progress, definite price for which has not been agreed on in advance, Contractor shall report to Owner each Business Day in writing in detail amount and cost of labor and material used, and any other expense incurred in Force-Account Work on preceding Day, by using the Cost Proposal form attached hereto. No claim for compensation for Force-Account Work will be allowed unless report shall have been made.

D. Whenever Force-Account Work is in progress, definite price for which has not been agreed on in advance, Contractor shall report to Owner when 75 percent of the NTE amount has been expended.

E. Force-Account Work shall be paid as extra Work under this Section 01250. Methods of determining payment for Work and materials provided in this paragraph 1.6 shall not apply to performance of Work or furnishings of material that, in judgment of Owner, may properly be classified under items for which prices are otherwise established in Contract Documents.

1.7 OWNER-FURNISHED MATERIALS

A. Owner reserves right to furnish materials as it deems advisable, and Contractor shall have no claims for costs and overhead and profit on such materials.

1.8 OVERHEAD DEFINED FOR MODIFICATIONS

A. The following constitutes charges that are deemed included in overhead for all Contract Modifications, including Force-Account Work or CCD Work, whether incurred by Contractor, Subcontractors, or suppliers, and Contractor shall not invoice or receive payment for these costs separately:
   1. Drawings: field drawings, Shop Drawings, as-builts, etc., including submissions of drawings
   2. Routine field inspection of Work proposed
   3. General superintendence
   4. General administration and preparation of cost proposals, schedule analysis, Change Orders, and other supporting documentation as necessary
   5. Computer services
   6. Reproduction services
   7. Salaries of project engineer, superintendent, timekeeper, storekeeper, and secretaries
   8. Janitorial services
   9. Temporary on-Site facilities:
      a. Offices
      b. Telephones
      c. Plumbing
      d. Electrical: Power, lighting

   e. Platforms
   f. Fencing, etc.
   g. Water
   h. Sanitation
10. Home office expenses
11. Insurance and Bond premiums
12. Procurement and use of vehicles and fuel used coincidentally in Work otherwise included in the Contract Documents
13. Surveying
14. Estimating
15. Protection of Work
16. Handling and disposal fees
17. Permit fees
18. Final cleanup
19. Other incidental Work

1.9 RECORDS AND CERTIFICATION

A. Force-Account (cost reimbursement) charges shall be recorded daily and summarized in Cost Proposal form attached hereto. Contractor or authorized representative shall complete and sign form each Day. Contractor shall also provide with the form: the names and classifications of workers and hours worked by each; an itemization of all materials used; a list by size, type, and identification number of equipment and hours operated; and an indication of all Work performed by specialists.

B. No payment for Force-Account Work shall be made until Contractor submits original invoices substantiating materials and specialists charges.

C. Owner shall have the right to audit all records in possession of Contractor relating to activities covered by Contractor's claims for Modification of Contract, including Force-Account Work and CCD Work.

D. Further, Owner will have right to audit, inspect, or copy all records maintained in connection with this Contract, including financial records and Escrow Bid Documents, in possession of Contractor relating to any transaction or activity occurring or arising out of, or by virtue of, the Contract. If Contractor is a joint venture, right of Owner shall apply collaterally to same extent to records of joint venture sponsor, and of each individual joint venture member. This right shall be specifically enforceable, and any failure of Contractor to voluntarily comply shall be deemed an irrevocable waiver and release of all claims then pending that were or could have been subject to the Article 12 of Document 00700 (General Conditions).

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

COST PROPOSAL FORM FOLLOWS ON NEXT PAGE

COST PROPOSAL (CP)

Mirabel Fish Screen and Fish Ladder Replacement
Contract Number 45-5.1-7 #1A

CP Number: _____
Date: _____
In Response To _____
RFP #, etc.

To: Sonoma County Water Agency
Attention: Contract Administration/Inspection
404 Aviation Boulevard, Santa Rosa, CA 95403-9019

Subject Ref. No: _____
(for Project Manager use only)
Phone: (707) 547-1913
Fax: (707) 544-6123

From: [Insert Contractor's Name/Address]
_____
_____

This Cost Proposal is in response to the above-referenced _____ [insert RFP, etc. as applicable].
Brief description of change(s): _____
_____

ITEM DESCRIPTION	PRIME CONTR.	SUB 1	SUB 2	SUB 3	SUB 4	TOTAL
MATERIAL						
DIRECT LABOR COST						
EQUIPMENT						
Other (Specify)						
Total Cost						
Subcontractor's Markup for Overhead and Profit 15 percent						
Contractor's Markup for Overhead and Profit 15 percent (Labor and Materials)						
Contractor's Markup for Overhead and Profit 10 percent (Equipment Rental)						
Markup for Overhead and Profit to Contractor for Subcontractor's Work 5 percent						
GRAND TOTAL						
(percent of Total Cost above not including any Markup for Overhead and Profit) [Grand Total divided by Total Cost]						
REQUESTED CHANGE IN CONTRACT TIME (DAYS)						

By Contractor: _____ Signature: _____ Date: _____

SECTION 01255

CONSTRUCTION COST REDUCTION INCENTIVE

PART 1 GENERAL

1.1 SUMMARY

A. This section describes general procedural requirements for reductions in the cost of the Contract that are initiated and developed by Contractor to change the Drawings, Specifications, or other requirements of the Contract Documents, and includes a structure of monetary incentives to encourage such cost reduction.

1.2 GENERAL

A. Contractor may submit to Owner, in writing, proposals for modifying the Contract Documents for the sole purpose of reducing the total cost of construction. Such construction cost reduction proposal ("CCRP") shall not impair, in any significant manner, the essential functions or characteristics of the Project, including but not limited to square footage, standardized features, service life, life cycle cost, reliability, warranty, ease and economy of use, maintenance and operation, desired appearance and design and safety standards; nor shall the CCRP require an unacceptable extension of the Contract Time.

B. The Owner shall have no liability to Contractor on any failure to accept or act upon any CCRP, nor will Owner have any liability to Contractor for any delays attributable to the CCRP.

1.3 PROCEDURE

A. CCRPs shall include the following information:
   1. Descriptions of both the existing Contract requirements for performing the Work and the proposed changes to the Contract requirements, and the comparative advantages and disadvantages of each.
   2. An itemization of the Contract requirements that must be changed if the CCRP is adopted.
   3. Detailed estimates of the cost of performing the Work under existing Contract requirements and under the CCRP. Cost of the CCRP must include a credit for all design and engineering costs.
   4. An assessment of any effects the proposed change[s] would have on costs of maintenance and operation.
   5. The Contract Work periods affected by the changes of the CCRP, including the time of any variation in Work periods believed to result from implementation of the CCRP.
   6. A statement of the time within which the Owner must make a decision on the CCRP, including:
      a. the date by which the Owner should decide the CCRP to efficiently implement the Work reduction, if accepted, including allowance for redesign time if appropriate ("the CCRP Target Response Date");
      b. the date by which the Owner must decide the CCRP to avoid adverse impacts to the Project Schedule in the event the CCRP is accepted ("the CCRP Response Deadline").

B. Contractor shall submit CCRP to the Owner.

C. Owner will review the CCRP to determine if the proposal contains all necessary information required by paragraph 1.3A of this Section 01255; in the event the Owner determines that additional information/analysis is required to complete the CCRP as required by paragraph

1.3A of this Section 01255, Owner will return the CCRP to the Contractor for revision; Contractor will thereafter resubmit the CCRP, if Contractor so desires, for further action by Owner.

D. If a CCRP is similar to a Change in the Drawings or Specifications for the Project under consideration by Owner when the CCRP is submitted, or if such CCRP is based upon or similar to the Contract Documents adopted by Owner after advertisement of the Contract, Owner will not accept such proposal and Owner reserves the right to make such Changes without compensation to Contractor under the provisions of this Section 01255.

E. Contractor shall continue to perform the Work in accordance with the Contract until an approved Change Order incorporating the CCRP has been issued. If an approved Change Order has not been issued by the date of the CCRP Response Deadline referenced in paragraph 1.3A.6.b of this Section 01255, above, or such other date as the Contractor may subsequently have specified in writing, such CCRP shall be deemed rejected.

F. Owner shall be the sole judge of the acceptability of a CCRP and of the estimated net savings in construction costs from the adoption of all or any part of such CCRP, and its decisions as to acceptance of any such proposal shall be final and shall not be subject to the claim or dispute resolution procedures in this Contract. In determining the estimated net savings, Owner reserves the right to disregard the Contract Price if, in the Owner's judgment, such prices do not represent a fair measure of the value of Work to be performed or deleted. Owner's exercise of discretion under this section shall be reasonable.

G. If Contractor's CCRP is accepted in whole or in part, such acceptance will be by a Contract Change Order changing the Contract Price and any affected provisions of the Contract, which shall specifically state that it is executed pursuant to this Section 01255.
   1. Such Change Order shall incorporate changes in the Contract Documents that are necessary to permit the CCRP, or such part thereof as has been accepted to be put into effect, and shall include any conditions upon which the Owner's approval thereof is based, if Owner's approval is conditional.
   2. The Change Order shall set forth the estimated net construction cost savings attributable to the CCRP effected by the Change Order, as determined by the Owner, if any. Estimated net construction cost savings shall be determined by deducting from the estimated gross savings the Contractor's costs of developing and implementing the proposal for the accepted CCRP (including any amount attributable to Subcontractor[s]), and the Owner’s estimated amount of increased costs resulting from the change, if any (such as implementation, inspection, related items and Owner-furnished property). Estimated net construction cost savings shall include Contractor's labor, material, equipment, overhead, profit and bonds, if any.
   3. The Change Order shall reduce the Contractor's Contract Price by an amount equal to 50 percent of the net construction cost savings affected by the CCRP, as recited therein.

H. Owner reserves the right, where it deems such action appropriate, to require Contractor to pay Owner's reasonable cost of investigating, redesigning, obtaining appropriate approvals and/or implementing a CCRP as a condition of considering such proposal. Where such a condition is imposed, Contractor shall indicate acceptance thereof in writing, and such acceptance shall constitute full authority for Owner to deduct such amounts, payable to Owner, from the savings generated by the CCRP. (For example, if the CCRP would save $100 in construction costs, and it cost the Owner $5 to investigate, net savings would be $95, so Contractor would be due 50 percent of $95.)

I. Acceptance of the CCRP and performance of the Work thereunder shall not extend the Contract Time unless specifically provided in the Change Order authorizing the performance of Work pursuant to the CCRP.
J. The cost reduction specified in the Change Order shall constitute full compensation to Contractor for the CCRP and the performance of Work thereof pursuant to the Change Order.
K. Owner expressly reserves the right to adopt any CCRP for general use in other Owner contracts when it determines that the CCRP is suitable for application to other contracts. When an accepted CCRP is adopted for general use, only the Contractor who first submitted such proposal will be eligible for compensation pursuant to this Section 01255, and in that case, only as to those Project contracts awarded to said Contractor before submission of the accepted CCRP. (Thus, the contractor who discovered the savings avenue gets the CCRP only on its contracts entered with the Owner, and if the same idea for savings is used on other Project contracts to which the discovering contractor is not a party, the Owner can use the idea on these contracts but the discovering contractor does not get a percentage of the savings on those contracts.) CCRPs that are identical or similar to previously submitted proposals will be eligible for consideration and compensation under the provisions of this Section 01255, and all contractors submitting the identical or similar previously submitted proposals shall share equitably the CCRP savings incentive.
L. Subject to the provisions contained herein, Owner or any other public agency shall have the right to use all of any submitted CCRP without obligation or compensation of any kind to Contractor.
M. The Contractor shall use its best efforts to include cost reduction arrangements in any subcontract that, in its judgment, appears to offer sufficient cost savings potential.

1.4 CONTRACTOR'S REPRESENTATION AND WARRANTY

A. CCRP constitutes a representation and warranty that Contractor:
   1. Has investigated proposed changes and determined that the Work, as modified, will either meet or exceed, in all respects, originally specified Work, or that Contractor has made full written disclosure of any changes.
   2. Will provide the same warranty for changed Work as for the specified Work.
   3. Will coordinate installation and make other changes that may be required for Work to be complete in all respects.
   4. Waives claims for additional costs that may subsequently become apparent on the Work subject to the CCRP, to the extent such additional costs arise due to the CCRP.
   5. Will compensate Owner for additional redesign costs associated with changes not covered in the Change Order.
   6. Will be responsible for any Progress Schedule delay due to changed Work.
   7. Will be responsible for Progress Schedule delay due to late ordering of available specified products caused by CCRP that is subsequently rejected by Owner.
   8. Will compensate Owner for all costs, including extra costs of Contract, extra cost to other contractors, extra costs to Owner, and any claims brought against Owner, caused by the CCRP or late ordering of products.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01315

PROJECT MEETINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Descriptions of the required Project meetings for the Work. These meetings include:
      a. Post-Notice of Award Meeting
      b. Schedule Review Meetings
      c. Preconstruction Conference
      d. Monthly Progress Meetings
      e. Progress Payment Meetings
      f. Optional Submittal Review Meeting
      g. ISO Training Meetings
      h. Special Meetings
      i. Safety Meetings

1.2 POST-NOTICE OF AWARD MEETING

A. Owner will call for and administer a Post-Notice of Award Meeting at time and place to be announced.
B. Contractor's general superintendent, Contractor's foreman, preparer of Safety Program, preparer of SWPPP, if applicable, and all major Subcontractors shall attend this meeting.
C. Agenda will include, but not be limited to, discussion of requirements for the following items:
   1. Insurance
   2. Bonds
   3. Owner's ISO Program and Contractor Requirements
   4. Notice to Proceed
   5. Commencement of Contract Time
   6. Start of Work at Site
   7. Contractor's Initial and Original Schedule
   8. Contractor's Schedule of Values
   9. Contractor's Schedule of Submittals
   10. Submittal and RFI procedures
   11. Safety Program
   12. SWPPP, if applicable
   13. Permits
   14. Name of Owner's Representative
   15. Other items as appropriate
D. Owner will distribute minutes of Post-Notice of Award Meeting to attendees. Attendees shall have 5 Days to submit comments or additions to minutes. Minutes will constitute final memorialization of results of Post-Notice of Award Meeting.

1.3 SCHEDULE REVIEW MEETINGS

A. Within 30 Days of issuance of Notice to Proceed, meet with Owner and conduct initial review of Contractor's draft Schedule of Submittals, draft Schedule of Values, and Initial Schedule.
B. Authorized representative in Contractor's organization, designated in writing, who will be responsible for working and coordinating with Owner relative to preparation and maintenance of Progress Schedule shall attend the initial schedule review meeting.
C. Contractor shall, within 30 Days from the commencement of Contract Time and prior to commencement of Work at the Site, meet with Owner to review the Original Progress Schedule and construction schedule submittals.
   1. Contractor shall have its manager, superintendent, scheduler, and key Subcontractor representatives, as required by Owner, in attendance. The meeting will take place over a continuous one-Day period.
   2. Owner's review will be limited to submittals' conformance to Contract Documents requirements including, but not limited to, coordination requirements. Owner's review may also include:
      a. Clarifications of Contract Requirements
      b. Directions to include activities and information missing from submittals
      c. Requests to Contractor to clarify its schedule
   3. Within 5 Days of the Schedule Review Meeting, Contractor shall respond in writing to all questions and comments expressed by Owner at the meeting.
D. Owner will administer Schedule Review Meetings and shall distribute minutes of Schedule Review Meetings to attendees. Attendees shall have 5 Days to submit comments or additions to minutes. Minutes will constitute final memorialization of results of Schedule Review Meetings.

1.4 PRECONSTRUCTION CONFERENCE

A. Owner will call for and administer Preconstruction Conference at time and place to be announced.
B. Contractor, all major Subcontractors, and major suppliers shall attend Preconstruction Conference.
C. Agenda will include, but not be limited to, the following items.
   1. Revised/updated schedules
   2. Personnel and vehicle permit procedures
   3. Use of premises
   4. Location of the Contractor's on-Site facilities
   5. Security
   6. Housekeeping
   7. Inspection and testing procedures, on-Site and off-Site
   8. Utility shutdown procedures
   9. Control and reference point survey procedures
   10. Safety Program
   11. Jurisdictional agency requirements
   12. Other items as appropriate
D. Owner will distribute copies of minutes to attendees. Attendees shall have 7 Days to submit comments or additions to minutes. Minutes will constitute final memorialization of results of Preconstruction Conference.

1.5 MONTHLY PROGRESS MEETINGS

A. Owner will schedule and administer monthly progress meetings throughout duration of Work. Progress meetings will be held monthly on approximately the 20th of each month.
   1. Meetings shall be held at Contractor's on-Site office unless otherwise directed by Owner.
   2. An Owner Representative will prepare agenda and distribute it at the meeting to Contractor.
   3. Contractor's general superintendent shall attend these meetings.
   4. Owner will record. Approximately 7 Days after meeting, Owner will distribute minutes to Contractor, who will distribute to those affected by decisions made at meeting. Attendees can either submit comments or additions to minutes prior to the next progress meeting, or may attend the next progress meeting and submit comments or additions there. Minutes will constitute final memorialization of results of meeting.

B. These meetings are considered a critical component of overall monthly schedule update submittal and Contractor shall have appropriate personnel attend. Contractor's job superintendent, major Subcontractors and suppliers, Owner, and others as appropriate shall attend progress meetings.

C. Agenda will contain the following items, as appropriate:
   1. Review, revise as necessary, and approve previous meeting minutes
   2. Review of Work progress since last meeting, including percent complete of each activity
   3. Review of the schedule update submittal
      a. Time impact evaluations for Change Orders and Time Extension Request
      b. Actual and anticipated activity sequence changes
      c. Actual and anticipated duration changes
      d. Actual and anticipated Contractor delays
   4. Review the Application for Payment
   5. Status of Construction Work Schedule, delivery schedules, adjustments
   6. Submittal, RFI, and Change Order status
   7. Review of the Contractor's safety program activities and results, including report on all serious injury and/or damage accidents
   8. Other items affecting progress of Work

1.6 PROGRESS PAYMENT MEETINGS

A. Prior to official application for Payment submission, a meeting will be held on approximately the 20th of each month to review the Application for Payment.
   1. At this meeting, the following items will be reviewed:
      a. Percent complete of each activity
      b. Project Schedule
      c. Hard-copy updates of the Project Record Drawings (Field Set)
   2. Contractor's general superintendent shall attend these meetings.

1.7 OPTIONAL SUBMITTAL REVIEW MEETING

A. At Owner or Contractor's request, in order to facilitate the timeliness of the review process, Owner may schedule a meeting to review the materials submitted.
   1. Request a meeting date with Owner at least 10 Business Days in advance.
   2. Provide complete package of Submittals at least 10 Business Days in advance of the meeting.
   3. The meeting shall take place at Owner's office. Owner will provide the authorized staff to review Submittals during the meeting.

4. Make available for this meeting the job superintendent and/or foreman, Contractor's safety officer, protective coating manufacturer's representative (if applicable), and someone knowledgeable of all Submittals and authorized to make substitutions or changes.

1.8 ISO TRAINING MEETINGS

A. Owner will conduct on-Site ISO awareness training during the first weekly toolbox safety talk conducted for the Project and as needed thereafter as additional Contractor and Subcontractor staff become active on-Site.

1.9 SPECIAL MEETINGS

A. Owner or Contractor may call special meetings by notifying all desired participants and Owner 5 Days in advance, giving reason for meeting. Special meetings may be held without advance notice in emergency situations.
B. At any time during the progress of Work, Owner shall have authority to require Contractor to attend meeting of any or all of the Subcontractors engaged in Work or in other work, and notice of such meeting shall be duly observed and complied with by Contractor.
C. Contractor shall schedule and conduct coordination meetings as necessary to discharge coordination responsibilities in Document 00700 (General Conditions). Contractor shall give Owner 5 Days written notice of coordination meetings. Contractor shall maintain minutes of coordination meetings. Attendees shall have 7 Days to submit comments or additions to minutes. Minutes will constitute final memorialization of results of coordination meetings.

1.10 SAFETY MEETINGS

A. Conduct monthly Contractor Safety Committee meetings.
B. Conduct weekly toolbox safety talks.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01320

PROGRESS SCHEDULES AND REPORTS

PART 1 GENERAL

1.1 SUMMARY

A. Perform scheduling of Work under this Contract in accordance with requirements of this Section 01320.
   1. Development of schedule, cost, and resource loading of the Progress Schedule, monthly payment requests, and Project status reporting requirements of the Contract Documents shall employ scheduling as required in this Section 01320.
   2. The Schedule shall be cost-loaded based on Schedule of Values as approved by Owner.
   3. Submit schedules and reports as specified in Document 00700 (General Conditions).

B. Upon Award of Contract, immediately commence development of Initial Schedule to ensure compliance with schedule submittal requirements.

C. Contractor's obligations under this Section 01320 are hereby deemed material obligations justifying Owner's remedies for default if Contractor fails to perform. Nothing in this paragraph 1.1.C of this Document 01320 or the lack of an express statement that any other Contract Documents provision is or is not material shall be considered in determining whether any such other provision is material.

D. Employ competent scheduling personnel or a schedule consultant with experience performing scheduling required herein on two prior, similar projects.

1.2 GENERAL

A. Progress Schedule shall be based on and incorporate Milestone and completion dates specified in Contract Documents.

B. Overall time of completion and time of completion for each Milestone shown on Progress Schedule shall adhere to times in Document 00520 (Agreement), unless an earlier (advanced) time of completion is requested by Contractor and agreed to by Owner. A Change Order shall formalize any such agreement.
   1. Owner is not required to accept an earlier (advanced) schedule, i.e., one that shows early completion date(s) for the Contract Time.
   2. Contractor is not entitled to extra compensation in event agreement is reached on an earlier (advanced) schedule and Contractor completes its Work, for whatever reason, beyond completion date shown in earlier (advanced) schedule but within the Contract Time.
   3. A schedule showing the Work completed in less than the Contract Time, which has been accepted by Owner, shall be considered to have Project Float. The Project Float is the time between the scheduled completion of the Work and Contract Substantial Completion. Project Float is a resource available to both Owner and Contractor.
   4. Project Float Ownership: Neither Owner nor Contractor owns Project Float. The Project owns the Project Float. As such, liability for delay of any Substantial Completion date rests with the party whose actions, last in time, actually cause delay to a Substantial Completion date.
      a. For example, in the event of unexcused delay by Party A and Party B, and if Party A uses some, but not all of the Project Float and Party B later uses remainder of the

Project Float as well as additional time beyond the Project Float, Party B shall be liable for the time that represents a delay to the Substantial Completion date.

b. Under this scenario, Party A would not be responsible for the time since it did not consume all of the Project Float and additional Project Float remained; therefore, the Substantial Completion Date was unaffected.

C. Progress Schedule shall be the basis for evaluating job progress, payment requests, and time extension requests. Responsibility for developing Contract schedule and monitoring actual progress as compared to Progress Schedule rests with Contractor.

D. Failure of Progress Schedule to include any element of the Work or any inaccuracy in Progress Schedule will not relieve Contractor from responsibility for accomplishing the Work in accordance with the Contract. Owner's acceptance of Schedule shall be for its use in monitoring and evaluating job progress, payment requests, and time extension requests, and shall not, in any manner, impose a duty of care upon Owner, or act to relieve Contractor of its responsibility for means and methods of construction.

E. Transmit each item using form approved by Owner or following Section 01330 (Submittal Procedures).

1. Identify Project with the Owner Contract number, and name of Contractor.
2. Provide space for Contractor's approval stamp and Owner's review stamps.
3. Submittals received from sources other than Contractor will be returned to Contractor without Owner's review.

1.3 INITIAL AND ORIGINAL PROGRESS SCHEDULE

A. Initial Schedule submitted within 21 Days after issuance of Notice to Proceed for review at the initial Schedule Review Meeting shall serve as Contractor's schedule for up to 30 Days after the commencement of Contract Time.

1. Initial Schedule must indicate detailed plan for the Work to be completed in first 30 Days after commencement of Contract Time of the Contract; details of planned mobilization of plant and equipment; sequence of early operations; and procurement of materials and equipment. Show Work beyond 30 Days in summary form.

B. Contractor shall submit its Original Schedule for review no later than first Application for Payment and prior to commencement of Work at the Site. Original Schedule and all updates shall comply with all standards herein.

C. All Schedules shall be time-scaled.

D. Except as otherwise expressly provided in this Section 01320, meet with Owner to review and discuss each Schedule (i.e., Initial, Original and updates) within seven Days after each Schedule has been submitted to Owner.

1. Owner's review and comment on any Schedule shall be limited to Contract conformance (with sequencing, coordination, and Milestone requirements).
2. Contractor shall make corrections to Schedule necessary to comply with Contract requirements and shall adjust Schedule to incorporate any missing information requested by Owner. Resubmit Initial Schedule if requested by Owner.

E. If Contractor is of the opinion that any of the Work included on its Schedule has been impacted, submit to Owner a written TIE in accordance with paragraph 1.8 of this Section 01320. The TIE shall be based on the most current update of the Schedule.

1.4 SCHEDULE FORMAT AND LEVEL OF DETAIL

A. Each Schedule (Initial, Original, and updates) shall indicate all separate submittals, fabrication, procurement and field construction activities required for completion of the Work, including but not limited to the following:

1. All Contractor, Subcontractor, and assigned Contractor Work shall be shown in a logical Work sequence that demonstrates a coordinated plan of Work for all contractors. The intent is to provide a common basis of acceptance, understanding, and communication, as well as interface with other contractors.
2. Incorporate Schedule of Submittals into each Schedule.
3. Activities related to the delivery of Contractor- and Owner-furnished equipment to be Contractor-installed per Contract shall be shown.
4. All activities shall be identified through codes or other identification to indicate the building (i.e. buildings, Site Work) and Contractor/Subcontractor responsibility to which they pertain.
5. Break up the Work schedule into activities of durations of approximately 21 Days or less each, except for non-field construction activities or as otherwise deemed acceptable by Owner.
6. Show the critical path in red. For each activity, show early start, late start, early finish, late finish, durations measured in Days, Project Float, resources, predecessor and successor activities, planned workday/week for the activity, manpower loading, and scheduled/actual progress payments.

B. Seasonal weather conditions (which do not constitute a delay as defined herein) shall be considered in the planning and scheduling of all Work influenced by high or low ambient temperatures or presence of high moisture for the completion of the Work within the allotted Contract Time.

C. Failure by Contractor to include any element of Work required for performance of the Work on the detailed construction schedule shall not excuse Contractor from completing all Work required within the Contract Time.

D. A two-week "look ahead," detailed daily bar chart schedule shall be updated and issued weekly.

E. Prepare schedule using Microsoft® Office Project 2007 software for all scheduling, including schedule updates.

1.5 MONTHLY SCHEDULE UPDATE SUBMITTALS

A. Following acceptance of Contractor's Initial Schedule, monitor progress of Work and adjust Schedule each month to reflect actual progress and any anticipated changes to planned activities.
   1. Each Schedule update submitted shall be complete, including all information requested for the Initial Schedule and Original Schedule submittal.
   2. Each update shall continue to show all Work activities including those already completed. Completed activities (shown in blue) shall accurately reflect "as built" information by indicating when activities were actually started and completed, and Contractor warrants the accuracy of as-built information as shown.

B. A meeting will be held in accordance with Section 01315 (Project Meetings) to review the Schedule update submittal. Submit Schedule updates monthly, 7 Days prior to the Monthly Progress Meeting.

C. Within five Days after monthly Schedule update meeting, submit the updated Schedule.

D. Within five Days of receipt of above-noted revised submittals, Owner will either accept or reject monthly schedule update submittal.
   1. If accepted, percent complete shown in monthly update will be basis for Application for Payment by Contractor. The schedule update shall be submitted as part of Contractor's Application for Payment.

2. If rejected, update shall be corrected and resubmitted by Contractor before the Application for Payment is submitted.

E. Updating, changing or revising of any report, curve, schedule or narrative submitted to Owner by Contractor under this Contract, nor Owner's review or acceptance of any such report, curve, schedule or narrative shall not have the effect of amending or modifying, in any way, the Contract Substantial Completion date or Milestone dates or of modifying or limiting, in any way, Contractor's obligations under this Contract.

1.6 SCHEDULE REVISIONS

A. Updating the Schedule (Initial and Original) to reflect actual progress shall not be considered revisions to the Schedule. Since scheduling is a dynamic process, however, revisions to activity durations and sequences are expected on a monthly basis.

B. To reflect revisions to the Schedule, provide Owner with a written narrative with a full description and reasons for each Work activity revised. For revisions affecting the sequence of Work, provide a schedule diagram that compares the original sequence to the revised sequence of Work. Provide the written narrative and schedule diagram for revisions three Days in advance of the monthly schedule update meeting. Clearly show and discuss any changes in the critical path.

C. Schedule revisions shall not be incorporated into any schedule update until Owner has reviewed the revisions. Owner may request further information and justification for schedule revisions and, within three Days, provide Owner with a complete written narrative response to Owner's request.

D. If Owner does not accept Contractor's revision, and Contractor disagrees with Owner's position, Contractor has seven Days from receipt of Owner's letter rejecting the revision, to provide a written narrative providing full justification and explanation for the revision. Contractor's failure to respond in writing within seven Days of Owner's written rejection of a schedule revision shall be contractually interpreted as acceptance of Owner's position, and Contractor waives its rights to subsequently dispute or file a claim regarding Owner's position. If Contractor files a timely response as provided in this paragraph, and the parties are still unable to agree, Contractor's sole right shall be to file a claim as provided in Document 00700 (General Conditions), Article 12.

E. At Owner's discretion, Contractor can be required to provide Subcontractor certifications of performance regarding proposed schedule revisions affecting said Subcontractors.

1.7 RECOVERY SCHEDULE

A. If a Schedule update shows a Substantial Completion date 21 Days beyond any Contract Substantial Completion date, or individual Milestone completion dates, submit to Owner within seven Days the proposed revisions to recover the lost time. As part of this submittal, provide a written narrative for each revision made to recapture the lost time. If the revisions include sequence changes, provide a schedule diagram comparing the original sequence to the revised sequence of Work. If Owner reasonably requests, show the intended critical path; secure appropriate Subcontractor and supplier consent to the recovery Schedule; submit a narrative explaining trade flow and construction flow changes, duration changes, added/deleted activities, critical path changes and identify all near critical paths and man-hour loading assumptions for major Subcontractors.

B. The revisions shall not be incorporated into any Schedule update until Owner has reviewed the revisions.

C. If Owner does not accept Contractor's revisions, Owner and Contractor shall follow the procedures in paragraphs 1.6C, 1.6D, and 1.6E of this Section 01320.

D. At Owner's discretion, Contractor can be required to provide Subcontractor certifications for revisions affecting said Subcontractors.

1.8 TIME IMPACT EVALUATION (TIE) FOR CHANGE ORDERS AND OTHER DELAYS

A. When Contractor is directed to proceed with changed Work, prepare and submit, within 14 Days from the direction to proceed, a TIE that includes both a written narrative and a schedule diagram depicting how the changed Work affects other schedule activities. The schedule diagram shall show how Contractor proposes to incorporate the changed Work in the schedule, and how it impacts the current Schedule update critical path or otherwise. Contractor is also responsible for requesting time extensions based on the TIE's impact on the critical path. The diagram shall be tied to the main sequence of scheduled activities to enable Owner to evaluate the impact of changed Work to the scheduled critical path.
B. Comply with the requirements of paragraph 1.8A of this Section 01320 for all types of delays such as, but not limited to, Contractor/Subcontractor delays, adverse weather delays, strikes, procurement delays, fabrication delays, etc.
C. Contractor is responsible for all costs associated with the preparation of TIEs, and the process of incorporating TIEs into the current schedule update.
D. Once agreement has been reached on a TIE, the Contract Time will be adjusted accordingly. If agreement is not reached on a TIE, the Contract Time may be extended in an amount Owner allows, and Contractor may submit a claim for additional time claimed by Contractor as provided in Document 00700 (General Conditions).

1.9 TIME EXTENSIONS

A. Contractor is responsible for requesting time extensions for time impacts that, in the opinion of Contractor, impact the critical path of the current schedule update. Notice of time impacts shall be given in accordance with Document 00700 (General Conditions).
B. Where an event for which Owner is responsible impacts the projected Substantial Completion date, provide a written mitigation plan, including a schedule diagram, which explains how (e.g., increase crew size, overtime, etc.) the impact can be mitigated. Also include a detailed cost breakdown of the labor, equipment, and material Contractor would expend to mitigate Owner-caused time impact. Submit mitigation plan to Owner within 14 Days from the date of discovery of said impact. Contractor is responsible for the cost to prepare the mitigation plan.
C. Failure to request time, provide TIE, or provide the required mitigation plan will result in Contractor waiving its right to a time extension and cost to mitigate the delay.
D. No time will be granted under the Contract Documents for cumulative effect of changes.
E. Owner will not be obligated to consider any time extension request unless requirements of Contract Documents are complied with.
F. Failure of Contractor to perform in accordance with the current schedule update shall not be excused by submittal of time extension requests.
G. Notwithstanding any other provision of this Section 01320, if Contractor does not submit a TIE within the required 14 Days for any issue, Contractor hereby agrees that Contractor does not require a time extension for that issue.

1.10 PROJECT STATUS REPORTING

A. In addition to submittal requirements for scheduling identified in this Section 01320, provide a monthly Project status report (i.e., written narrative report) to be submitted in conjunction with each Schedule as specified herein. Status reporting shall be in form specified in this paragraph 1.10 below.

B. Prepare monthly written narrative reports of status of Project for submission to Owner. Written status reports shall include:
   1. Status of major Project components (percent complete, amount of time ahead or behind schedule) and an explanation of how Project will be brought back on schedule if delays have occurred.
   2. Progress made on critical activities indicated on each Schedule, including inspections.
   3. Explanations for any lack of Work on critical path activities planned to be performed during last month.
   4. Explanations for any schedule changes, including changes to logic or to activity durations.
   5. List of critical activities scheduled to be performed during the next month.
   6. Status of major material and equipment procurement.
   7. Any delays encountered during reporting period.
   8. Description or list of any required permit reports prepared or submitted.
   9. Provide printed report indicating actual versus planned resource loading for each trade and each activity. This report shall be provided on weekly and monthly basis.
      a. Actual resource shall be accumulated in field by Contractor, and shall be as noted on Contractor's daily reports. These reports will be basis for information provided in monthly and weekly printed reports.
      b. Explain all variances and mitigation measures.
   10. Contractor may include any other information pertinent to status of Project. Include additional status information requested by Owner at no additional cost.
   11. Status reports, and the information contained therein, shall not be construed as claims, notice of claims, notice of delay, or requests for changes or compensation.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01330

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Description of general requirements for Submittals for the Work, as applicable:
      a. Procedures
      b. Schedule of Submittals
      c. Construction Material Waste Management Plan
      d. Safety Program
      e. Progress Schedule
      f. Product Data
      g. Shop Drawings
      h. Samples
      i. Coordination Drawings (If Applicable)
      j. Quality Assurance/Control Submittals
         1) Design Data
         2) Test Reports
         3) Certificates
         4) Manufacturers' Instructions
         5) Work Plans
      k. Installation, Operation, and Maintenance Manual
      l. Project Record Documents
      m. Storm Water Pollution Prevention Program
      n. Delay of Submittals

1.2 PROCEDURES

A. Submit at Contractor's expense the Submittals required by the Contract Documents.
B. Submit Submittals to Owner in accordance with accepted Schedule of Submittals. If no such schedule is agreed upon, then all Submittals shall be submitted within 35 Days after receipt of Notice of Award from Owner.
C. Transmit each item with the appropriate Submittal transmittal form (included at the end of this Section 01330). Where manufacturer's standard drawings or data sheets are used, they shall be marked clearly to show those portions of the data that are applicable to this Project. Inapplicable portions shall be marked out. Organize Submittals by Specification Section. Submittals containing information about more than one Specification Section will be returned for resubmittal. Submittals shall include all information requested by each Specification Section. Incomplete Submittals will be returned not reviewed by Owner.
D. The data shown on the Submittals shall be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Owner the materials and equipment Contractor proposes to provide and to enable Owner to review the information for the limited purposes specified in this Section 01330. Submittals shall be identified clearly as to material, supplier, pertinent data such as catalog numbers and the use for which it is intended and otherwise as Owner may require to enable Owner to review the Submittal.

E. At the time of each submission, give Owner specific written notice of all variations, if any, that the Submittal may have from the requirements of the Contract Documents, and the reasons therefore. This written notice shall be in a written communication attached to the Submittal transmittal form. In addition, cause a specific notation to be made on each Submittal submitted to Owner for review and approval of each such variation. If Owner accepts deviation, Owner will note its acceptance on the returned Submittal transmittal form and, if necessary, issue appropriate Contract Modification.

F. Submittal coordination and verification is the responsibility of Contractor; this responsibility shall not be delegated in whole or in part to Subcontractors or suppliers. Before submitting each Submittal, review and coordinate each Submittal with other Submittals and with the requirements of the Work and the Contract Documents, and determine and verify:
   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; and
   3. All information relative to Contractor's sole responsibility for means, methods, techniques, sequences, and procedures of construction and safety precautions and programs incident thereto.

G. Contractor's submission to Owner of a Submittal shall constitute Contractor's representation that it has satisfied its obligations under the Contract Documents, and as set forth immediately above in this paragraph 1.2 of this Section 01330, with respect to Contractor's review and approval of that Submittal.

H. Designation of Work "by others," if shown in Submittals, shall mean that Work will be responsibility of Contractor rather than Subcontractor or supplier who has prepared Submittals.

I. After review by Owner of each Submittal, an electronic copy of each Submittal will be returned to Contractor with actions defined as follows:
   1. NO EXCEPTIONS TAKEN - Accepted subject to its compatibility with future Submittals and additional partial Submittals for portions of the Work not covered in this Submittal. Does not constitute approval or deletion of specified or required items not shown on the Submittal.
   2. MAKE CORRECTIONS NOTED (NO RESUBMISSIONS REQUIRED) - Same as item 1 above, except that minor corrections as noted shall be made by Contractor.
   3. REVISE AS NOTED AND RESUBMIT - Rejected because of major inconsistencies or errors that shall be resolved or corrected by Contractor prior to subsequent review by Owner.
   4. REJECTED - RESUBMIT - Submitted material does not conform to Drawings and/or Specifications in major respect, i.e.: wrong size, model, capacity, or material.

J. Make a complete and acceptable Submittal at least by second submission. Owner reserves the right to deduct monies from payments due Contractor to cover additional costs of review beyond the second submission per paragraph 1.2T. Illegible Submittals will be rejected and returned to Contractor for resubmission. Contractor shall be in breach of the Contract if Contractor's first resubmittal, following a Submittal which Owner determines falls within categories 3 or 4 above, does not fall within categories 1 or 2 above.

K. Favorable review will not constitute acceptance by Owner of any responsibility for the accuracy, coordination, or completeness of the Submittals. Accuracy, coordination, and

completeness of Submittals shall be sole responsibility of Contractor, including responsibility to back-check comments, corrections, and modifications from Owner's review before fabrication. Contractor, Subcontractors, or suppliers may prepare Submittals, but Contractor shall ascertain that Submittals meet requirements of Contract Documents, while conforming to structural space and access conditions at point of installation. Owner's review will be only to assess if the items covered by the Submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as indicated by the Contract Documents. Favorable review of Submittal, method of Work, or information regarding materials and equipment Contractor proposes to furnish shall not relieve Contractor of responsibility for errors therein and shall not be regarded as assumption of risks or liability by Owner, or any officer or employee thereof, and Contractor shall have no claim under Contract Documents on account of failure or partial failure or inefficiency or insufficiency of any plan or method of Work or material and equipment so accepted. Favorable review shall be considered to mean merely that Owner has no objection to Contractor using, upon Contractor's own full responsibility, plan or method of Work proposed, or furnishing materials and equipment proposed.

L. Unless otherwise specified, Owner's review will not extend to the means, methods, techniques, sequences, or procedures of construction or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

M. Submit complete initial Submittal for those items where required by individual Specification Sections. Complete Submittal shall contain sufficient data to demonstrate that items comply with Specifications, shall meet minimum requirements for submissions cited in Specification Sections, shall include motor data and seismic anchorage certifications, where required, and shall include necessary revisions required for equipment other than first named. If Contractor submits incomplete initial Submittal when complete Submittal is required, Submittal may be returned to Contractor without review.

N. Copy, conform, and distribute reviewed Submittals in sufficient numbers for Contractor's files, Subcontractors, and vendors.

O. After Owner's review of Submittal, revise as noted and resubmit as required. Identify changes made since previous Submittal.
   1. Begin no fabrication or Work that requires Submittals until return of Submittals not requiring resubmittal. Do not extrapolate from Submittals covering similar Work.
   2. Normally, Submittals will be processed and returned to Contractor within ~~30~~ 21 Days of receipt.

P. Distribute reviewed Submittals to concerned persons. Instruct recipients to promptly report any inability to comply with provisions.

Q. All Submittals shall be number-identified by Contractor, prior to submission to Owner, in accordance with Owner's numbering format. Owner will provide Contractor with sample numbering format.

R. Submission Requirements:
   1. Deliver Submittals to Owner at least 30 Days before dates reviewed Submittals will be needed.
   2. Initial Submittal of Installation, Operation, and Maintenance Manual shall be:
      a. 45 Days after the date Submittal(s) that pertain to the item are favorably reviewed; and
      b. Prior to start-up and testing of the applicable product or equipment.

3. The following table lists the number of initial Submittals required from Contractor for each type of submission and to whom Contractor shall distribute the information. Submittals requiring resubmission will require the same quantity and distribution as an initial Submittal.

Submittal	**Contractor Submittal**	
	# of hard copies/ Prints/ Samples	Electronic copy
Items Go To →	Owner	Owner
Schedule of Submittals	0	✓
Construction Material Waste Management Plan	0	✓
Monthly Progress Reports for Construction Material Waste Management Plan	0	✓
Safety Program	1	✓
Fire Protection Plan	1	✓
Progress Schedule	1	✓
Product Data	0	✓
MSDSs	0	✓
Shop Drawings	0	✓
Drawings or any documents larger than 11″ x 17″	0	✓
Samples	2	-
Coordination Drawings	0	✓
Quality Assurance/Control Submittals:		
Design Data	0	✓
Test Reports	0	✓
Certificates	0	✓
Manufacturers' Instructions	0	✓
Work Plans	0	✓
Installation, Operation, and Maintenance Manuals (initial submittal)	0	✓
Installation, Operation, and Maintenance Manuals (final submittal)	4	✓
Major Products List	0	✓
Storm Water Pollution Prevention Program	0	✓
Other Documents	0	✓

4. The following table lists the Submittals required from Contractor after Owner's favorable review, if Submittal requires a stamp or signature.

Submittal	**Contractor Submittal**
	# of hard copies
Items Go To →	Owner
Shop Drawings	1

Submittal	Contractor Submittal # of hard copies
Coordination Drawings	1
Quality Assurance/Control Submittals:	
Design Data	1
Test Reports	1
Certificates	1
Work Plans	1
Storm Water Pollution Prevention Program	1
Other Documents	1

5. Accompany each copy of the Submittal(s) with a Submittal transmittal form, containing:
   a. Date, revision date, and Submittal identification number.
   b. Project name and Owner's Contract number.
   c. Contractor's name, address, and job number.
   d. Specification Section number clearly identified.
   e. The quantity of Shop Drawings, Product Data, or Samples submitted.
   f. Notification of deviations from Contract Documents.
   g. MSDS for each item complying with OSHA's Hazard Communication Standard 29 CFR 1910.1200.
   h. Other pertinent data.
6. Submittal shall include:
   a. Date and revision dates.
   b. Revisions, if any, identified.
   c. Project Name and Contract number.
   d. The names of:
      1) Contractor, Subcontractor, Supplier, Manufacturer, and separate detailer, when pertinent.
   e. Identification of product material by location within the Project.
   f. Relation to adjacent structure or materials.
   g. Field dimensions, clearly identified as such.
   h. Specification Section number and applicable detail reference number and Drawing number.
   i. Applicable reference standards, such as ASTM, ANSI, FS, NEMA, SMACNA or ACI.
   j. A blank space, on the first sheet of each Submittal set, 5" x 4" for the Owner's stamp.
   k. Identification of deviations from Contract Documents.

S. Resubmission requirements:
1. Shop Drawings:
   a. Revise initial Shop Drawings as required and resubmit as specified for initial Submittals.
   b. Indicate on Shop Drawings any changes that have been made other than those requested by Owner.
2. Product Data and Samples:
   a. Submit new Product Data and Samples as required for initial Submittals.
3. Installation, Operation, and Maintenance Manual:
   a. Revise initial Installation, Operation, and Maintenance Manual(s) as required and resubmit as specified for initial Submittals.

T. Charge for resubmissions:
   1. One re-examination of Contractor's Submittals that have been returned for correction or replacement will be included in Owner's budget. Any additional re-examination of Contractor's Submittals will be considered additional scope services to be paid by Contractor through Owner. Contractor shall pay Owner (or Owner may deduct from any progress or final payment), for engineering personnel, on an hourly basis at 2.5 times direct payroll expenses, and for consultant personnel time at 1.25 times the amount billed Owner.

1.3 SCHEDULE OF SUBMITTALS

A. Submit a preliminary Schedule of Submittals as required herein and by Document 00700 (General Conditions). Utilize Owner's Submittal Log form to prepare Schedule of Submittals. Owner's Submittal Log form will be provided to Contractor in electronic media format compatible with Microsoft® Excel 2000.
B. Schedule of Submittals will be used by Owner to schedule its activities relating to review of Submittals. Schedule of Submittals shall indicate a spreading out of Submittals and early Submittals of long-lead-time items and of items that require extensive review.
C. Schedule of Submittals will be reviewed by Owner and shall be revised and resubmitted until accepted by Owner.
D. Unless otherwise specified, transmit Submittals for associated items simultaneously to ensure that information is available for checking each item when it is received. Identify on the Submittal transmittal form that such Submittals should be reviewed together.

1.4 CONSTRUCTION MATERIAL WASTE MANAGEMENT PLAN

A. Submit Construction Material Waste Management Plan specific to these Contract Documents as required by Section 01741 (Construction Material Waste Management Plan).

1.5 SAFETY PROGRAM

A. Submit Safety Program specific to these Contract Documents as required by Section 01540 (Site Security and Safety).

1.6 PROGRESS SCHEDULE

A. See Section 01320 (Progress Schedules and Reports) for schedule and report requirements. Section 01320 (Progress Schedules and Reports) shall control in any conflict with this Section 01330.
B. Progress schedules, schedule updates, and reports shall be submitted using software described Section 01320 (Progress Schedules and Reports). Electronic files shall be complete copies, including all programs and electronic coding.

1.7 PRODUCT DATA

A. Within ten Days after Contract Time commences to run, submit complete list of major products proposed for use (included at the end of this Section 01330, if required), with name of manufacturer, telephone number, trade name, and model number of each product. Tabulate data by Specification Section.
B. Product or Catalog Data:
   1. Manufacturers' standard drawings shall be modified to delete non-applicable data or include applicable data.
   2. Manufacturers' catalog sheets, brochures, diagrams, schedules, charts, illustrations, and other standard descriptive data:

a. Mark each copy to identify pertinent materials, products, or models.
b. Show dimensions and clearances required, performance characteristics and capacities, wiring diagrams and controls.

3. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.
4. Material Safety Data Sheets:
   a. In addition to MSDSs otherwise required by the Contract Documents, submit MSDSs for any products containing a hazardous substance such as paints, solvents, thinners, varnish, lacquer, glues and adhesives, mastics, sealants, equipment fuel, equipment lubricant, or other materials needed for the Project as required by the individual Specification Sections or as otherwise specified in the Contract Documents.
   b. MSDSs must be submitted with Product Data Submittal in order for the Submittal to be reviewed.

C. Supplemental Data:
1. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturer's standard data to provide information unique to Project.

1.8 SHOP DRAWINGS

A. Minimum Sheet Size: 8½ inches by 11 inches. All others: Multiples of 8½ inches by 11 inches, 34 inches by 44 inches maximum.
B. The electronic copy will be marked with Owner's review comments and returned to Contractor.
C. Mark each copy to identify applicable products, models, options, and other data; supplement manufacturers' standard data to provide information unique to Work.
D. Include manufacturers' installation instructions when required by Specification Section.
E. If Contractor submits Shop Drawings for items that Shop Drawings are not specified, Owner will not be obliged to review them.
F. Contractor is responsible for procuring copies of Shop Drawings for its own use as it may require for the progress of the Work.
G. Shop Drawings shall be drawn to scale and completely dimensioned, showing plan view together with such sectional views as are necessary to clearly show construction detail, materials, and methods.

1.9 SAMPLES

A. Submit full range of manufacturers' standard colors, textures, and patterns for Owner's selection.
B. Submit Samples to illustrate functional and aesthetic characteristics of product, with integral parts and attachment devices. Coordinate Submittal of different categories for interfacing Work.
C. Include identification on each Sample, giving full information.
D. Sizes: Unless otherwise specified, provide the following:
1. Paint Chips: Manufacturers' standard
2. Flat or Sheet Products: Minimum 6 inches square, maximum 12 inches square
3. Linear Products: Minimum 6 inches, maximum 12 inches long
4. Bulk Products: Minimum 1 pint, maximum 1 gallon

E. Full size Samples may be used in Work upon approval by Owner.
F. Field Samples and Mock-ups (if applicable):

1. Erect field Samples and mock-ups at Site in accordance with requirements of Specification Sections. If testing is conducted, record and certify results and full Contract compliance.
2. Modify or make additional field Samples and mock-ups as required to provide appearance and finishes approved by Owner.
3. Approved field Samples and mock-ups may be used in Work upon approval by Owner.
4. Construct or prepare as many additional Samples as may be required, as directed by the Owner, until desired textures, finishes, and/or colors are obtained.
5. Accepted Samples and mock-up shall serve as the standard of quality for the various units of Work.

G. No review of a Sample shall be taken in itself to change or modify the requirements in the Contract Documents.

H. Finishes, materials, and workmanship in the completed Work shall match accepted Samples.

I. Samples will not be returned to Contractor.

1.10 COORDINATION DRAWINGS (IF APPLICABLE)

A. Layout Drawings: As soon as practical and in no case starting later than 30 Days after issuance of Notice to Proceed, Contractor shall prepare layout drawings of all equipment and piping at not less than ¼" scale. The layout drawings shall show the location of all equipment as well as locations of all valves, piping, fittings, and other items requiring access for service and maintenance. The layout drawings shall also show beams, ceiling heights, walls, floor-to-floor dimensions, columns, doors and other major architectural and structural drawings.

1. At Contractor's option, the layout drawings may be produced using computer-aided drafting.

B. Coordination with Subcontractors: Within 30 Days after the date of the Notice to Proceed, send one reproducible and two prints of the layout drawings to Subcontractors who shall then make on the reproducible their own routings, etc., as required to determine interrelationship and possible interferences with mechanical equipment, piping and architectural or structural features. The marked-up reproducibles shall then be returned to Contractor no less than 30 Days after receipt by the Subcontractors.

C. Composite Drawings: Contractor shall prepare preliminary composite drawings of such layout drawings, incorporating all the information and routings provided by the Subcontractors. (At Contractor's option, a group of transparent overlays may be substituted, provided that they clearly show the relationship of all proposed installations and they are pin-registered/aligned.)

1. The preliminary composite drawings or the overlays shall be reviewed during a series of meetings called by Contractor and attended by Owner, at which all Subcontractors and trades shall be represented in order to review and resolve any real or apparent interferences or conflicts.

D. Agreement by Subcontractors: After all conflicts or interferences are resolved, Contractor shall develop a final set of composite drawings showing the agreed-upon routing, layout and juxtaposition of all , piping, major conduit, valves, panels, controls, lighting fixtures and all major mechanical and electrical installations. In areas where no mechanical and electrical installations are installed, each Subcontractor shall be responsible for its own Work and pay its own costs in connection therewith. In preparation of all the final composite drawings, large scale details as well as cross and longitudinal sections shall be prepared as required to

fully delineate all conditions. Particular attention shall be given to the locations, size, and clearance dimensions of equipment items, shafts, and similar features. These final composite drawings shall then be signed off by Subcontractors and Contractor, indicating their awareness of and agreement with the indicated routings and layouts and their interrelationship with the adjoining or contiguous Work. Thereafter, no unauthorized deviations will be permitted and, if made without knowledge or agreement of Owner, such unauthorized Work will be subject to removal and correction at no additional cost to Owner.

E. Minor Changes: In preparing the composite drawings, minor changes in duct, pipe or conduit routings that do not affect the intended function may be made as required to avoid space conflicts, when mutually agreed, but items may not be resized or exposed items relocated without Owner's written approval. No changes shall be made in any wall or chase locations, ceiling heights, door swings or locations, window or other openings or other features affecting the function or aesthetic effect of the building. If conflicts or interferences cannot be satisfactorily resolved, Owner shall be notified and Owner's decision obtained.

F. Distribution of Composite Drawings: After the final composite drawings have been agreed upon and signed by all Subcontractors, provide and distribute four prints and one electronic copy to each of the Subcontractors for reference and record purposes. Make similar distribution of all supplementary composite drawings, initiated by other Subcontractors. Also provide final composite drawings to Owner. All Subcontractors desiring additional prints of such drawings, beyond the basic distribution indicated above in this paragraph 1.10F, shall arrange for and pay the cost of same.

G. Record Composite Drawings: The record copies of the final composite drawings shall be retained by Owner, Contractor, and each Subcontractor as a working reference. All Shop Drawings, prior to their Submittal to Owner, shall be compared with the composite drawings and developed accordingly by Contractor and the responsible Subcontractor. Any revisions to the composite drawings that may become necessary during the progress of the Work shall be noted by Contractor and all Subcontractors and shall be neatly and accurately recorded on the record copies. Contractor and each Subcontractor shall be responsible for the up-to-date maintenance of Subcontractor record copies of the composite drawings and for keeping two copies available at the Site. Contractor and each Subcontractor shall utilize the composite drawings, and any subsequent changes thereto, in the development of Subcontractor "Project Record Documents" drawings.

H. Timely Submission: The composite drawings need not be submitted as a whole, but shall be submitted in all cases in ample time to avoid construction delay. The coordination drawings may lack complete data in certain instances pending receipt of Shop Drawings, but sufficient space shall be allotted for the items affected. When final information is received, such data shall be promptly inserted on the composite drawings.

I. Improperly Coordinated Work: No extra compensation will be paid for relocating any duct, pipe, conduit, or other material that has been installed without proper coordination between Contractor and all Subcontractors involved. If any improperly coordinated Work or Work installed that is not in accordance with the approved composite drawings, necessitates additional Work by Contractor or other Subcontractors, the costs of all such Work shall be borne solely by Contractor or the Subcontractor responsible for the Work.

J. Incorporation of Changes: All changes in the scope of Work due to revisions formally issued and approved shall be shown on the composite drawings.

K. Quality Draftsmanship: All Work on Shop Drawings, layout drawings, coordination drawings, and composite drawings shall be performed by competent drafters and shall be clear and fully legible. Owner shall be the sole judge of the acceptability of the drawings.
L. Structural Cutting: Obtain specific positive written instructions from Owner before cutting beams or other structural members, walls, arches, or lintel, and comply with such instructions.

1.11 QUALITY ASSURANCE/CONTROL SUBMITTALS

A. Design Data:
   1. Indicate that material or product conforms to or exceeds specified requirements.
B. Test Reports:
   1. Indicate that material or product conforms to or exceeds specified requirements.
   2. Reports may be from recent or previous tests on material or product, but shall be acceptable to Owner. Comply with requirements of each individual Specification Section.
C. Certificates:
   1. Indicate that material or product conforms to or exceeds specified requirements.
   2. Submit supporting reference data, affidavits, and certifications as appropriate.
   3. Certificates may be recent or from previous test results on material or product, but shall be acceptable to Owner.
D. Manufacturers' Instructions:
   1. Include manufacturers' printed instructions for delivery, storage, assembly, installation, startup, adjusting, and finishing.
   2. Identify conflicts between manufacturers' instructions and Contract Documents.
E. Work Plans:
   1. Submit work plans with sufficient detail to clearly indicate compliance with Specification requirements and to clearly describe by what means and methods Contractor intends to execute the subject Work.

1.12 INSTALLATION, OPERATION, AND MAINTENANCE MANUAL (IF APPLICABLE)

A. Sheet Size: 8½ x 11 inch
B. Drawing Size: Reduce drawings or diagrams to an 8½ x 11 inch or 11 x 17 inch size. However, where reduction is not practical to ensure readability, fold larger drawings separately and place in vinyl envelopes bound into the binder. Identify vinyl envelopes with drawing numbers.
C. Binding: Bind in heavy-duty white vinyl D-ring binders (locking rings), not more than 3" thick, with standard three-hole punch, two inside pockets, and a clear overlay (front pocket). Binder shall be no more than 80% full.
D. Multiple Items: Multiple items may be combined into one binder; tab each section with plastic-coated dividers.
E. Volumes: create volumes, numbered sequentially, as appropriate.
F. Page Protectors: Provide plastic sheet lifters prior to first page and following last page.
G. Binder title: Include the following title on front and spine of binder(s):

MIRABEL FISH SCREEN AND FISH LADDER REPLACEMENT
INSTALLATION, OPERATION, AND MAINTENANCE MANUAL, [YEAR]
VOLUME [__(number) of __(total number of volumes)]

H. Contents:
   1. Introductory Information:
      a. Title page providing the same information as paragraph 1.12G above

b. Contractor's name, address, and telephone number
c. Table of Contents: include a complete table of contents in each volume, if applicable

2. Include, at a minimum, the following detailed information for each item as applicable and as required by individual Specification Sections:
   a. Bill of materials: include manufacturer, complete model number, quantity, and equipment location.
   b. Operational information:
      1) Equipment function, normal operating characteristics, limiting operations.
      2) Operating instructions for startup, routine and normal operation, regulation and control, shutdown, and emergency conditions.
      3) A list of recommended spare parts with a price list, predicted life of parts subject to wear, and a list of spare parts provided under this Contract.
      4) Instrumentation or tag numbers relating the equipment back to the Contract Documents.
   c. Maintenance information:
      1) Assembly, disassembly, installation, alignment, adjustment, and checking instructions.
      2) Lubrication and maintenance instructions including specific type and amount of lubricant and recommended lubrication interval.
      3) Outline, cross-section, and assembly drawings; engineering data; and electrical diagrams, including elementary diagrams, labeled wiring diagrams, connection diagrams, word description of wiring diagrams and interconnection diagrams.
      4) Test data and performance curves.
      5) Parts lists or other documents packed with equipment when delivered.
      6) Instrumentation or tag numbers relating the equipment back to the Contract Documents.
      7) Include a filled-out Maintenance Summary form (included at the end of this Section 01330) as the first page(s) of each manual. Complete maintenance requirements in detail. Reference to the manual will not be accepted. For equipment items involving components or sub-units, a Maintenance Summary for each operating component or sub-unit is required.
   d. Troubleshooting guide.
   e. Delete information that is not pertinent to the Project.
3. Index: alphabetical by keyword

I. Final Submittal: Upon favorable review of Installation, Operation, and Maintenance Manual(s) by Owner, deliver the final approved Installation, Operation, and Maintenance Manual(s). Electronic media format copy shall be searchable and include all tables, charts, drawings, codes and all other matters reflected in hard copies.

1.13 PROJECT RECORD DOCUMENTS

A. Submit Project Record Documents as required by Section 01780 (Project Record Documents).

1.14 STORM WATER POLLUTION PREVENTION PROGRAM (IF APPLICABLE)

A. Submit Storm Water Pollution Prevention Program if required by Section 01500 (Temporary Facilities and Controls).

1.15 DELAY OF SUBMITTALS

A. Delay of Submittals by Contractor is considered avoidable delay. Liquidated damages incurred because of late Submittals will be assessed to Contractor.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

MAJOR PRODUCTS LIST AND TRANSMITTAL FORMS FOLLOW THIS PAGE

MAJOR PRODUCTS LIST

	Specification Section Number	Product	Name of Manufacturer, Trade Name, Model Number	Telephone number
1.	02488	Permanent sheet piling		
2.	02462	Steel pipe pile		
3.	02170	Cofferdam		
4.	05920	Flat Panel Fish Screens and Associated Metal Works		
5.	08800	Viewing windows		
6.	11296	Fish screen cleaner		

SUBMITTAL, TRANSMITTAL NO. _____

Project Name: Mirabel Fish Screen and Fish Ladder Replacement		Date Received:
Owner: Sonoma County Water Agency Attention: Construction Management Section 404 Aviation Boulevard Santa Rosa, CA 95403-9019		Checked By:
Contractor: Address: Attention:		Log Page: Specification Section Number:
		1st Submittal ☐ / Resubmittal ☐

By Date

Contractor's signature above shall constitute Contractor's representation that it has satisfied its obligations under the Contract Documents with respect to Contractor's review and approval of Submittals.

Date Transmitted:	Previous Transmittal Date:

No. Copies	Description	Manufacturer	Dwg. or Data No.	Action Taken*

Remarks:

* The action designated above is in accordance with the following legend:

A – No Exceptions Taken
B – Make Corrections Noted (No Resubmission Required)
C – Revise as Noted and Resubmit
D – Rejected - Resubmit
1. Not enough information for review
2. No reproducibles submitted
3. Copies illegible
4. Not enough copies submitted
5. Wrong sequence number
6. Wrong resubmittal number
7. Wrong Specification section number
8. Wrong form used
9. See comments

Comments:

By Date

INSTALLATION, OPERATION, AND MAINTENANCE MANUAL, TRANSMITTAL NO. _____

Project Name: Mirabel Fish Screen and Fish Ladder Replacement	Date Received:
Owner: Sonoma County Water Agency 404 Aviation Boulevard Santa Rosa, CA 95403-9019	Attention: Construction Management Section
Contractor: Address: Attention:	Log Page: Specification Section Number: 1st Submittal ☐ Resubmittal ☐

By Date

Contractor's signature above shall constitute Contractor's representation that it has satisfied its obligations under the Contract Documents with respect to Contractor's review and approval of Submittals.

Date Transmitted:	Previous Transmittal Date:

No. Copies	Description	Manufacturer	Dwg. or Data No.	Action Taken*

Remarks:

* The action designated above is in accordance with the following legend:

A – No Exceptions Taken

B – Make Corrections Noted (No Resubmission Required)

C – Revise as Noted and Resubmit

D – Rejected - Resubmit– this manual Submittal is deficient in the following area:

1. Equipment record sheets
2. Functional description
3. Assembly, disassembly, installation, alignment, adjustment, and checkout instructions
4. Operating instructions

D – (continued)

5. Lubrication and maintenance instructions
6. Troubleshooting guide
7. Parts list and ordering instructions
8. Organization (indexing and tabbing)
9. Wiring diagrams and schematics specific to installation
10. Outline, cross section, and assembly diagrams
11. Test data and performance curves
12. Tag or equipment identification numbers
13. See comments

Comments:

By Date

MAINTENANCE SUMMARY

1. EQUIPMENT ITEM:_____
2. MANUFACTURER:_____
3. MODEL NUMBER:_____
4. SERIAL NO. (IF APPLICABLE):_____
5. NAMEPLATE DATE (HP, VOLTAGE, SPEED, ETC.):_____
6. MANUFACTURER'S LOCAL REPRESENTATIVE
   NAME:_____
   ADDRESS: _____
   TELEPHONE NUMBER: _____ FAX NUMBER: _____
7. MAINTENANCE REQUIREMENTS:

MAINTENANCE OPERATION

List briefly each maintenance operation required and refer to specific information in manufacturer's standard maintenance manual, if applicable. _____

FREQUENCY

List required frequency of each maintenance operation. _____

LUBRICANT (IF APPLICABLE)

Refer by symbol to lubricant list as required. _____

COMMENTS

8. LUBRICANT LIST: REFERENCE SYMBOL
   (A-) (B-) (C-) (D-)

List symbols used. List equivalent lubricants as distributed and recommended by manufacturer’s representative listed in item 6 above.

9. SPARE PARTS:

Include your recommendations regarding what spare parts, if any, should be kept on the job.

SECTION 01410

REGULATORY REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes: regulatory requirements that may be applicable to Contract Documents.
B. Specific reference in the Specifications to codes and regulations or requirements of regulatory agencies shall mean the latest printed edition of each adopted by the regulatory agency in effect at the time of the opening of Bids, except as may be otherwise specifically stated in the Contract Documents.
C. Should any conditions develop not covered by the Contract Documents wherein the finished Work will not comply with current codes, a Change Order detailing and specifying the required Work shall be submitted to and approved by Owner before proceeding with the Work.

1.2 REFERENCES TO REGULATORY REQUIREMENTS

A. Codes, laws, ordinances, rules and regulations referred to shall have full force and effect as though printed in full in these Specifications. Code, laws, ordinances, rules and regulations are not furnished to Contractor, because Contractor is assumed to be familiar with these requirements. The listing of applicable codes, laws, and regulations for hazardous waste abatement Work in the Contract Documents is supplied to Contractor as a courtesy and shall not limit Contractor's responsibility for complying with all applicable laws, regulations, or ordinances having application to the Work. Where conflict among the requirements or with these Specifications occurs, the most stringent requirements shall be used.
B. Conform to referenced codes, laws, ordinances, rules and regulations.

1.3 CODES

A. Codes that apply to Contract Documents include, but are not limited to, the following:
   1. CBC (Part 2, Title 24, CCR, including, without means of limitation, Sections 16A, 102A.23, 308, 420A, 504-506, 904.2.6, 1019 and 1604)
   2. CEC (Part 3, Title 24, CCR)
   3. CMC (Part 4, Title 24, CCR)
   4. CPC (Part 5, Title 24, CCR),
   5. State Elevator Safety Regulations (Part 7, Title 24, CCR)
   6. UPC
   7. UMC
   8. NEC
   9. Sonoma County Code

1.4 LAWS, ORDINANCES, RULES, AND REGULATIONS

A. During prosecution of Work to be done under Contract Documents, comply with applicable laws, ordinances, rules and regulations, including, but not limited to, the following:
   1. Federal:
      a. Americans With Disabilities Act of 1990
      b. 29 CFR, Section 1910.1001, Asbestos
      c. 40 CFR, Subpart M, National Emission Standards for Asbestos

   d. Executive Order 11246
   e. Federal Endangered Species Act
   f. Clean Water Act
2. State of California:
   a. California Code of Regulations, Titles 5, 8, 19, 21, 22, 24 and 25
   b. California Public Contract Code
   c. California Health and Safety Code
   d. California Government Code
   e. California Labor Code
   f. California Civil Code
   g. California Code of Civil Procedure
   h. CPUC General Order 95, Rules for Overhead Electric Line Construction
   i. CPUC General Order 128, Rules for Construction of Underground Electric Supply and Communications Systems
   j. Cal/OSHA
   k. OSHA: Hazard Communications Standards
   l. California Endangered Species Act
   m. Water Code
   n. Fish and Game Code
3. State of California Agencies:
   a. State and Consumer Services Agency
   b. Office of the State Fire Marshall
   c. Office of Statewide Health Planning and Development
   d. Department of Fish and Game
   e. Bay Area Air Quality Management District
   f. San Francisco Bay Regional Water Quality Control Board
   g. North Coast Regional Water Quality Control Board
      1) Order No. 93-61
      2) Order No. 81-73
      3) Clean Water Act Section 401
4. County of Sonoma:
   a. Ordinance 3836R
   b. Building permit
   c. Electrical permit
   d. Grading permit
   e. Encroachment permit
   f. Valley Oak Protection Ordinance
5. Local Agencies:
   a. Applicable City Ordinances
   b. Northern Sonoma County Air Pollution Control District, including, but not limited to Rule 430
6. Other Requirements:
   a. National Fire Protection Association (NFPA): Pamphlet 101, Life Safety.
   b. References on Drawings or in Specifications to "code" or "building code" not otherwise identified shall mean the codes specified in this Section 01410, together with all additions, amendments, changes, and interpretations adopted by code authorities of the jurisdiction.

B. Have access to all of the foregoing within 24 hours.

C. Other Applicable Laws, Ordinances and Regulations:
   1. Work shall be accomplished in conformance with all applicable laws, ordinances, rules and regulations of federal, state, and local governmental agencies and jurisdictions having authority over the Project.
   2. Work shall be accomplished in conformance with all rules and regulations of public utilities and utility districts.
   3. Where such laws, ordinances rules, and regulations require more care or greater time to accomplish Work, or require better quality, higher standards or greater size of products, Work shall be accomplished in conformance to such requirements with no change to the Contract Time and Contract Sum, except where changes in laws, ordinances, rules, and regulations occur subsequent to the time of opening of the Bids.

D. Change Orders and Claims. The California Public Contract Code (including but not limited to Section 7105 (d)(2)) applies to all contract procedures for changes, time extensions, change orders (time and money), and claims, and per California Government Code Section 930.2, et seq., Contractor's timely compliance with these procedures is a mandatory prerequisite to filing a Government Code Claim. Any change, alteration, modifications, waiver, or omission to implement these procedures, shall have no legal effect unless approved in advance in a fully executed Change Order approved by the Board. Federal construction law (U.S. v. Holspuch 326 U.S. 234) and the jurisprudence of the Federal District of Columbia Circuit shall supplement (but not supersede) California law on construction claims topics including but not limited to, termination claims, home office overhead claims, and delay/disruption claims.

1.5 PRECEDENCE

A. Where Drawings or Specifications require or describe products or execution of better quality, higher standard or greater size than required by applicable codes, ordinances and standards, Drawings and Specifications shall take precedence so long as such increase is legal.

B. Where no requirements are identified on Drawings or in Specifications, comply with all requirements of applicable codes, ordinances and standards of governing authorities having jurisdiction.

C. Conflicts between referenced regulatory requirements: Comply with the one establishing the more stringent requirement.

D. Conflicts between referenced regulatory requirements and Contract Documents: Comply with the one establishing the more stringent requirement.

1.6 REQUIRED PROVISIONS ON CONTRACT CLAIM RESOLUTION

A. The California Public Contract Code specifies required provisions on resolving contract claims less than $375,000, which are set forth below, and constitute a part of this Contract.
   1. For the purposes of this section, "Claim" means a separate demand by Contractor of $375,000 or less for (1) a time extension, (2) payment or money or damages arising from Work done by or on behalf of Contractor arising under the Contract Documents and payment of which is not otherwise expressly provided for or the Claimant is not otherwise entitled to, or (3) an amount the payment of which is disputed by Owner. In order to qualify as a Claim, the written demand must state that it is a Claim submitted under Article 12 of Document 00700 (General Conditions) and be submitted in compliance with all requirements of Document 00700 (General Conditions), Article 12. Separate Claims which total more than $375,000 do not qualify as a "separate demand of $375,000 or less," as referenced above, and are not subject to this section.

2. A voucher, invoice, payment application, or other routine or authorized form of request for payment is not a Claim for purposes of this section. If such request is disputed as to liability or amount, then the disputed portion of the submission may be converted to a Claim under this section by submitting a separate claim in compliance with Contract Documents claim submission requirements.
3. Caution: This section does not apply to tort claims and nothing in this section is intended nor shall be construed to change the time periods for filing tort claims or actions specified by Chapter 1 and Chapter 2 of Part 3 of Division 3.6 of Title 1 of the California Government Code.

B. Procedure:
1. The Claim must be in writing, submitted in compliance with all requirements of Document 00700 (General Conditions), Article 12, including, but not limited to, the time prescribed by and including the documents necessary to substantiate the Claim, pursuant to Document 00700 (General Conditions), paragraph 12.3. Claims must be filed on or before the day of final payment. Nothing in this section is intended to extend the time limit or supersede notice requirements for the filing of claims as set forth in Document 00700 (General Conditions), Article 12 or elsewhere in the Contract Documents.
2. For Claims of fifty thousand dollars ($50,000) or less
   a. Owner shall respond in writing within 45 days of receipt of the Claim, or
   b. Owner may request in writing within 30 days of receipt of the Claim, any additional documentation supporting the Claim or relating to any defenses or claims Owner may have against Claimant.
      1) If additional information is thereafter required, it shall be requested and provided in accordance with this section, upon mutual agreement of Owner and Claimant.
      2) Owner's written response to the Claim, as further documented, shall be submitted to Claimant within 15 days after receipt of further documentation or within a period of time no greater than taken by Claimant in producing the additional information, whichever is greater.
3. For Claims over Fifty Thousand Dollars ($50,000) and less than or equal to $375,000:
   a. Owner shall respond in writing within 60 days of receipt of the Claim, or
   b. Owner may request in writing within 30 days of receipt of the Claim, any additional documentation supporting the Claim or relating to any defenses or claims Owner may have against Claimant.
      1) If additional information is thereafter required, it shall be requested and provided in accordance with this section, upon mutual agreement of Owner and Claimant;
      2) Owner's written response to the Claim, as further documented, shall be submitted to Claimant within 30 days after receipt of further documentation or within a period of time no greater than taken by Claimant in producing the additional information, whichever is greater.
4. Meet and Confer:
   a. If Claimant disputes Owner's written response, or Owner fails to respond within the time prescribed above, Claimant shall notify Owner, in writing, either within 15 days of receipt of Owner's response or within 15 days of Owner's failure to timely respond, and demand an informal conference to meet and confer for settlement of

the issues in dispute. Upon demand Owner will schedule a meet and confer conference within 30 days for settlement of the dispute.

b. Following the meet and confer conference, if the Claim or any portion remains in dispute, Claimant may file a claim as provided in Chapter 1 (commencing with Section 900) and Chapter 2 (commencing with Section 910) of Part 3 of Division 3.6 of Title 1 of the California Government Code. For purposes of those provisions, the running of the period of time within which a claim must be filed shall be tolled from the time Claimant submits its written claim as set forth in paragraph 12.2.B of Document 00700 (General Conditions), until the time that Claim is denied as a result of the meet and confer process, including any period of time utilized by the meet and confer process.

1.7 COMPLIANCE WITH AMERICANS WITH DISABILITIES ACT

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

1.8 SUBSTITUTION OF SECURITIES IN LIEU OF RETENTION

A. In accordance with the provisions of Public Contract Code Section 22300, substitution of securities for any moneys withheld under Contract Documents to ensure performance is permitted under following conditions:

1. At request and expense of Contractor, securities listed in Section 16430 of the Government Code, bank or savings and loan certificates of deposit, interest bearing demand deposit accounts, standby letters of credit, or any other security mutually agreed to by Contractor and Owner which are equivalent to the amount withheld under retention provisions of Contract shall be deposited with Controller or with a state or federally chartered bank in California, as the escrow agent, who shall then pay such moneys to Contractor. Upon satisfactory completion of Contract, securities shall be returned to Contractor.
2. Alternatively, Contractor may request and Owner shall make payment of retentions earned directly to the escrow agent at the expense of Contractor. At the expense of Contractor, Contractor may direct the investment of the payments into securities and receive the interest earned on the investments upon the same terms provided for in this Section 01410 for securities deposited by Contractor. Upon satisfactory completion of Contract Documents, Contractor shall receive from escrow agent all securities, interest, and payments received by the escrow agent from Owner, pursuant to the terms of this Section 01410. Pay to each Subcontractor, not later than 20 Days after receipt of the payment, the respective amount of interest earned, net of costs attributed to retention withheld from each Subcontractor, on the amount of retention withheld to insure the performance of Contractor.
3. Contractor shall be beneficial owner of securities substituted for moneys withheld and shall receive any interest thereon.

4. Enter into escrow agreement with Controller according to Document 00680 (Escrow Agreement for Security Deposits in Lieu of Retention), as authorized under Public Contract Code Section 22300, specifying amount of securities to be deposited, terms and conditions of conversion to cash in case of default of Contractor, and termination of escrow upon completion of Contract Documents.
5. Public Contract Code Section 22300 is hereby incorporated in full by this reference.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01415

REGULATORY REQUIREMENTS - FUNDING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Regulatory requirements applicable to Contract Documents related to Federal funding sources.

B. This Section 01415 supplements Section 01410 (Regulatory Requirements) and the Work-specific listings of applicable regulatory requirements elsewhere in the Specifications.

1.2 LAWS, ORDINANCES, RULES, AND REGULATIONS

A. Contractor shall be responsible for compliance with the federal and state requirements set forth or otherwise referenced in this Section 01415.

1.3 FUNDING SOURCE

A. The Project is funded in whole or part under California Department of Fish and Wildlife (CDFW) Fisheries Restoration Grant Program and National Oceanic and Atmospheric Administration funds. The agreement between Owner and CDFW is included at the end of this Section 01415 as Attachment A. Contractor shall comply with all conditions of the Agreement between Owner and CDFW which apply to any of Owner's contractors.

1.4 DAVIS BACON ACT

A. Davis Bacon Act requirements apply to this Project.

B. Requirements of the Davis Bacon Act are included at the end of this Section 01415 as Attachment B. Owner is the "Recipient" for the purposes of the provisions in Attachment B and Contractor is the "contractor." Contractor agrees to comply with the provisions included in Attachment B and shall include specified provisions in all subcontracts to the same extent as such obligations apply to the "Recipient."

C. A copy of the Federal Wage Decision is included, as required by the Davis Bacon Act, as general information at the end of this Section 01415 as Attachment C. Attachment C was the most current Federal Wage Decision available at the time the Project Manual was assembled (03/07/2014). The federal wage decision is updated periodically by the U.S. Department of Labor and is available online at www.wdol.gov. If there is a discrepancy between the state prevailing wage rate and the federal minimum wage rate, Contractor shall pay not less than the higher wage rate.

1.5 DBE SOLICITATION REQUIREMENTS

A. Contractor shall comply with the DBE solicitation requirements included at the end of this Section 01415, Attachment D.

B. DBE solicitation requirements apply for Project duration and are required regardless of Contractor's DBE status.

C. Contractor shall update Document 00454 (Summary of Subcontractors/Suppliers/Vendors/Service Providers Hired) and provide completed Document 00470 (Certification Regarding Debarment Suspension Ineligibility and

Voluntary Exclusion – Lower Tier Transactions) for each entity hired and submit to Owner within 3 Business Days of entering into any subcontract.

D. Contractor shall complete and submit Document 00459 (Semi-Annual DBE/SBE/DVBE Procurement Report) as directed on the form. Negative reports are required. Upon Final Completion, Contractor shall submit Document 00459 to Owner, covering the period from the last submittal to the date of Final Completion.

1.6 DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

A. Contractor shall be responsible for compliance with 2 CFR part 180.

B. Contractor shall obtain and submit form Document 00470 (Certification Regarding Debarment, Suspension, Ineligibility, and Voluntary Exclusion – Lower Tier Covered Transactions) from each subcontractor/supplier that provides services or materials to the Project. This form shall be delivered to Owner as set forth in Document 00200 (Supplemental Submissions) and for the duration of the project within 3 Business Days of entering into any subcontractor/supplier agreement.

1.7 NEW RESTRICTIONS ON LOBBYING

A. Contractor shall be responsible for compliance with 15 CFR part 28.

B. Contractor shall obtain and submit form Document 00474 (Certification Regarding New Restrictions on Lobbying – Lower Tiers) from each subcontractor/supplier that provides services or materials to the Project, if the total sum to be paid to that subcontractor/supplier is or could surpass $100,000. This form shall be delivered to Owner as set forth in Document 00200 (Supplemental Submissions) and for the duration of the project, within 3 Business Days of entering into any subcontractor/supplier agreement.

1.8 FUNDING COMPLIANCE FORMS

Doc #	Title	Purpose	When to submit
00454	Summary of Subcontractors/Suppliers/ Vendors/Service Providers Hired	Documents DBE outreach efforts	Throughout the Project at any time a new vendor, contractor, or supplier is hired and as requested by Owner.
00457	Affirmative Steps Checklist	Documents DBE outreach efforts	At time of Bid.
00459	Semi-Annual DBE/SBE/DVBE Procurement Report	Report DBE activity to Owner's funding agency	Semi-annually and at Final Completion, as directed on form.
00469	Certification Regarding Debarment, Suspension, Ineligibility, and Voluntary Exclusion – Contractor	Certification that all participants are eligible for federal funded projects	At time of Bid.

Doc #	Title	Purpose	When to submit
00470	Certification Regarding Debarment, Suspension, Ineligibility, and Voluntary Exclusion – Lower Tier Transactions	Certification that all lower tier participants (subcontractors/ suppliers) are eligible for federal funded projects	Within 3 Business Days after Apparent Low Bidder is notified of its status, and within 3 Business Days of entering into a new subcontractor/supplier agreement.
00471	Certification of Compliance with State and Federal Laws and Authorities	Certification that Contractor agrees to comply with all state and federal requirements	At time of Bid.
00473	Certification Regarding New Restrictions on Lobbying – Contractor	Certification that Contractor followed lobbying regulations	At time of Bid.
00474	Certification Regarding New Restrictions on Lobbying – Lower Tiers	Certification that lower tier participants who will be paid more than $100,000 on Project followed lobbying regulations	Within 3 Business Days after Apparent Low Bidder is notified of its status, and within 3 Business Days of entering into a new subcontractor/supplier agreement when total value of that agreement is or could surpass $100,000.

COPIES OF FUNDING AGREEMENT, DAVIS BACON ACT REQUIREMENTS, FEDERAL WAGE DECISION, AND DBE/SBE/DVBE SOLICITATION REQUIREMENTS FOLLOW THIS PAGE

END OF SECTION

ATTACHMENT A

State of California - Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
1416 9th Street
Sacramento, CA 95814
www.wildlife.gov

EDMUND G. BROWN JR., Governor
CHARLTON H. BONHAM, Director

6/13

FISHERIES RESTORATION GRANT PROGRAM
GRANT AGREEMENT NUMBER P1230411

GRANTOR: State of California, acting by and through The Department of Fish and Wildlife, 1416 9th Street, 12th Floor Sacramento, CA 95814 (Grantor)

GRANTEE: Sonoma County Water Agency 404 Aviation Boulevard Santa Rosa, California 95403 Facsimile Number: (707) 544-6123 (Grantee)

SECTION 1- LEGAL BASIS OF AWARD

Pursuant to Public Resource Code 6217.1, Grantor is authorized to enter into a Grant Agreement ("Agreement") and to make an award to the Grantee for the purposes set forth herein. Grantor and Grantee ("the parties") accept the grant on the terms and conditions of this Agreement. Accordingly, the parties hereby agree as follows:

SECTION 2 - GRANT AWARD

2.01 **Grant.** In accordance with the terms and conditions of this Agreement, Grantor shall provide Grantee with a maximum of **$1,183,138.00** to financially support and assist Grantee's implementation of **Mirabel Dam Modifications for Improved Fish Passage**.

2.02 **Term.** The term of this agreement is **June 1, 2013** through **January 30, 2016.** Grantee must obtain an executed grant and a Notice to Proceed letter before commencing work. The Grantee should be aware that time is of the essence and the Grantor expects work will be started during the first available field season, or as soon as practicable. This Grant must commence work within one year of execution date of the grant or the State reserves the right to terminate this agreement.

SECTION 3 - USES OF GRANT

3.01 **Eligible Uses of Grant.** Grantee's use of the Grant moneys is limited to those expenditures necessary to implement the Project and that are eligible under applicable Federal and State of California law. Furthermore, Grantee's expenditure of Grant moneys must be in accordance with the Project budget and narrative (the "Budget") set forth within this agreement. Grantee may not transfer Grant moneys between or among Budget line items without written approval from Grant Manager.

To: Hultberg, Koldis

CF/45-5-20 California Department of Fish and Wildlife (Grant Agree for the Mirabel Dam Modifications for Improved Fish Passage Project) TW No (ID 4708)

This Grant does not constitute approval of the project or of any specific project features for purposes of compliance with any State or Federal environmental law, including but not limited to the California Environmental Quality Act (CEQA). Independent review and recommendation will be provided by the Grantor as appropriate on those projects where local, State, or Federal permits or other environmental compliance is required.

SECTION 4 - GRANTEE'S REPRESENTATIONS AND WARRANTIES

Grantee represents and warrants to Grantor as follows:

4.01 **Existence and Power.** Grantee is a **governmental entity,** validly existing, and in good standing under the laws of California. Grantee has full power and authority to transact the business in which it is engaged and full power, authority, and legal right to execute and deliver this Agreement and incur and perform its obligations hereunder.

4.02 **Binding Obligation.** This Agreement has been duly authorized, executed and delivered on behalf of Grantee and constitutes the legal, valid, and binding obligation of Grantee, enforceable in accordance with its terms.

4.03 **Disputes.** Any disputes concerning the project or the Grant shall be resolved by the Project Managers of the Grantor and Grantee. In the event the dispute cannot be resolved by the Project Managers, the dispute shall be referred to the Director of the California Department of Fish and Wildlife, whose decision will be final.

SECTION 5 - GRANTEE'S AGREEMENTS

5.01 **Purpose.** This Agreement is entered into by the parties for the purpose of providing financial support to Grantee to complete the activities identified within Section 6 - Project Statement: Objectives and Timelines.

5.02 **Project Statement:** Grantee shall complete activities as set forth in Section 6 - Project Statement: Objectives and Timelines. Changes to Section 6 shall be submitted to the CDFW Project Manager for prior approval and may be made only as provided in Exhibit 1.a of this Agreement, which is attached hereto.

5.03 **Use of Project Funds.** Grantee shall use the funds provided by this Agreement for the provision of activities described in Section 6 - Project Statement: Objectives and Timelines, and shall expend these funds in accordance with the budget or statement of work shown in Section 8 - Budget. Any changes in the program's budget shall be submitted to the Grantor for approval prior to any change taking place.

5.04 **Payment Schedule.** Payments shall be made to Grantee according to the payment and report schedule identified in Section 8 - Budget.

5.05 **Eligibility of Funds.** In the event that the California Budget Act does not provide sufficient appropriations to allow Grantor to fund the Program at the level initially agreed, the Grantor reserves the right to modify this agreement to reflect a reduction in available funds, as an alternative to termination.

5.06 **Submission of Reports.** Grantee shall submit progress reports in accordance with the payment and report schedule in Section 7 - Reports. Reports shall be submitted in the format prescribed by the Grantor, as identified in Section 7 - Reports, and shall address the activities outlined in Section 6 - Project Statement: Objectives and Timelines. Failure to submit timely and accurate reports shall be considered evidence of non-compliance with this Agreement and shall permit termination of the Agreement by the Grantor.

5.07 **General Terms and Conditions.** **Public Entities General Grant Provisions, Exhibit 1.a,** is hereby incorporated into this agreement and attached hereto.

5.08 **Federal Terms and Conditions.** Exhibit 2, Federal Terms and Conditions, is hereby incorporated into this agreement and attached hereto.

5.09 **Amendments.** Any request for an amendment by the Grantee must be submitted to the Grantor no later then 120 days prior to the close of the grant. Request must include explanation and justification for the amendment.

SECTION 6 - PROJECT STATEMENT: OBJECTIVES AND TIMELINES

6.01 **Introduction:**
This project will improve fish passage over the Mirabel Inflatable Dam for coho salmon in the Russian River in Sonoma County by replacing the right bank Denil fishway with a vertical slot fishway. The Mirabel Dam Modifications for Improved Fish Passage project will be implemented by the Grantee.

6.02 **Objective(s):**
The goal of the proposed project is to modify an existing water diversion structure (Mirabel Inflatable Dam) to improve fish passage. The project will improve attractive flows to a new fish passage structure, eliminating delays in fish passage due to sub-optimal flow conditions, unattractive flow conditions over the Dam and eliminate the need to alter Dam inflation to accommodate fish passage.

The proposed project addresses the above goal by installing a new vertical slot fishway and fish screen that will provide an attractive flow of 65 cubic feet per second (cfs), which is much greater than the current 25 cfs through the right bank Denil fishway. Additional attractive flows within the pump intake structure will also provide additional water supply, increasing attractive flows to approximately 135 cfs both up and downstream of the fishway. The greater flow is generally understood to be more attractive to fish.

This project will improve access for coho salmon to an estimated 2045 miles of anadromous habitat in the Russian River basin.

6.03 Project Description:

6.03.1 Location:

The project is located on the Russian River approximately 2000 feet downstream of the Wholer Bridge. The project is located in Section 32 of Township 9 north, Range 8 west, Mount Diablo Base and Meridian, of the Guerneville 7.5 minute United States Geologic Service quadrangle, at 38.50009100° north, 122.88614900° west North American Datum 1983, as depicted in Exhibit B, Project Location Map, which is attached and made part of this Grant by this reference.

6.03.2 Project Set Up:

Personnel:

The Principal Engineer will participate in the bidding and award, construction contract administration and inspection, environmental compliance and monitoring, dewatering, substantial completion, and final completion.

The Water Agency Engineer will participate in the bidding and award, construction contract administration and inspection, environmental compliance and monitoring, dewatering, substantial completion, and final completion.

The Principal Environmental Specialist will participate in construction contract administration and inspection, environmental compliance and monitoring, dewatering, and final completion.

The Senior Environmental Specialist will participate in construction contract administration and inspection, environmental compliance and monitoring, dewatering and final completion.

The Natural Resource Program Assistants (5) will participate in construction contract administration and inspection, environmental compliance and monitoring, dewatering, and final completion.

The Land Surveyor will participate in construction contract administration and inspection, environmental compliance and monitoring, substantial completion, and final completion.

The Survey Engineering Technician III (2) will participate in construction contract administration and inspection, environmental compliance and monitoring, substantial completion, and final completion.

The Assistant Project Specialist will participate in construction contract administration and inspection, environmental compliance and monitoring, substantial completion, and final completion.

The Engineering Technician (Onsite Inspector) will participate in construction contract administration and inspection, environmental compliance and monitoring, substantial completion, and final completion.

The Computer Aided Drafting (CAD) Geographic Information Systems (GIS) Manager will participate in the bidding and award, construction contract administration and inspection, environmental compliance and monitoring, dewatering, substantial completion, and final completion.

The Drafting Engineering Technician III will participate in the bidding and award, construction contract administration and inspection, environmental compliance and monitoring, dewatering, substantial completion, and final completion.

The Technical Writing Specialists will participate in the bidding and award, construction contract administration and inspection, environmental compliance and monitoring, dewatering, substantial completion, and final completion.

The Subcontractors will participate in dewatering, demolition, construction, Substantial completion, and final completion.

6.03.3 Tasks:

CONSTRUCTION PROJECT ELEMENTS

Task 1. Bidding and Award: This element consists of project advertisement, a pre-bid conference; written responses to bidders' questions; addenda issuance; receipt and opening of sealed bids; contractor selection; and contract award for project construction.

Task 2. Construction Contract Administration and Inspection: Grantee Construction Administration staff will inspect the project and prepare daily reports and project communication. A Grantee construction manager and an inspector will be assigned to verify that all work is completed in accordance with the plans and specifications; meet periodically with the contractor assure that accurate drawings and other records are maintained; insure that project permits are in place; and review and approve submittals.

Task 3. Environmental Compliance and Monitoring: Environmental permits will stipulate the types and frequency of environmental monitoring to occur prior to and during construction.

Task 4. Dewatering: Prior to any work commencing, the project site must be prepared for work. The preparation of the work site along with the delivery of equipment, tools and materials is referred to as mobilization. Once mobilization has been completed the construction of the project may begin. The first task to facilitate the construction of the project is to dewater the project site. The site must be dewatered prior to constructing any of the concrete foundations or walls. The Project includes 180 days of dewatering at the cofferdam area during construction. Water pumped from site dewatering will be directed to the Grantee infiltration ponds. Any displaced fish will be rescued and relocated by qualified biologists with all necessary State and Federal permits. Rescued fish shall be moved to the nearest appropriate site outside of the work area. The biologists shall maintain a record of all fish rescued and moved, including the date of capture and relocation, the method of capture, the location of the relocation site in relation to the project site, and the number and species of fish captured and relocated. The record shall be provided to California Department of Fish and Wildlife (Department) within two (2) weeks of the close of the work season or project completion, whichever comes first.

Task 5. Demolition: The existing fishway will be abandoned in place by filling with low-strength concrete, and conflicting utilities will be removed. The existing fish screen will be removed. A fish screen is an engineered structure designed to prevent fish from swimming into, being drawn into, or become impinged upon the point of diversion.

Task 6. Construction: Construction of the new fishway includes site grading, asphalt concrete access roads, structural foundations, retaining walls, fishway, fish screen, water pipes, electrical conduit, pumps, monitoring equipment and all other utilities and structural components contained in the construction drawings.

Task 7. Substantial Completion: The project will be substantially complete when the new fishway is functional and the inflatable dam can be returned to service and used for bypass pumping through the fish screen; all monitoring equipment has been installed and is in working order; all soils have been stabilized to prevent erosion; plants including trees, shrubs and grasses disturbed during construction have been replaced with new plantings or seeds, known as revegetation, has been completed; all Grantee operations, personnel, new facility operations and maintenance training has been completed; and new fishway operations and maintenance manuals have been submitted.

Task 8. Final Completion: The project will be finally complete when all submittals have been completed, operations and maintenance manuals have been approved, final punch list is complete, the final project

accounting is complete, and all required release forms have been executed.

6.03.4 Deliverables;

1. Record of Fish Relocation Activities: The Grantee shall maintain a record of all fish rescued and moved. The record shall include the date of capture and relocation, the method of capture, the location of the relocation site in relation to the project site, and the number and species of fish captured and relocated. The record shall be provided to Grantor within two (2) weeks of the close of the work season or project completion, whichever comes first.

2. Conformed Project Construction Manual: The Conformed Project Manual will incorporate any technical or administrative changes to the documents by addenda during the bidding process. It will also incorporate completed and executed agreement and contract documents, federal and state forms, and other documents submitted by the contractor after the project is awarded.

3. Notice of Completion and As-Built Drawing Plan Set: The Grantee will provide sets of this final construction documentation to Grantor with the Final Report, described below.

4. Final Report to Grantor: The Grantee will prepare a draft report upon completion of the construction project and will submit a Final report by January 2, 2016.

All data collected and created for this grant is a required deliverable of this grant and will become the property of the Department of Fish and Wildlife, and not of the Grantee. A condition of final payment on this grant shall include the delivery of all related data. Spatial data should be delivered in Geographic Information System (GIS) shape files or if necessary geodatabase files where applicable and documented with metadata in accordance with minimum Biogeographic Information and Observation System (BIOS) metadata standards (http://bios.dfg.ca.gov/metadata.asp) and Federal Geographic Data Committee (FGDC) metadata standards (http://www.fgdc.gov/metadata/documents/workbook_0501_bmk.pdf).

6.03.5 Timelines:

1. Project Bid and Award: Between 3/5/2013 – 5/14/2013
2. Environmental Compliance Monitoring: Between 4/15/2013 – 10/1/2015
3. Notice to Proceed: Between 5/17/2013 – 5/31/2013
4. Mobilization: Between 6/3/2013 – 6/21/2013
5. Site Work: 6/5/2013 – 10/2/2015
6. Fish Screen Structure: Between 6/3/2013 – 9/5/2014
7. Dewatering: Between 6/3/2013 – 10/15/2013, and 6/2/2014 -- 10/15/2014

8. Fishway and Gallery Structure: Between 6/3/2013 – 8/7/2015
9. Site Restoration: Between 10/15/2013 – 10/2/2015
10. Revegetation Work: 10/15/2013 – 9/30/2015
11. Draft Report and other end-of-project documentation to Grantor by 12/15/2015

6.03.6 Compliance: Grantee shall provide verification of CEQA and permit compliance to the CDFW Grant Manager before project work begins. Written permission must be obtained from landowner(s) for access to perform grant work. As may be necessary, the Grantee shall be responsible for obtaining the services of appropriately licensed professionals to comply with the applicable requirements of the Business and Professions Code including but not limited to section 6700 et seq. (Professional Engineers Act) and/or section 7800 et seq. (Geologists and Geophysicists Act).

The Grantee shall acknowledge the participation of the California Department of Fish and Wildlife, Fisheries Restoration Grant Program and National Oceanic and Atmospheric Administration (NOAA) Fisheries funds on any signs, flyers, or other types of written communication or notice to advertise or explain the **Mirabel Dam Modifications for Improved Fish Passage** project.

If the Grantee fails to perform in accordance with the provisions of this Agreement, the Grantor retains the right, at its sole discretion, to delay, interrupt, or suspend the work for which the grant monies are supplied.

6.04 Contacts:

The point of contact may be changed at any time by either party by providing a ten (10) day advance written notice to the other party.

The Project Managers during the term of this Agreement are:

CDFW Grant Manager:	Sonoma County Water Agency:
Name: Derek Acomb Title: Environmental Scientist Address: 4070 University Road, Hopland, California 95449 Phone: (707) 744-8713 FAX: (707) 744-8712 Email: derek.acomb@wildlife.ca.gov	Name: Steve Koldis Title: Water Agency Engineer III Address: 404 Aviation Boulevard, Santa Rosa, California 95403 Phone: (707) 547-1914 FAX: (707) 544-6123 Email: steve.koldis@scwa.ca.gov

Direct all administrative inquiries to:

CDFW Grant Coordinator:	Sonoma County Water Agency:
Name: Julie Paine Title: Associate Governmental Program Analyst Address: 7329 Silverado trail, Napa, California 94558 Phone: (707) 944-5512 FAX: (707) 944-5563 Email: jpaine@dfg.ca.gov	Name: Lynne Rosselli Title: Administrative Services Officer II Address: 404 Aviation Boulevard, Santa Rosa, California 95403 Phone: (707) 524-3771 FAX: (707) 544-6123 Email: lynne.rosselli@scwa.ca.gov

A Grantee's name and address may be provided to the public if requested. Other personal information submitted on this grant may be released to governmental entities involved with the funding of the project, for law enforcement purposes, pursuant to court order, or for official natural resources management purposes.

SECTION 7 - REPORTS

7.01 Progress Reports

The Grantor must receive by November 1, **annual** progress reports. These reports should be delivered to the CDFW Grant Manager identified in Section 6.04 – Contacts, in the manner and format identified in Requirements, below.

Requirements: The Annual Report shall contain all metrics listed in the Report Template as described in Attachment 1. The Annual Report shall contain the results of all work performed to date, reported by calendar year, and address any comments submitted to the Grantee by the CDFW Grant Manager. The report shall describe the types of activities and specific accomplishments during the period since the previous report, rather than merely listing the number of hours worked during the reporting period.

The progress report shall be delivered in the following quantities and formats: one (1) printed paper copy and one (1) electronic, International Standards Organization (ISO) ISO 19005-2:2011 Portable Document Format (PDF) and ISO 29500-1:2012 Office Open Extensible Markup Language (.docx), copy on compact disc.

7.02 Final Report

A Draft Final Progress Report which summarizes the life of the grant and describes the work and results pursuant to Section 6 - Project Statement: Objectives and Timelines, including all metrics listed in the Report Template as described in Attachment 1 is due no later than **December 15, 2015**. Within 30 days of receipt of the Draft Final Progress Report, the CDFW Grant Manager shall submit her/his final comments to the Grantee.

Upon completion of the project, but not later than **January 2, 2016**, the Grantee shall submit to the CDFW Grant Manager three (3) printed paper copies of the Final Progress Report and three (3) electronic, International Standards Organization (ISO) ISO 19005-2:2011 Portable Document Format (PDF) or ISO 29500-1:2012 Office Open Extensible Markup Language (.docx), copies on compact discs.

The Final Progress Report shall contain all metrics listed in the Report Template as described in Attachment 1. The Final Progress Report shall address all CDFW Grant Manager comments submitted to the Grantee during the review of the Draft Final Report. The Final Progress Report shall contain the results of the work performed, reported by calendar year and project total, and address any comments submitted to the Grantee by the CDFW Contract Manager. The Final Progress Report shall describe the types of activities and specific accomplishments rather than merely listing the number of hours worked during the project.

SONOMA COUNTY WATER AGENCY
GRANT AGREEMENT NUMBER P1230411

SECTION 8 - BUDGET

8.01. Expenditure Summary

The Grantor will provide an amount not to exceed **$1,183,138.00** as shown below in this Budget. The Grantee or their partners will provide up to **$3,942,872.00** in funds or in-kind services as cost share to complete tasks described in SECTION 6 - Project Statement: Objectives and Timelines. Accurate records of in-kind funds or services will be provided to the Grantor with the final invoice.

	Totals
Personnel Services	
Principal Engineer	$11,180.00
Water Agency Engineer	$3,834.00
Senior Environmental Scientist	$1,260.00
Natural Resources Program Assistants	$315.00
Land Surveyor	$460.00
Survey Engineering Technician III	$1,020.00
Assistant Project Specialist	$442.00
Engineering Technician	$16,280.00
CAD/GIS Manager	$300.00
Drafting Engineering Technician III	$600.00
Technical Writing Specialists	$5,476.00
Staff Benefits	$12,762.00
Total Personnel Services	**$53,929.00**
Subcontractor Expenses Site clearing at $0.58 per square foot, demolition at $52785, dewatering at $483 per day, cofferdam at $196 per foot, earthwork at $22 per cubic yard, sheet piling at $66 per square foot, structural backfill at $13 per cubic yard, concrete foundations at $765 per cubic yard, concrete walls including science window at $84 per cubic yard, water diffuser at $9 per pound, trash rack at $9 per pound, floor grating at $95 per square foot, aluminum railings at 127 per foot, water control gates at $15801 each, communications, control systems and electrical at $79005, mobilization and demobilization at $192762	$1,121,120.00
Total Subcontractor Expenses	**$1,121,120.00**
Administration and Overhead @ 15%	**$8,089.00**
Total	**$1,183,138.00**

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SONOMA COUNTY WATER AGENCY
GRANT AGREEMENT NUMBER P1230411

This grant has both state and federal funds, therefore the grantee must spend $1,107,924 of this grant by March 31, 2015 or the grant will be canceled.

Table of Funding Sources and Cost Share

SOURCE OF FUNDS	CASH	IN-KIND (If Applicable)	TOTAL
Fisheries Restoration Grant Program	$1,183,138.00	$	$1,183,138.00
Other State Agency(ies)	$	$	$
Federal	$	$	$
Applicant	$3,942,872.00	$	$3,942,872.00
Other(s) including partners	$	$	$
Total Project Cost	$5,126,010.00	$	$5,126,010.00

Note: Any changes or modifications to a fund source indicated above must be promptly reported to the Grant Manager. Projects with undisclosed fund sources may be subject to an audit.

8.02 Payment Provisions

8.02.1 Disbursements: Grant disbursements will be made to the Grantee not more frequently than monthly in arrears, upon receipt of an original itemized invoice and any required progress report or other mandatory documentation as identified within this agreement. The invoice package must be sent to the Grant Manager at:

California Department of Fish and Wildlife,
Derek Acomb
4070 University Road
Hopland, California 95449

The invoice shall contain the following information:

- The word "Invoice" should appear in a prominent location at the top of the page(s);
- Printed name of the Grantee;
- Business address of the Grantee including Post Office Box, City, State, and Zip Code;
- Name of the Region/Division of the California Department of Fish and Wildlife being billed;
- The date of the invoice and the time period covered; i.e., the term "from" and "to";
- The number of the Grant upon which the claim is based;
- The invoice must be itemized using the categories and following the format of the budget;
- The total amount due. This should be in a prominent location in the lower right-hand portion of the last page and clearly distinguished from other figures or computations appearing on the invoice. The total amount due shall include all costs incurred by the Grantee under the terms of this grant;
- The original signature of the Grantee (not required of established firms or entities using preprinted letterhead invoices); and
- The Grantee must provide supporting documentation for the invoice and actual receipts with the invoice.

8.02.2 **Invoice Documentation:** Each invoice for payment must be accompanied by supporting documentation, such as subcontractor invoices, expense receipts, and travel verification. If there are cost shares involved with the project, the final invoice must include a summary of all cost share expenditures by fund source.

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IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be duly executed as of the dates set forth below their respective signatures.

CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

By:
Signature: _____
Printed Name: Helen Carriker
Title: Deputy Director, Administration
Date: 6/13/13

AUTHORIZED AGENT FOR GRANTEE

By:
Signature: _____
Printed Name: Grant Davis
Title: General Manager
Date: 6-6-13

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SONOMA COUNTY WATER AGENCY
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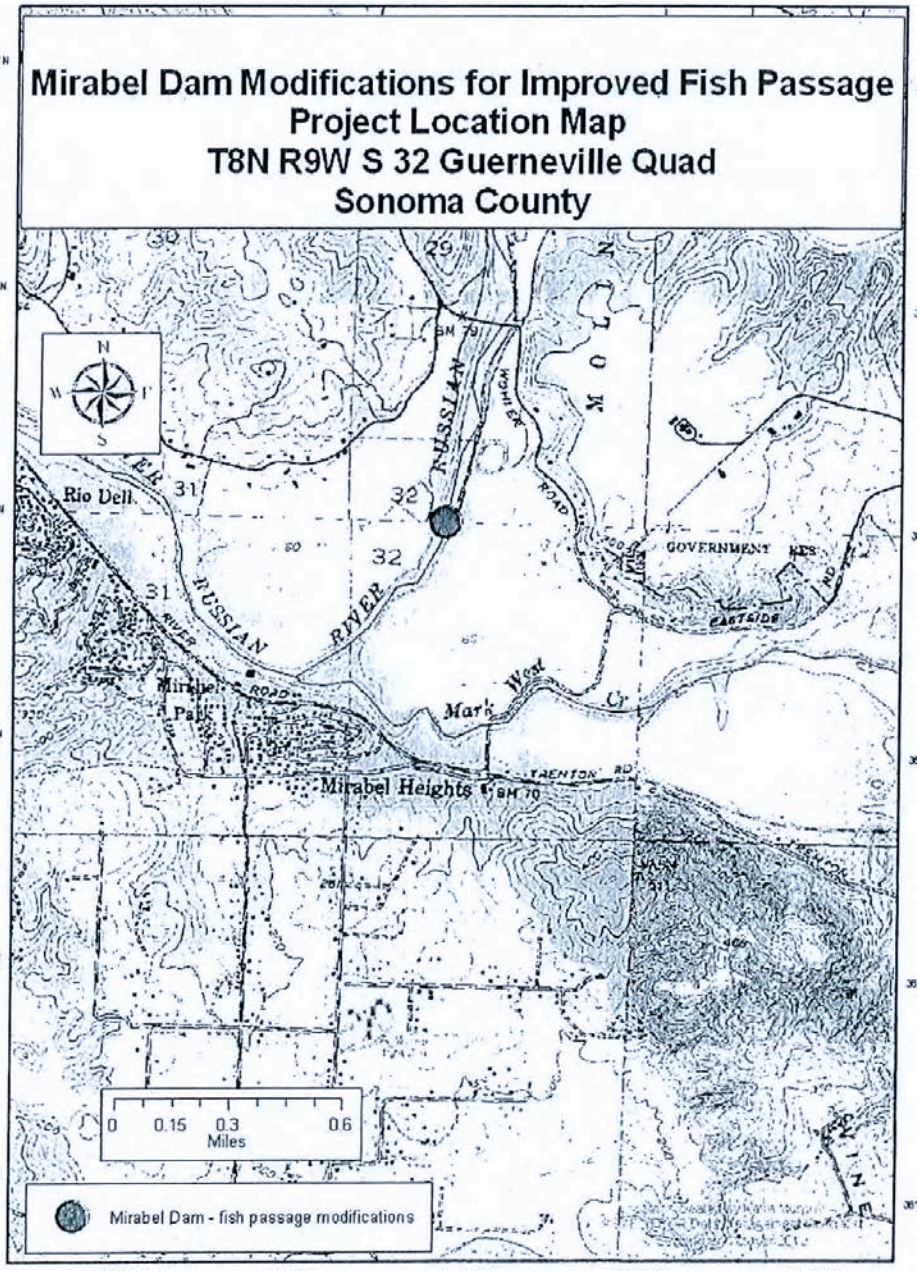
ATTACHMENT 1 – PROJECT LOCATION MAP



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ATTACHMENT 2 – FINAL REPORT TEMPLATE

Project Title: Mirabel Dam Modifications for Improved Fish Passage

FRGP Grant Number: P1230411

Grantee Name and Contact Information:

Sonoma County Water Agency
Steve Koldis
Professional Engineer
404 Aviation Boulevard
Santa Rosa, California 95403
(707) 547-1914 voice
(707) 544-6123 fax
steve.koldis@scwa.ca.gov

Date: [enter the date the report was prepared / finalized]
Author Information: [enter author information here]

Overview of Project:
[Write a summary overview of the project.]

Final Budget:
[In this section include a complete final Budget including: Total of each fund source, by line item, expended to complete the project, breaking down Grant dollars, by line item, and any other funding, including type of match (cash or in-kind service). This should be in the same format as is outlined in the PSN.]

As Built Description:
[Please provide a detailed, description.]

Photos:
[Photos for these project types are not mandatory, but if provided need to adhere to the guidelines below.

The report must include all the information in the following table for each photograph uploaded. When selecting photographic subjects, consideration should be given to the usefulness of the picture for proposal review and subsequent implementation and effectiveness monitoring purposes. Photographs should contain a scale element such as a vehicle or person, and if possible include fixed landscape features, which help orient the location of the subject in the project site]

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FileName	Date	Subject/Site Name	Description	Standing	Facing
photo_1.jpg	5/1/2010	stream crossing	east approach	mid road 100 feet east of stream crossing	west
photo_2.jpg	5/1/2010	culvert inlet	projecting barrel	road shoulder on north side	nw
photo_3.jpg	4/25/2009	culvert outlet	4 foot drop into channel	mid-channel 50 feet downstream of culvert outlet	upstream

Project Location Topographic Map:
Include or attach a project location map. The location map submitted with the report to indicate the project location should only have the current project location and must follow the specifications listed below. Please do not include past or alternate funded projects on the location map for your proposal. You may submit a separate map with this information.

SITE: A project site is defined as a point, length (reach), or area which spatially describes a work area where specific restoration activities take place. Many projects employ multiple treatment types within a given work site. An example of dividing a project into sites: A project that included instream restoration and riparian treatments in a contiguous area would require two sites; a line for the instream activities and a polygon for the riparian plantings. The reach of stream may have instream habitat structures, stream bank stabilization structures, and a log jam barrier removal and be considered as one line site, provided the distance between any two individual features is less than 0.5 miles apart. Similarly, the area of riparian habitat where Himalayan blackberry was removed and conifer trees were planted would be one polygon site.

FEATURE: A feature is a distinct physical implementation at a location within a project work site intended to interact with the environment to improve anadromous salmonid habitat. Features consist of one or more restoration treatments. Within one project site there can be numerous features. For implementation monitoring, features are divided by treatment type and location. However, functional groups of structures or treatments can be grouped as one feature. For example, a group of tightly spaced willow baffles should be considered one feature. It is impractical to separate each baffle because they interact and work together as a group for the same objective at the same location. A string of closely spaced grade control weirs is another example of this situation. However, willow baffles and rip-rap bank stabilization at the same location would need to be separated into different features because they have different objectives.

POINT SITES describe work that occurs at one or more discrete locations that are more than ½ mile from each other.

LINE (LENGTH) SITES are a continuous line along which associated treatments are implemented. Lines must either follow the path of a stream or a road where work is taking place.

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AREA SITES are described by the outline of an area on the landscape. These areas may be relatively small, such as the planting area for a riparian project, or relatively large, such as a watershed in which a planning project is taking place.

The project should be shown on an appropriately scaled, USGS (or equivalent) 7.5 minute contoured topographic quadrangle map that shows each location where work is being done. Aerial photos do not satisfy this requirement. All maps must be labeled with project title, grantee name, USGS quad name and stream name, and be positioned so that relevant map information such as stream names, towns, main roads, water bodies, etc. are not obscured.

All proposals for habitat restoration (which includes upslope restoration) must also include a detailed plan-view diagram with scale depicting all pertinent features of the project site. The diagram will show the stream channel or other area of work, structure locations, revegetation areas, and distance to each project structure from a reference point, and other significant project and existing features. Applicants may use "typical" drawings if multiple similar physical improvements are proposed.

After implementation, project work sites may require modification for a variety of reasons. Site modification must be approved in writing by the assigned DFW grant manager. The project proponent will be required to provide final site descriptions and latitude/longitude coordinates to be incorporated into an agreement before it may be executed.

Plans:
[Attach copies of as-built plans for all work completed]

Data:
[Reference and then attach (for large or cumbersome attachments digital files only are okay, be sure to note this in the written report) all data gathered as part of this grant. This includes but is not limited to: data sheets for surveys, databases, tables, documents, programs, program code, GIS layers, maps.]

Species Surveys:
[Attach reports for all species surveys conducted for the grant. Organize these reports by year.]

Fish Relocation Data / Report:
Attach a fish relocation report and include data for each year of the grant. Please use the data sheet provided to record the relocation effort(s), Channel Dewatering / Species Relocation Datasheet. Please organize these reports by year.]

Dewatering Data / Report:
Attach a dewatering report and include data for each year of the grant. Please use the data sheet provided to record the dewatering effort(s), Channel Dewatering / Species Relocation Datasheet. Please organize these reports by year.]

Performance Measures:
[In this section please answer the required performance measures, based on each site. If metric is not applicable to work done at a given site, mark the metric "N/A." Insert columns for each calendar year and have a total column for all years at the far right.]

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Instream Barrier Modification for Fish Passage (HB)

1. Eligible instream barrier projects are limited to work in the stream channel (bankfull) and along the stream bank. Instream barriers include grade control structures (weirs), flash board dams, dams, debris basins, water diversion structures, and log debris accumulations. It is recommended that proposals under this category include the baseline data discussed in Parts II and III, of the California Salmonid Stream Habitat Restoration Manual, 3rd edition (California Department of Fish and Wildlife).

   This project type does not include pre-project planning. Planning should already be complete for this project type. Proposals for pre-project planning and development should be submitted under Project Design (PD).

2. If the proposal is funded the following information will be required with the Final Report of the grant agreement. This information is provided so that the applicant is able to budget for these deliverables in the proposal as necessary. The required information is as follows;

   a. Post longitudinal profile for projects where channel grade is to be restored or otherwise modified by the project.

   3. Each proposal must describe in detail the following additional specific information in the project description;

   a. Miles of stream treated (include only the actual length of stream treated by the project, not the length of stream affected by the project);
   b. Number of barriers treated for fish passage;
   c. Type(s) of barriers treated, select from: diversion dam; push-up dam; wood or concrete dam; grade control structures (weirs); logs; or debris;
   d. Each project element (pertinent natural features and specific work areas) shall be assigned a unique station number that reflects its measured distance from the project start location. For example, a logjam proposed for modification 250 feet downstream from a bridge designated as the project starting point would have a "station number" of 2+50. A scaled map with all pertinent features and work site station shall be included as part of the proposal.
   e. Miles of stream made more accessible by removing barriers (accessible to next barrier or to upstream end of anadromy);
   f. Number of fishway chutes/pools installed;
   g. Number of fish ladders installed/improved;
   h. If the project is identified in an assessment or recovery plan, provide the name of the plan/assessment, in the format: Author, date, title, name, source, source address;
   i. Indicate type of required listed species surveys which will be done and type of protocols to be used; and
   j. Indicate if fish relocation is needed. Refer to "Stream Dewatering and Fish Exclusion / Relocation" definition in Part V.

4. Applicants for this project type must include the following supplemental information;

   a. Intermediate Plan. If a design element within the intermediate plan is thought to be unnecessary, provide the rationale for not including it.

b. Conceptual plan: If an intermediate plan is determined to be unnecessary provide a conceptual plan. Projects where channel grade is to be restored or otherwise modified by the proposed project must also include a longitudinal profile and scaled plan and elevation view diagrams showing the proposed work.

c. Project Location Topographic Map: The project must be shown on an appropriately scaled, USGS (or equivalent) 7.5 minute contoured topographic quadrangle map that shows each location where work is being done. Lines for in stream work must be labeled with a label plus an arrow marked "U" pointing at the upstream end of the site and an arrow marked "D" pointing at the downstream end. The stream where work is being done needs to be labeled on every map submitted. USGS Quad names for all areas shown on the map need to be clearly labeled on every map submitted. Locations on each side of the bank need to be differentiated. If there are multiple sites along a stream length, make sure that the individual sites are numbered or labeled. If this makes the map too busy to easily read, then multiple maps will be necessary. Project should be represented as point(s) or line(s) along streams, according to the following guidelines:

i. Features that are more than ½ mile apart will be shown as separate points on the map.

ii. Features less than ½ mile apart should be combined into one line on the stream where work is being performed.

iii. If the features are closer than ½ mile apart BUT are on different drainages, the project should be represented as multiple sites, by stream/drainage.

d. Provisional Landowner Access Agreement/Provisional Resolution.

e. Water Right Verification: If a water right is involved with the project, written verification of the right to divert, use, store, sell, or transfer the water is required for a project that addresses issues related to the diversion, use, storage, or purchase of water.

f. Photographs of proposed project site.

1. The report shall include, but not necessarily be limited to the following information:

ALL

- Grant number;
- Project name;
- Geographic area (e.g., watershed name);
- Location of work – show project location using U.S.G.S. 7.5 minute topographical map or appropriately scaled topographical map;
- Geospatial reference/location (lat/long is preferred – defined as point, line, or polygon);
- Project start and end dates;
- A complete final Budget including: Total of each fund source, by line item, expended to complete the project, breaking down Grant dollars, by line item, and any other funding, including type of match (cash or in-kind service);
- Total number of volunteer hours; dollar value of volunteer work; description of how the dollar value of the volunteer labor was determined; dollar value of non-volunteer donated labor (employees whose labor is not paid for by FRGP funding); and description and dollar value of non-labor in-kind contributions to the project.
- Expected benefits to anadromous salmonids from the project;
- Labeled before and after photographs of any restoration activities and techniques;

- Specific project access using public and private roads and trails, with landowner name and address;
- Complete as built project description; and
- Report measurable metrics for the project for each site individually by responding to the restoration project metrics listed below. <Delete any reporting metric areas not applicable to this grant.>

Habitat Protection and Restoration Projects – Reporting Metrics as identified below. <Delete from the grant agreement those that do not apply>

Fish Ladders (FL)

- Miles of stream treated (include only the actual length of stream treated by the project, not the length of stream affected by the project);
- Miles of stream made more accessible by treating stream crossings (accessible to next barrier or to upstream end of anadromy);
- Number of fishway chutes/pools installed;
- Number of fish ladders installed/improved;
- If monitoring was included in the project:
  - Type of monitoring, select from: implementation monitoring; compliance monitoring-engineering design; compliance monitoring-project design; pre-treatment monitoring; post treatment monitoring; salmonid monitoring; non-salmonid biological monitoring; water flow monitoring; or physical monitoring; and
  - Location of monitoring, select from: onsite; upstream; downstream; or upslope.

Instream Barrier Modification for Fish Passage (HB)

- Miles of stream treated (include only the actual length of stream treated by the project, not the length of stream affected by the project);
- Number of barriers treated for fish passage;
- Type(s) of barriers treated, select from: diversion dam; push-up dam; wood or concrete dam; grade control structures (weirs); logs; or debris;
- Miles of stream made more accessible by removing barriers (accessible to next barrier or to upstream end of anadromy);
- Number of fishway chutes/pools installed;
- Number of fish ladders installed/improved;
- If monitoring was included in the project:
  - Type of monitoring, select from: implementation monitoring; compliance monitoring-engineering design; compliance monitoring-project design; pre-treatment monitoring; post treatment monitoring; salmonid monitoring; non-salmonid biological monitoring; water flow monitoring; or physical monitoring; and
  - Location of monitoring, select from: onsite; upstream; downstream; or upslope.

SONOMA COUNTY WATER AGENCY
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CHANNEL DEWATERING / SPECIES RELOCATION DATASHEET

Project Information

Grant #:	Project Type (2 letter code):	DFG Region:
Project Name:		
Stream Name:		
Stream Length affected (ft):	Stream Width affected (ft):	
Biologist:	Affiliation:	Phone:
DFG Oversight:		

Was an endangered species survey completed for this project? Circle one: yes no
Is dewatering needed? Circle one: yes no
Explain:
Is species relocation needed? Circle one: yes no
Explain:
List endangered species found:
List endangered species for which habitat was found:

Channel Dewatering

Reference Point Description:	
Start Date:	Reference Point Latitude:
End Date:	Reference Point Longitude:
Flow (gal/min) Seepage Pump:	Direction from Ref. Pt.
	Start distance from Ref Pt:
	Starting Point Latitude:
	Starting Point Longitude:
Method used to block stream:	End distance from Ref Pt:
Upstream:	Ending Point Latitude:
Downstream:	Ending Point Longitude:
Comments:	

Species Relocation

Date:	Start Water (deg F):	Release location:
Start time:	End Water (deg F):	
End Time:	Start Air (deg F):	Release Latitude:
	End Air (deg F):	Release Longitude:
	Capture Method:	
Comments:		

If Electrofishing:	Frequency:	Voltage:	Conductivity (µs):	Total Seconds:

Fish and Other Species Capture Information

Species	Year Class	Total Captured	# Injured	# Killed	# Relocated

Version: 20071020

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1. **APPROVAL:** This Agreement is of no force or effect until signed by both parties and approved by the California Department of Fish and Wildlife (CDFW). Grantee may not commence performance until such approval has been obtained.

2. **AMENDMENT:** No amendment or variation of the terms of this Agreement shall be valid unless made in writing, signed by the parties and approved as required. No oral understanding or Agreement not incorporated in the Agreement is binding on any of the parties.

3. **ASSIGNMENT:** This Agreement is not assignable by the Grantee, either in whole or in part, without the consent of the State in the form of a formal written amendment.

4. **AUDIT:** Grantee agrees that the CDFW, the Department of General Services, the Bureau of State Audits, or their designated representative shall have the right to review and to copy any records and supporting documentation pertaining to the performance of this Agreement. Grantee agrees to maintain such records for possible audit for a minimum of three (3) years after final payment, unless a longer period of records retention is stipulated. Grantee agrees to allow the auditor(s) access to such records during normal business hours and to allow interviews of any employees who might reasonably have information related to such records. Further, Grantee agrees to include a similar right of the State to audit records and interview staff in any subcontract related to performance of this Agreement. (Gov. Code §8546.7, Pub. Contract Code, CCR Title 2, Section 1896).

5. **INDEMNIFICATION:** Grantee agrees to indemnify, defend and save harmless the State of California, CDFW, its officers, agents and employees from any and all claims and losses accruing or resulting to any and all of Grantee's employees or agents, contractors, subcontractors, suppliers, laborers, and any other person, firm or corporation furnishing or supplying work services, materials, or supplies in connection with the performance of this Agreement, and from any and all claims and losses accruing or resulting to any person, firm or corporation who may be injured or damaged by Grantee in the performance of this Agreement.

   The State of California shall defend, indemnify and hold the Grantee, its officers, employees and agents harmless from and against any and all liability, loss, expense, attorney's fees, or claims for injury or damages arising out of the performance of this Agreement but only in proportion to and to the extent such liability, loss, expense, attorney's fees, or claims for injury or damages are caused by or result from the negligent or intentional acts or omissions of the State of California, or its agencies, their respective officers, agents or employees.

6. **DISPUTES:** Grantee shall continue with the responsibilities under this Agreement during any dispute.

7. **INDEPENDENT CONTRACTOR:** Grantee, and the agents and employees of Grantee, in the performance of this Agreement, shall act in an independent capacity and not as officers or employees or agents of the State. Grantee acknowledges and promises that CDFW is not acting as an employer to any individuals furnishing services or work pursuant to this Agreement.

(Rev. 12/21/12)

8. **NON-DISCRIMINATION CLAUSE:** During the performance of this Agreement, Grantee and its subcontractors shall not unlawfully discriminate, harass, or allow harassment against any employee or applicant for employment because of sex, race, color, ancestry, religious creed, national origin, physical disability (including HIV and AIDS), mental disability, medical condition (e.g., cancer), age (over 40), marital status, and denial of family care leave. Grantee and subcontractors shall ensure that the evaluation and treatment of their employees and applicants for employment are free from such discrimination and harassment. Grantee and subcontractors shall comply with the provisions of the Fair Employment and Housing Act (Gov. Code §12990 (a-f) et seq.) and the applicable regulations promulgated there under (California Code of Regulations, Title 2, Section 7285 et seq.). The applicable regulations of the Fair Employment and Housing Commission implementing Government Code Section 12990 (a-f), set forth in Chapter 5 of Division 4 of Title 2 of the California Code of Regulations, are incorporated into this Agreement by reference and made a part hereof as if set forth in full. Grantee and its subcontractors shall give written notice of their obligations under this clause to labor organizations with which they have a collective bargaining or other Agreement.

   Grantee shall include the nondiscrimination and compliance provisions of this clause in all subcontracts to perform work under the Agreement.

9. **UNENFORCEABLE PROVISION:** In the event that any provision of this Agreement is unenforceable or held to be unenforceable, then the parties agree that all other provisions of this Agreement have force and effect and shall not be affected thereby.

10. **LICENSES AND PERMITS (If Applicable):** The Grantee shall obtain, at its expense, all licenses and permits required by law for accomplishing any work required in connection with this Agreement.

11. **RIGHTS IN DATA:** The Grantee agrees that all data, plans, drawings, specifications, reports, computer programs, operating manuals, notes and other written or graphic work produced in the performance of this Agreement, are subject to the rights of the State as set forth in this section. The State shall have the right to reproduce, publish, and use all such work, or any part thereof, in any manner and for any purposes whatsoever and to authorize others to do so. If any such work is copyrightable, the Grantee may copyright the same, except that, as to any work which is copyrighted by the Grantee, the State reserves a royalty-free, nonexclusive and irrevocable license to reproduce, publish, and use such work, or any part thereof, and to authorize others to do so.

12. **CONTINGENT FUNDING:** It is mutually understood between the parties that this Agreement may have been written before ascertaining the availability of State appropriation of funds for the mutual benefit of both parties in order to avoid program and fiscal delays which would occur if the Agreement were executed after that determination was made.

    This Agreement is valid and enforceable only if sufficient funds are made available pursuant to the California State Budget Act for the fiscal year(s) covered by this Agreement for the purposes of

this program. In addition, this Agreement is subject to any additional restrictions, limitations, or conditions enacted by the Legislature of any statute enacted by the Legislature which may affect the provisions, terms or funding of this Agreement in any manner.

It is mutually agreed that if the Legislature does not appropriate sufficient funds for the Agreement, the State has the option to terminate the Agreement under the termination clause or to amend the Agreement to reflect any reduction of funds. CDFW has the option to invalidate the contract under the 30-day cancellation clause or to amend the Agreement to reflect any reduction in funds.

13. **RIGHT TO TERMINATE:**

a. This agreement may be terminated by mutual consent of both parties or by any party upon thirty (30) days written notice and delivered by USPS First Class or in person.
b. In the event of termination of this Agreement, Grant Recipient shall immediately provide CDFW an accounting of all funds received under the Agreement and return to CDFW all funds received under this Agreement which have not been previously expended to provide the services outlined within this agreement.
c. Any such termination of this Agreement shall be without prejudice to any obligations or liabilities of either party already accrued prior to such termination. CDFW shall reimburse Grantee for all allowable and reasonable costs incurred by it for the Project, including foreseeable and uncancellable obligations. Upon notification of termination from CDFW, Grantee shall use its reasonable efforts to limit any outstanding financial commitments.

14. **CONFIDENTIALITY OF DATA:** The Grantee shall protect from disclosure all information made available by CDFW. The Grantee shall not be required to keep confidential any data or information which is publicly available, independently developed by the Grantee, or lawfully obtained from third parties. Written consent of CDFW must be obtained prior to disclosing information under this Agreement.

15. **DISCLOSURE REQUIREMENTS:** Any document or written report prepared in whole or in part pursuant to this Agreement shall contain a disclosure statement indicating that the document or written report was prepared through an Agreement with the State. The disclosure statement shall include the Agreement number and dollar amount of all Agreements and subcontracts relating to the preparation of such documents or written reports. The disclosure statement shall be contained in a separate section of the document or written report.

If the Grantee or any subcontractor(s) are required to prepare multiple documents or written reports, the disclosure statement may also contain a statement indicating that the total Agreement amount represents compensation for multiple documents or written reports. The Grantee shall include in each of its subcontracts for work under this Agreement, a provision which incorporates the requirements stated within this section.

16. **POTENTIAL SUBCONTRACTOR(S):** Nothing contained in this Agreement or otherwise shall create any contractual relation between the State and any subcontractor(s) and no subcontract shall relieve the Grantee of its responsibilities and obligations hereunder. The Grantee agrees to

be as fully responsible to the State for the acts and omissions of its subcontractor(s) and of persons directly employed or indirectly employed by any of them as it is for the acts and omissions of persons directly employed by the Grantee. The Grantee's obligation to pay its subcontractor(s) is an independent obligation from the State's obligation to make payments to the Grantee. As a result, the State shall have no obligation to pay or to enforce the payment of any monies to any subcontractor.

17. **TRAVEL AND PER DIEM (if applicable):** The Grantee agrees to pay reasonable travel and per diem to its employees under this Agreement. The reimbursement rates shall not exceed those amounts identified in the Department of Personnel Administration and/or Universities of California travel reimbursement guidelines.

18. **LIABILITY INSURANCE (as applicable):** Unless otherwise specified in the Grant Agreement, when the Grantee submits a signed Agreement to the State, the Grantee shall also furnish to the State either proof of self-insurance or a certificate of insurance stating that there is liability insurance presently in effect for the Grantee of not less than $1,000,000 per occurrence for bodily injury and property damage liability combined. Grantee agrees to make the entire insurance policy available to the State upon request.

The certificate of insurance will include provisions a, b, and c, in their entirety:

a. The insurer will not cancel the insured's coverage without thirty (30) days prior written notice to the State;
b. The State of California, its officers, agents, employees, and servants are included as additional insured, by insofar as the operations under this Agreement are concerned; and
c. The State will not be responsible for any premiums or assessments on the policy.

The Grantee agrees that the bodily injury liability insurance herein provided for, shall be in effect at all times during the term of this Agreement. In the event said insurance coverage expires at any time or times during the term of this Agreement, Grantee agrees to provide, prior to said expiration date, a new certificate of insurance evidencing insurance coverage as provided for herein for not less than the remainder of the term of the Agreement, or for a period of not less than one (1) year. New certificates of insurance are subject to the approval of the Department of General Services, and the Grantee agrees that no work or services shall be performed prior to giving of such approval. In the event the Grantee fails to keep in effect, at all times, insurance coverage as herein provided, the State may, in addition to any other remedies it may have, terminate this Agreement upon occurrence of such event.

CDFW will not provide for, nor compensate the Grantee for any insurance premiums or costs for any type or amount of insurance. The insurance required above, shall cover all Grantee supplied personnel and equipment used in the performance of this Agreement. When applicable, if subcontractors performing work under this Agreement do not have insurance equivalent to the above, the Grantee's liability shall provide such coverage for the subcontractor, except for coverage for error, mistake, omissions, or malpractice, which shall be provided by the subcontractor if such insurance is required by the State.

19. **GRANTEE STAFF REQUIREMENTS:** The Grantee represents that it has or shall secure at its own expense, all staff required to perform the services described in this Agreement. Such personnel shall not be employees of or have any contractual relationship with the CDFW or any other California State entity.

20. **PROPERTY ACQUISITIONS:** Property, as used in this exhibit shall include the following:

    a. Equipment – Tangible property (including furniture) with a unit cost of $5,000 or more and a useful life of four (4) years or more. Actual cost includes the purchase price plus all costs to acquire, install, and prepare the equipment for its intended use.

    b. Furniture – Standard office furnishings including desks, chairs, bookcases, credenzas, tables, etc.

    c. Portable Assets – Items considered 'highly desirable' because of their portability and value, e.g., calculators, typewriters, computers, printers, scanners, shredders, cameras, etc.

    d. Electronic Data Processing (EDP) Equipment – All computerized and auxiliary automated information handling, including system design and analysis; conversion of data; computer programming; information storage and retrieval; voice, video and data communications; requisite system controls; simulation and all related interactions between people and machines.

The Grantee may purchase property under this Grant Agreement only if specified in the budget detail and payment provisions section. All property purchased by Grantee is property of Grantee. CDFW does not claim title to the property, but requires Grantee to maintain accountability for all property purchased with grant funds.

Title to property with a unit cost of $5,000 or more may be retained by Grantor upon end of the grant cycle; final disposition will be coordinated by CDFW's Grant Manager.

Before property purchases made by the Grantee are reimbursed by CDFW, the Grantee shall submit paid Grantee receipts identifying the Grant Agreement Number, purchase price, description of the item (s), serial number(s), model number(s), and location, including street address where property will be used during the term of this Grant Agreement. Said paid receipts shall be attached to the Grantee's invoice(s).

The Grantee shall keep, and make available to Grantor, adequate and appropriate records of all property purchased with the Grant Agreement funds.

Prior written authorization by the CDFW Grant Manager shall be required before the Grantee will be reimbursed for any property purchases not specified in the budget. The Grantee shall provide to CDFW Grant Manager, all particulars regarding the necessity for such property and the reasonableness of the cost.

(Rev. 12/21/12)

Property will only be considered for purchase approval if no other equipment owned by the applicant is available and suitable for the project.

Grant funds cannot be used to reimburse the project for equipment obtained prior to the beginning of the grant term.

Grant funds cannot be used for property if specifically prohibited in the authorizing legislation or restricted in the terms of the program.

Should this Grant Agreement be cancelled for any reason, any property purchased with grant funds shall be returned to Grantor.

State policies and procedures applicable to procurement with nonfederal funds, shall apply to procurement by the Grantee under this Grant Agreement, provided that procurements conform to applicable State law and the standards identified in this exhibit. These include, but are not limited to: statutes applicable to State agencies; statutes applicable to State colleges and universities; public works projects; the California Constitution governing University of California contracting, the State Administrative Manual; statutes applicable to specific local agencies; applicable city and county charters and implementing ordinances including policies and procedures incorporated in local government manuals or operating memoranda.

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1. **UTILIZATION OF SMALL, MINORITY AND WOMEN'S BUSINESSES:** The Grantee agrees that affirmative steps will be taken to assure that qualified small, minority and women-owned businesses are used when possible as sources of supplies, construction, and services in the performance of grant-assisted Agreements and subcontracts. Affirmative steps taken shall include the following:

   a. Include qualified small, minority and women-owned businesses on solicitation lists;
   b. Assuring that small, minority and women-owned businesses are solicited whenever they are potential sources;
   c. Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation of small, minority and women-owned businesses;
   d. Establishing delivery schedules, where the requirements of the work permit, which will encourage participation by small, minority and women-owned businesses;
   e. Using the services and assistance of the Small Business Administration, the Minority business Development Agency of the U.S. Department of Commerce, and the State Office of Small Business and Disabled Veteran Business Enterprise Certification; and
   f. If the Grantee awards subcontracts, requiring the subcontractor to take the affirmative steps in paragraphs A through E of this section.

2. **DISCLOSURE REQUIREMENTS:** Any document or written report prepared in whole or in part pursuant to this Agreement shall contain a disclosure statement indicating that the document or written report was prepared through Agreement with the State. The disclosure statement shall include the Agreement number and dollar amount of all Agreements and subcontracts relating to the preparation of such documents or written reports. The disclosure statement shall be contained in a separate section of the document or written report.

3. **PRIVITY:** This Agreement is funded in whole or in part by a grant from the Federal Government. Neither the United States nor any of its departments, agencies, or employees are, or will be, a part to this Agreement or any lower tier subcontract or to any solicitation or request for proposal.

4. **COMPLIANCE WITH FEDERAL REGULATIONS:** The Grantee understands that the State is obligated, in accordance with its assistance Agreement with the Federal Government, to comply with the provisions of federal regulations contained in Title 48 Code of Federal Regulations (CFR) Part 31 and any conditions in the grant Agreement and any amendments thereto. In order to ensure that the State can meet these obligations, the Grantee warrants, represents, and agrees that it and its subcontractors, employees, and representatives will comply with: 1) all applicable provisions of Title 48 CFR Part 31; and 2) all general and special conditions contained in the Agreement.

5. **COPYRIGHTS:** The Grantee agrees to and does hereby grant to the Federal Government, a royalty-free nonexclusive and irrevocable license to reproduce, publish, or otherwise use, and to authorize others to use, for Federal Government purposes:

   a. The copyright in any work developed under this Agreement; and

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b. Any rights of copyright which the Grantee purchases, in whole or in part, with funds provided by this Agreement.

6. **STANDARDS FOR FINANCIAL MANAGEMENT SYSTEM:** The Grantee and all subcontractors shall maintain fiscal control and accounting procedures which are sufficient to:

   a. Permit preparation of reports required by Title 48 CFR Part 31 (including those required by Title 48 CFR part 31.40 and 31.41) and statutes authorizing the grant.

   b. Permit tracing of funds to a level of expenditures adequate to establish that such funds have not been used in violation of the restrictions and prohibitions of applicable statutes.

   A requirement to this effect shall be placed in all subcontracts related to performance of work under this Agreement.

7. **APPLICABLE COST PRINCIPLES:** The cost principles for this Agreement are applicable as set forth below (Office of Management and Budget (OMB):

   a. OMB Circular 21 – Education Institutions;
   b. OMB Circular A-87 – State, Local or Indian Tribe Governments;
   c. OMB Circular A-122 – Cost Principals for Non-Profit Organizations;
   d. OMB Circular A-133 – Audits of States, Local Governments and Non-Profit Organizations; or
   e. Title 48 CFR Part 31 – For-Profit Organizations

   Funds provided under this Agreement shall not be used for payment of salaries to individual consultants retained by the Grantee or any subcontractors in excess of the rate for Level 4, of the Federal Executive Schedule. The limit expressed herein does not include transportation and subsistence costs for necessary travel for work required under this Agreement.

8. **CONTINGENT FUNDING:** It is mutually understood between the parties that this Agreement may have been written before ascertaining the availability of congressional appropriation of funds for the mutual benefit of both parties in order to avoid program and fiscal delays which would occur if the Agreement were executed after that determination was made.

   This Agreement is valid and enforceable only if sufficient funds are made available to the State by the US Government for the fiscal year(s) covered by this Agreement for the purposes of this program. In addition, this Agreement is subject to any additional restrictions, limitations, or conditions enacted by the Congress of any statute enacted by the Congress which may affect the provisions, terms or funding of this Agreement in any manner.

   It is mutually agreed that if the Congress does not appropriate sufficient funds for the Agreement, the State has the option to terminate the Agreement under the termination clause or to amend the Agreement to reflect any reduction of funds.

The California Department of Fish and Wildlife (CDFW) has the option to invalidate the Agreement under the 30-day cancellation clause or to amend the Agreement to reflect any reduction in funds.

9. **ENVIRONMENTAL QUALITY:** The Grantee and subcontractors shall comply with all applicable standards, orders, or requirements issued under Section 306 of the Clean Air Act, Title 42 U.S.C. 1857(h), Section 508 of the Clean Air Act, Title 33 U.S.C. 1368 Executive Order 11738 and, Title 40 CFR part 15.

   The Grantee shall comply with mandatory standards and policies related to energy efficiency which are contained in the State Energy Conservation Plan issued in compliance with the Conservation Act (Publ. L. 94-163).

10. **RECYCLED PAPER:** The Grantee agrees to use recycled paper for all reports which are prepared as a part of this Agreement and delivered to the State. This requirement does not apply to reports which are prepared on form supplied by the Federal Government. This requirement applies even when the cost of recycled paper is higher than that of virgin paper.

11. **SINGLE AUDIT ACT:** To the extent applicable, the Grantee shall be subject to and shall comply with the provisions and requirements of the Single Audit Act of 1984 (Pub. L 98-502) and implementing policies, procedures and guidelines, including applicable circulars issued by the Federal OMB.

12. **FEDERAL ASSURANCES:** It is further agreed that by signing this Agreement, the Grantee is subject to Title VI of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973, Title II of the Americans with Disabilities Act of 1990, the Age Discrimination Act of 1975, Title IX of the Education Amendments of 1972, and offers all persons the opportunity to participate in programs or activities regardless of race, color, national origin, age, sex, or disability. Further, it is agreed that no individual will be turned away from or otherwise denied access to or benefit from any program or activity that is directly associated with a program of CDFW on the basis of race, color, national origin, age, sex (in education activities) or disability.

13. **COMPLIANCE WITH FEDERAL FUNDING ACCOUNTABILITY AND TRANSPARENCY ACT 2006 (FFATA):** As a recipient of a federal contract, grant or other federal funds, the State is required under the Federal Funding Accountability and Transparency Act of 2006 (FFATA) to report certain information about the State's contractors, grantees and sub-recipients of that federal funding. The Grantee, as a sub-recipient of federal funds, agrees to provide the State with data required under the FFATA unless exempted under that act. Grantee shall complete a Grantee's FFATA Certification form (State form) and submit it as instructed, on or before execution of the agreement. If not exempt the Grantee shall create a registration, or update its data if already registered, on the federal Contractors Central Registry (CCR) at www.bpn.gov/ccr. A DUNS number is required for the CCR registration and must be included on the FFATA Certification form. Grantee agrees to update its CCR registration and notify the State if there is a material change to its CCR data or its exemption status changes.

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ATTACHMENT B

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Contract and Subcontract Provisions.

(a) The Recipient shall insert in full in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a public building or public work, or building or work financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated), and which is subject to the labor standards provisions of any of the acts listed in § 5.1, the following clauses:

(1) Minimum wages.

(i) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in § 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

The **Recipient** may obtain wage determinations from the U.S. Department of Labor's web site, www.wdol.gov.

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

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

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

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

(B) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the **Recipient** agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the **Recipient** to the State Water Board. The State Water Board will transmit the report, to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the State Water Board or will notify the State Water Board within the 30-day period that additional time is necessary.

(C) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the **Recipient** do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), USEPA will refer the questions, including the views of all interested parties and the recommendation of the State Water Board, to the Administrator for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.

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

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

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

(2) Withholding.

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

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cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) Payrolls and basic records.

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

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

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

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

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

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

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

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

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

(4) Apprentices and Trainees

(i) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage

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determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

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

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

(5) Compliance with Copeland Act Requirements.

The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.

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(6) Subcontracts.

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

(7) Contract Termination: Debarment.

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

(8) Compliance with Davis-Bacon and Related Act Requirements.

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

(9) Disputes Concerning Labor Standards.

Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the R**ecipient**, State, EPA, the U.S. Department of Labor, or the employees or their representatives.

(10) Certification of Eligibility.

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

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

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

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

(a) Contract Work Hours and Safety Standards Act.

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

(1) Overtime requirements.

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

(2) Violation; liability for unpaid wages; liquidated damages.

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

(3) Withholding for unpaid wages and liquidated damages.

The **Recipient,** upon written request of the EPA Award Official or an authorized representative of the Department of Labor, shall withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (a)(2) of this section.

(4) Subcontracts.

The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (a)(1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (a)(1) through (4) of this section.

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

ATTACHMENT C

Federal Wage Decision
(version date: 3/7/14)

General Decision Number: CA140009 03/07/2014 CA9

Superseded General Decision Number: CA20130009

State: California

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

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

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

Modification Number	Publication Date
0	01/03/2014
1	01/10/2014
2	01/24/2014
3	03/07/2014

* ASBE0016-001 01/01/2014

AREA 1: ALAMEDA, CONTRA COSTA, LAKE, MARIN, MENDOCINO, MONTEREY, NAPA, SAN BENITO, SAN FRANCISCO, SAN MATEO, SANTA CLARA, SANTA CRUZ, SOLANO, & SONOMA COUNTIES

AREA 2: ALPINE, AMADOR, BUTTE, CALAVERAS, COLUSA, DEL NORTE, EL DORADO, FRESNO, GLENN, HUMBOLDT, KINGS, LASSEN, MADERA, MARIPOSA, MERCED, MODOC, MONO, NEVADA, PLACER, PLUMAS, SACRAMENTO, SAN JOAQUIN, SHASTA, SIERRA, SISKIYOU, STANISLAU, SUTTER, TEHEMA, TRINITY, TULARE, TUOLUMNE, YOLO, & YUBA COUNTIES

	Rates	Fringes
Asbestos Workers/Insulator (Includes the application of all insulating materials, Protective Coverings, Coatings, and Finishes to all types of mechanical systems)		
Area 1	$ 57.15	18.72
Area 2	$ 44.05	18.62

ASBE0016-007 01/01/2013

	Rates	Fringes
Asbestos Removal worker/hazardous material handler (Includes		

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preparation, wetting,
stripping, removal,
scrapping, vacuuming, bagging
and disposing of all
insulation materials from
mechanical systems, whether
they contain asbestos or not)....$ 31.13             6.95
----------------------------------------------------------------
 BOIL0549-002 01/01/2013

                                  Rates          Fringes

BOILERMAKER
     (1) Marin & Solano Counties.$ 42.06            33.43
     (2) Remaining Counties......$ 38.37            31.32
----------------------------------------------------------------
 BRCA0003-001 06/01/2011

                                  Rates          Fringes

MARBLE FINISHER.................$ 28.02            12.22
----------------------------------------------------------------
 BRCA0003-004 05/01/2011

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

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


                                  Rates          Fringes

BRICKLAYER
     AREA 1......................$ 35.11            18.99
     AREA 2......................$ 39.85            22.00

SPECIALTY PAY:
  (A)  Underground work such as tunnel work, sewer work,
  manholes, catch basins, sewer pipes and telephone conduit
  shall be paid  $1.25 per hour above the regular rate.  Work
  in direct contact with raw sewage shall receive $1.25 per
  hour in addition to the above.
  (B)  Operating a saw or grinder shall receive $1.25 per hour
  above the regular rate.
  (C)  Gunite nozzle person shall receive $1.25 per hour above
  the regular rate.

----------------------------------------------------------------
 BRCA0003-008 07/01/2013

                                  Rates          Fringes

TERRAZZO FINISHER...............$ 33.15            13.93
TERRAZZO WORKER/SETTER..........$ 39.95            24.39
----------------------------------------------------------------
 BRCA0003-010 01/01/2011

                                  Rates          Fringes
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TILE FINISHER
     Area 1.....................$ 21.21            10.01
     Area 2.....................$ 21.26            12.44
     Area 3.....................$ 21.44            12.31
     Area 4.....................$ 20.93            11.79
Tile Layer
     Area 1.....................$ 36.08            11.95
     Area 2.....................$ 34.41            13.68
     Area 3.....................$ 38.61            13.73
     Area 4.....................$ 35.45            13.68

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

-----------------------------------------------------------------
 BRCA0003-014 06/01/2011

                                  Rates          Fringes

MARBLE MASON....................$ 39.22            18.68
-----------------------------------------------------------------
 CARP0034-001 07/01/2013

                                  Rates          Fringes

Diver
     Assistant Tender, ROV
     Tender/Technician...........$ 38.60            29.78
     Diver standby...............$ 43.38            29.78
     Diver Tender................$ 42.38            29.78
     Diver wet...................$ 85.91            29.78
     Manifold Operator (mixed
     gas)........................$ 47.38            29.78
     Manifold Operator (Standby).$ 42.38            29.78

DEPTH PAY (Surface Diving):
050 to 100 ft    $2.00 per foot
101 to 150 ft    $3.00 per foot
151 to 220 ft    $4.00 per foot

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

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

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

CARP0034-003 07/01/2013

	Rates	Fringes
Piledriver	$ 38.60	29.78

CARP0035-001 08/01/2013

AREA 1: MARIN, NAPA, SOLANO & SONOMA

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

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

	Rates	Fringes
Drywall Installers/Lathers:		
Area 1	$ 39.35	27.02
Area 3	$ 33.97	27.02
Area 4	$ 32.62	27.02
Drywall Stocker/Scrapper		
Area 1	$ 19.68	15.65
Area 3	$ 16.99	15.65
Area 4	$ 16.31	15.65

CARP0035-009 07/01/2013

Marin County

	Rates	Fringes
CARPENTER		
Bridge Builder/Highway Carpenter	$ 39.35	26.58
Hardwood Floorlayer, Shingler, Power Saw Operator, Steel Scaffold & Steel Shoring Erector, Saw Filer	$ 39.50	26.58
Journeyman Carpenter	$ 39.35	26.58
Millwright	$ 39.45	28.17

CARP0035-010 07/01/2013

AREA 1: Marin, Napa, Solano & Sonoma Counties

AREA 2: Alpine, San Benito and Santa Cruz

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

	Rates	Fringes
Modular Furniture Installer		
Area 1		
Installer I	$ 22.96	17.52
Installer II	$ 19.53	17.52
Lead Installer	$ 26.41	18.02
Master Installer	$ 30.63	18.02
Area 2		
Installer I	$ 20.31	17.52
Installer II	$ 17.36	17.52
Lead Installer	$ 23.28	18.02
Master Installer	$ 26.91	18.02
Area 3		
Installer I	$ 19.36	17.52
Installer II	$ 16.59	17.52
Lead Installer	$ 22.16	18.02
Master Installer	$ 25.58	18.02

CARP0046-001 07/01/2013

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

	Rates	Fringes
Carpenters		
Bridge Builder/Highway Carpenter	$ 39.35	26.58
Hardwood Floorlayer, Shingler, Power Saw Operator, Steel Scaffold & Steel Shoring Erector, Saw Filer	$ 33.62	26.58
Journeyman Carpenter	$ 33.47	26.58
Millwright	$ 35.97	28.17

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

CARP0046-002 07/01/2013

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

	Rates	Fringes
Carpenters		
Bridge Builder/Highway Carpenter	$ 39.35	26.58

```
     Hardwood Floorlayer,
     Shingler, Power Saw
     Operator, Steel Scaffold &
     Steel Shoring Erector, Saw
     Filer.......................$ 32.27            26.58
     Journeyman Carpenter........$ 32.12            26.58
     Millwright..................$ 34.62            28.17
-----------------------------------------------------------------
 CARP0152-003 07/01/2013

Amador County

                                 Rates          Fringes

Carpenters
     Bridge Builder/Highway
     Carpenter...................$ 39.35            26.58
     Hardwood Floorlayer,
     Shingler, Power Saw
     Operator, Steel Scaffold &
     Steel Shoring Erector, Saw
     Filer.......................$ 32.27            26.58
     Journeyman Carpenter........$ 32.12            26.58
     Millwright..................$ 34.62            28.17
-----------------------------------------------------------------
 CARP0180-001 07/01/2013

Solano County

                                 Rates          Fringes

Carpenters
     Bridge Builder/Highway
     Carpenter...................$ 39.35            26.58
     Hardwood Floorlayer,
     Shingler, Power Saw
     Operator, Steel Scaffold &
     Steel Shoring Erector, Saw
     Filer.......................$ 39.50            26.58
     Journeyman Carpenter........$ 39.35            26.58
     Millwright..................$ 39.45            28.17
-----------------------------------------------------------------
 CARP0751-001 07/01/2013

Napa and Sonoma Counties

                                 Rates          Fringes

Carpenters
     Bridge Builder/Highway
     Carpenter...................$ 39.35            26.58
     Hardwood Floorlayer,
     Shingler, Power Saw
     Operator, Steel Scaffold &
     Steel Shoring Erector, Saw
     Filer.......................$ 39.50            26.58
     Journeyman Carpenter........$ 39.35            26.58
     Millwright..................$ 39.45            28.17
-----------------------------------------------------------------
 CARP1599-001 07/01/2013
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Butte, Glenn, Lassen, Modoc, Plumas, Shasta, Siskiyou, Tehama
and Trinity Counties

	Rates	Fringes
Carpenters		
Bridge Builder/Highway Carpenter	$ 39.35	26.58
Hardwood Floorlayer, Shingler, Power Saw Operator, Steel Scaffold & Steel Shoring Erector, Saw Filer	$ 32.27	26.58
Journeyman Carpenter	$ 32.12	26.58
Millwright	$ 34.62	28.17

ELEC0180-001 06/01/2013

NAPA AND SOLANO COUNTIES

	Rates	Fringes
CABLE SPLICER	$ 49.29	21.609
ELECTRICIAN	$ 43.81	21.444

ELEC0180-003 12/01/2013

NAPA AND SOLANO COUNTIES

	Rates	Fringes
Sound & Communications		
Installer	$ 31.32	3%+15.30
Technician	$ 35.66	3%+15.30

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

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

ELEC0340-002 12/01/2013

ALPINE, AMADOR, BUTTE, COLUSA, EL DORADO, GLENN, LASSEN,

NEVADA, PLACER, PLUMAS, SACRAMENTO, TRINITY, YOLO, YUBA COUNTIES

	Rates	Fringes
Communications System		
Sound & Communications Installer	$ 24.68	3%+12.85
Sound & Communications Technician	$ 28.38	3%+12.85

SCOPE OF WORK

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

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

B. FIRE ALARM SYSTEMS
Installation, wire pulling and testing

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

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

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

the electrician wage rate, when either of the following two (2) conditions apply:
1. The project involves new or major remodel building trades construction.
2. The conductors for the fire alarm system are installed in conduit.

ELEC0340-003 12/01/2013

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

	Rates	Fringes
ELECTRICIAN		
Remaining area.....	$ 39.06	18.54
Sierra Army Depot, Herlong..	$ 48.83	18.54
Tunnel work.....	$ 41.01	18.54

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

ELEC0401-005 07/01/2013

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

	Rates	Fringes
ELECTRICIAN.....	$ 37.00	14.62

ELEC0551-004 06/01/2013

MARIN AND SONOMA COUNTIES

	Rates	Fringes
ELECTRICIAN.....	$ 46.70	15.21

ELEC0551-005 12/01/2013

MARIN & SONOMA COUNTIES

	Rates	Fringes
Sound & Communications		
Installer.....	$ 31.32	16.23
Technician.....	$ 35.66	16.36

SCOPE OF WORK INCLUDES-
SOUND & VOICE TRANSMISSION (Music, Intercom, Nurse Call,

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

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

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 ELEC0659-006 01/01/2013

DEL NORTE, MODOC and SISKIYOU COUNTIES

                                  Rates          Fringes

ELECTRICIAN......................$ 30.27            14.81
-----------------------------------------------------------------
 ELEC0659-008 02/01/2013

DEL NORTE, MODOC & SISKIYOU COUNTIES

                                  Rates          Fringes

Line Construction
     (1) Cable Splicer...........$ 51.09         4%+13.30
     (2) Lineman, Pole Sprayer,
     Heavy Line Equipment Man....$ 45.62         4%+13.30
     (3) Tree Trimmer............$ 32.07          4%+9.80
     (4) Line Equipment Man......$ 45.62          4%+9.80
     (5) Powdermen,
     Jackhammermen...............$ 34.22          4%+9.80
     (6) Groundman...............$ 31.31          4%+9.80
-----------------------------------------------------------------
 ELEC1245-004 06/01/2013

ALL COUNTIES EXCEPT DEL NORTE, MODOC & SISKIYOU

                                  Rates          Fringes

LINE CONSTRUCTION
     (1) Lineman; Cable splicer..$ 50.30               15
     (2) Equipment specialist
     (operates crawler
     tractors, commercial motor
     vehicles, backhoes,
     trenchers, cranes (50 tons
     and below), overhead &
     underground distribution
     line   equipment)...........$ 40.17            14.56
     (3) Groundman...............$ 30.73            13.48
     (4) Powderman...............$ 44.91            13.48
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HOLIDAYS: New Year's Day, M.L. King Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day and day after Thanksgiving, Christmas Day

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ELEV0008-001 01/01/2014

	Rates	Fringes
ELEVATOR MECHANIC	$ 59.19	26.785

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

ENGI0003-008 07/01/2013

	Rates	Fringes
Dredging: (DREDGING: CLAMSHELL & DIPPER DREDGING; HYDRAULIC SUCTION DREDGING:)		
AREA 1:		
(1) Leverman	$ 40.53	27.81
(2) Dredge Dozer; Heavy duty repairman	$ 35.57	27.81
(3) Booster Pump Operator; Deck Engineer; Deck mate; Dredge Tender; Winch Operator	$ 34.45	27.81
(4) Bargeman; Deckhand; Fireman; Leveehand; Oiler	$ 31.15	27.81
AREA 2:		
(1) Leverman	$ 42.53	27.81
(2) Dredge Dozer; Heavy duty repairman	$ 37.57	27.81
(3) Booster Pump Operator; Deck Engineer; Deck mate; Dredge Tender; Winch Operator	$ 36.45	27.81
(4) Bargeman; Deckhand; Fireman; Leveehand; Oiler	$ 33.15	27.81

AREA DESCRIPTIONS

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

AREA 2: MODOC COUNTY

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

ALPINE COUNTY:
Area 1: Northernmost part
Area 2: Remainder

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

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

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

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

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

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

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

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

MONTERREY COUNTY
Area 1: Except Southwestern part
Area 2: Southwestern part

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

PLACER COUNTY:
Area 1: Al but the Central portion
Area 2: Remainder

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

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

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

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

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

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

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

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

ENGI0003-018 07/01/2013

"AREA 1" WAGE RATES ARE LISTED BELOW

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

SEE AREA DEFINITIONS BELOW

	Rates	Fringes
OPERATOR: Power Equipment (AREA 1:)		
GROUP 1	$ 39.02	26.27
GROUP 2	$ 37.49	26.27
GROUP 3	$ 36.01	26.27
GROUP 4	$ 34.63	26.27
GROUP 5	$ 33.36	26.27
GROUP 6	$ 32.04	26.27
GROUP 7	$ 30.90	26.27
GROUP 8	$ 29.76	26.27
GROUP 8-A	$ 27.55	26.27
OPERATOR: Power Equipment (Cranes and Attachments - AREA 1:)		
GROUP 1		
Cranes	$ 39.90	26.27
Oiler	$ 32.93	26.27
Truck crane oiler	$ 36.50	26.27
GROUP 2		
Cranes	$ 32.67	26.27

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      Oiler.....................$ 32.67            26.27
      Truck crane oiler.........$ 36.21            26.27
     GROUP 3
      Cranes....................$ 36.40            26.27
      Hydraulic.................$ 32.04            26.27
      Oiler.....................$ 32.43            26.27
      Truck Crane Oiler.........$ 35.94            26.27
OPERATOR:  Power Equipment
(Piledriving - AREA 1:)
     GROUP 1
      Lifting devices...........$ 40.24            26.27
      Oiler.....................$ 30.98            26.27
      Truck crane oiler.........$ 33.26            26.27
     GROUP 2
      Lifting devices...........$ 38.42            26.27
      Oiler.....................$ 30.71            26.27
      Truck Crane Oiler.........$ 33.01            26.27
     GROUP 3
      Lifting devices...........$ 36.74            26.27
      Oiler.....................$ 30.49            26.27
      Truck Crane Oiler.........$ 32.72            26.27
     GROUP 4
      Lifting devices...........$ 34.97            26.27
     GROUP 5
      Lifting devices...........$ 33.67            26.27
     GROUP 6
      Lifting devices...........$ 32.33            26.27
OPERATOR:  Power Equipment
(Steel Erection - AREA 1:)
     GROUP 1
      Cranes....................$ 40.87            26.27
      Oiler.....................$ 31.32            26.27
      Truck Crane Oiler.........$ 33.55            26.27
     GROUP 2
      Cranes....................$ 39.10            26.27
      Oiler.....................$ 31.05            26.27
      Truck Crane Oiler.........$ 33.33            26.27
     GROUP 3
      Cranes....................$ 37.62            26.27
      Hydraulic.................$ 32.67            26.27
      Oiler.....................$ 30.83            26.27
      Truck Crane Oiler.........$ 33.06            26.27
     GROUP 4
      Cranes....................$ 35.60            26.27
     GROUP 5
      Cranes....................$ 34.30            26.27
OPERATOR:  Power Equipment
(Tunnel and Underground Work
- AREA 1:)
     SHAFTS, STOPES, RAISES:
      GROUP 1...................$ 35.12            26.27
      GROUP 1-A.................$ 37.59            26.27
      GROUP 2...................$ 33.86            26.27
      GROUP 3...................$ 32.53            26.27
      GROUP 4...................$ 31.39            26.27
      GROUP 5...................$ 30.25            26.27
     UNDERGROUND:
      GROUP 1...................$ 35.02            26.27
      GROUP 1-A.................$ 37.49            26.27
      GROUP 2...................$ 33.76            26.27
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GROUP 3	$ 32.43	26.27
GROUP 4	$ 31.29	26.27
GROUP 5	$ 30.15	26.27

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

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

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

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

GROUP 3: Asphalt milling machine; Cable backhoe; Combination backhoe and loader over 3/4 cu. yds.; Continuous flight tie back machine assistant to engineer or mechanic; Crane mounted continuous flight tie back machine, tonnage to apply; Crane mounted drill attachment, tonnage to apply; Dozer, slope brd; Gradall; Hydraulic excavator, up to 3 1/2 cu. yds.; Loader 4 cu. yds. and over; Long reach excavator; Multiple engine scraper (when used as push pull); Power shovels, up to and including 1 cu. yd.; Pre-stress wire wrapping machine; Side boom cat, 572 or larger; Track loader 4 cu. yds. and over; Wheel excavator (up to and including 750 cu. yds. per hour)

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

GROUP 5: Cast-in-place pipe laying machine; Combination slusher and motor operator; Concrete conveyor or concrete pump, truck or equipment mounted; Concrete conveyor, building site; Concrete pump or pumpcrete gun; Drilling

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

GROUP 6: Armor-Coater (or similar); Ballast jack tamper; Boom- type backfilling machine; Assistant plant engineer; Bridge and/or gantry crane; Chemical grouting machine, truck-mounted; Chip spreading machine operator; Concrete saw (self-propelled unit on streets, highways, airports and canals); Deck engineer; Drilling equipment Texoma 600, Hughes 200 Series or similar up to and including 30 ft. m.r.c.; Drill doctor; Helicopter radio operator; Hydro-hammer or similar; Line master; Skidsteer loader, Bobcat larger than 743 series or similar (with attachments); Locomotive; Lull hi-lift or similar; Oiler, truck mounted equipment; Pavement breaker, truck-mounted, with compressor combination; Paving fabric installation and/or laying machine; Pipe bending machine (pipelines only); Pipe wrapping machine (tractor propelled and supported); Screed (except asphaltic concrete paving); Self- propelled pipeline wrapping machine; Tractor; Self-loading chipper; Concrete barrier moving machine

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

GROUP 8: Bit sharpener; Boiler tender; Box operator; Brakeperson; Combination mixer and compressor (shotcrete/gunite); Compressor operator; Deckhand; Fire tender; Forklift (under 20 ft.); Generator; Gunite/shotcrete equipment operator; Hydraulic monitor; Ken seal machine (or similar); Mixermobile; Oiler; Pump operator; Refrigeration plant; Reservoir-debris tug (self-propelled floating); Ross Carrier (construction site);

Rotomist operator; Self-propelled tape machine; Shuttlecar; Self-propelled power sweeper operator (includes vacuum sweeper); Slusher operator; Surface heater; Switchperson; Tar pot firetender; Tugger hoist, single drum; Vacuum cooling plant; Welding machine (powered other than by electricity)

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

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ALL CRANES AND ATTACHMENTS

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

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

GROUP 3: Clamshell and dragline up to and including 1 cu. yd.; Cranes 45 tons and under; Self-propelled boom-type lifting device 45 tons and under; Boom Truck or dual purpose A-frame truck, non-rotating over 15 tons; Truck-mounted rotating telescopic boom type lifting device, Manitex or similar (boom truck) over 15 tons;

PILEDRIVERS

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

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

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

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

GROUP 5: Deck engineer

GROUP 6: Deckhand; Fire tender

STEEL ERECTORS

GROUP 1: Crane over 100 tons; Derrick over 100 tons; Self-propelled boom-type lifting device over 100 tons

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

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

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

GROUP 5: Boom cat

TUNNEL AND UNDERGROUND WORK

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

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

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

GROUP 3: Drill doctor; Mine or shaft hoist

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

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

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AREA DESCRIPTIONS:

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

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

AREA 2 - MODOC COUNTY

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

ALPINE COUNTY:
Area 1: Northernmost part
Area 2: Remainder

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

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

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

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

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

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

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

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

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

MADERA COUNTY
Area 1: Remainder
Area 2: Eastern part

MARIPOSA COUNTY
Area 1: Remainder
Area 2: Eastern part

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

MONTEREY COUNTY
Area 1: Remainder
Area 2: Southwestern part

NEVADA COUNTY:
Area 1: All but the Northern portion along the border of

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  Sierra County
Area 2: Remainder

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

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

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

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

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

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

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

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

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

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

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 ENGI0003-019 07/01/2013

SEE AREA DESCRIPTIONS BELOW

                                  Rates          Fringes

OPERATOR:  Power Equipment
(LANDSCAPE WORK ONLY)
     GROUP 1
      AREA 1.....................$ 29.64            25.71
      AREA 2.....................$ 31.64            25.71
     GROUP 2
      AREA 1.....................$ 26.04            25.71
      AREA 2.....................$ 28.04            25.71
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    GROUP 3
     AREA 1.....................$ 21.43            25.71
     AREA 2.....................$ 23.43            25.71

GROUP DESCRIPTIONS:

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

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

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

AREA DESCRIPTIONS:

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

AREA 2 - MODOC COUNTY

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

ALPINE COUNTY:
Area 1: Northernmost part
Area 2: Remainder

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

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

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

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

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

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

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

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

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

MADERA COUNTY
Area 1: Remainder
Area 2: Eastern part

MARIPOSA COUNTY
Area 1: Remainder
Area 2: Eastern part

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

MONTEREY COUNTY
Area 1: Remainder
Area 2: Southwestern part

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

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

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

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

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

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

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

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

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

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

IRON0377-002 07/01/2013

	Rates	Fringes
Ironworkers:		
Fence Erector	$ 26.58	17.74
Ornamental, Reinforcing and Structural	$ 33.00	26.30

PREMIUM PAY:

$6.00 additional per hour at the following locations:

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

$4.00 additional per hour at the following locations:

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

$2.00 additional per hour at the following locations:

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

LABO0067-002 12/01/2012

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

AREA "B" - ALPINE, AMADOR, BUTTE, CALAVERAS, COLUSA, DEL NORTE, EL DORADO, FRESNO, GLENN, HUMBOLDT, KINGS, LAKE, LASSEN, MADERA, MARIPOSA, MENDOCINO, MERCED, MODOC, MONTEREY, NAPA,

NEVADA, PLACER, PLUMAS, SACRAMENTO, SAN BENITO, SAN JOAQUIN, SANTA CRUZ, SHASTA, SIERRA, SISKIYOU, SOLANO, SONOMA, STANISLAUS, SUTTER, TEHAMA, TRINITY, TULARE, TUOLUMNE, YOLO AND YUBA COUNTIES

	Rates	Fringes
Asbestos Removal Laborer		
Areas A & B	$ 19.06	8.62
LABORER (Lead Removal)		
Area A	$ 36.25	9.19
Area B	$ 35.25	9.19

ASBESTOS REMOVAL-SCOPE OF WORK: Site mobilization; initial site clean-up; site preparation; removal of asbestos-containing materials from walls and ceilings; or from pipes, boilers and mechanical systems only if they are being scrapped; encapsulation, enclosure and disposal of asbestos-containing materials by hand or with equipment or machinery; scaffolding; fabrication of temporary wooden barriers; and assembly of decontamination stations.

LAB00067-006 06/28/2010

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

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

	Rates	Fringes
Laborers: (CONSTRUCTION CRAFT LABORERS - AREA A:)		
Construction Specialist Group	$ 27.84	15.82
GROUP 1	$ 27.14	15.82
GROUP 1-a	$ 27.36	15.82
GROUP 1-c	$ 27.19	15.82
GROUP 1-e	$ 27.69	15.82
GROUP 1-f	$ 27.72	15.82
GROUP 1-g (Contra Costa County)	$ 27.34	15.82
GROUP 2	$ 26.99	15.82
GROUP 3	$ 26.89	15.82
GROUP 4	$ 20.58	15.82

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

	Rates	Fringes
Laborers: (CONSTRUCTION CRAFT LABORERS - AREA B:)		
Construction Specialist Group	$ 26.84	15.82
GROUP 1	$ 26.14	15.82
GROUP 1-a	$ 26.36	15.82

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     GROUP 1-c...................$ 26.19            15.82
     GROUP 1-e...................$ 26.69            15.82
     GROUP 1-f...................$ 26.72            15.82
     GROUP 2.....................$ 25.99            15.82
     GROUP 3.....................$ 25.89            15.82
     GROUP 4.....................$ 19.58            15.82
  See groups 1-b and 1-d under laborer classifications.
Laborers: (GUNITE - AREA A:)
     GROUP 1.....................$ 28.10            15.82
     GROUP 2.....................$ 27.60            15.82
     GROUP 3.....................$ 27.60            15.82
     GROUP 4.....................$ 27.60            15.82
Laborers: (GUNITE - AREA B:)
     GROUP 1.....................$ 27.10            15.82
     GROUP 2.....................$ 26.60            15.82
     GROUP 3.....................$ 26.01            15.82
     GROUP 4.....................$ 25.89            15.82
Laborers: (WRECKING - AREA A:)
     GROUP 1.....................$ 27.14            15.82
     GROUP 2.....................$ 26.99            15.82
Laborers: (WRECKING - AREA B:)
     GROUP 1.....................$ 26.14            15.82
     GROUP 2.....................$ 25.99            15.82
Landscape Laborer (GARDENERS,
HORTICULTURAL & LANDSCAPE
LABORERS - AREA A:)
     (1) New Construction........$ 26.89            15.82
     (2) Establishment Warranty
     Period......................$ 20.58            15.82
Landscape Laborer (GARDENERS,
HORTICULURAL & LANDSCAPE
LABORERS - AREA B:)
     (1) New Construction........$ 25.89            15.82
     (2) Establishment Warranty
     Period......................$ 19.58            15.82

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

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LABORER CLASSIFICATIONS

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

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

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

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

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

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

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

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

GROUP 1-g, CONTRA COSTA COUNTY: Pipelayer (including grade checking in connection with pipelaying); Caulker; Bander; Pipewrapper; Conduit layer; Plastic pipe layer; Pressure pipe tester; No joint pipe and stripping of same, including repair of voids; Precast manhole setters, cast in place manhole form setters

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

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

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

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

GUNITE LABORER CLASSIFICATIONS

GROUP 1: Structural Nozzleman

GROUP 2: Nozzleman, Gunman, Potman, Groundman

GROUP 3: Reboundman

GROUP 4: Gunite laborer

WRECKING WORK LABORER CLASSIFICATIONS

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

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

LABO0185-002 07/01/2013

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

	Rates	Fringes
LABORER		
Mason Tender-Brick	$ 31.52	16.53

LABO0185-005 07/01/2013

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

	Rates	Fringes
Tunnel and Shaft Laborers:		
GROUP 1	$ 34.10	16.53
GROUP 2	$ 33.87	16.53
GROUP 3	$ 33.62	16.53
GROUP 4	$ 33.17	16.53
GROUP 5	$ 32.63	16.53
Shotcrete Specialist	$ 36.12	16.53

TUNNEL AND SHAFT CLASSIFICATIONS

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

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

GROUP 3: Bit grinder; Blaster, driller, powdermen, heading; Cherry pickermen - where car is lifted; Concrete finisher in tunnel; Concrete screedman; Grout pumpman and potman;

Gunite & shotcrete gunman & potman; Headermen; High pressure nozzleman; Miner - tunnel, including top and bottom man on shaft and raise work; Nipper; Nozzleman on slick line; Sandblaster - potman, Robotic Shotcrete Placer, Segment Erector, Tunnel Muck Hauler, Steel Form raiser and setter; Timberman, retimberman (wood or steel or substitute materials therefore); Tugger (for tunnel laborer work); Cable tender; Chuck tender; Powderman - primer house

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

GROUP 5: Grout crew; Reboundman; Swamper/ Brakeman

LABO0261-002 07/01/2009

MARIN COUNTY

	Rates	Fringes
LABORER (TRAFFIC CONTROL/LANE CLOSURE)		
Escort Driver, Flag Person..	$ 26.89	14.93
Traffic Control Person I....	$ 27.19	14.93
Traffic Control Person II...	$ 24.69	14.93

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

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

LABO0261-004 07/01/2013

MARIN COUNTY

	Rates	Fringes
Tunnel and Shaft Laborers:		
GROUP 1.....	$ 34.10	16.53
GROUP 2.....	$ 33.87	16.53
GROUP 3.....	$ 33.62	16.53
GROUP 4.....	$ 33.17	16.53
GROUP 5.....	$ 32.63	16.53
Shotcrete Specialist.....	$ 36.12	16.53

TUNNEL AND SHAFT CLASSIFICATIONS

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

GROUP 3: Bit grinder; Blaster, driller, powdermen, heading; Cherry pickermen - where car is lifted; Concrete finisher

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

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

GROUP 5: Grout crew; Reboundman; Swamper/ Brakeman

LABO0261-007 07/01/2013

MARIN COUNTY

	Rates	Fringes
LABORER		
Mason Tender-Brick	$ 32.77	16.53

LABO0324-004 07/01/2009

NAPA, SOLANO, AND SONOMA, COUNTIES

	Rates	Fringes
LABORER (TRAFFIC CONTROL/LANE CLOSURE)		
Escort Driver, Flag Person	$ 25.89	14.93
Traffic Control Person I	$ 26.19	14.93
Traffic Control Person II	$ 23.69	14.93

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

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

LABO0324-008 07/01/2013

NAPA, SOLANO, AND SONOMA COUNTIES

	Rates	Fringes
Tunnel and Shaft Laborers:		
GROUP 1	$ 34.10	16.53
GROUP 2	$ 33.87	16.53
GROUP 3	$ 33.62	16.53
GROUP 4	$ 33.17	16.53
GROUP 5	$ 32.63	16.53
Shotcrete Specialist	$ 36.12	16.53

TUNNEL AND SHAFT CLASSIFICATIONS

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

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

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

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

GROUP 5: Grout crew; Reboundman; Swamper/ Brakeman

LABO0324-010 07/01/2013

NAPA, SOLANO AND SONOMA COUNTIES

	Rates	Fringes
LABORER (Brick)		
Mason Tender-Brick.....	$ 31.95	16.53

LABO1414-005 08/07/2013

	Rates	Fringes
Plasterer tender.....	$ 30.00	16.36

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

PAIN0016-004 01/01/2013

MARIN, NAPA, SOLANO & SONOMA COUNTIES

	Rates	Fringes
Painters:.....	$ 33.86	20.26

PREMIUMS:
EXOTIC MATERIALS - $0.75 additional per hour.
SPRAY WORK: - $0.50 additional per hour.
INDUSTRIAL PAINTING - $0.25 additional per hour
[Work on industrial buildings used for the manufacture and processing of goods for sale or service; steel construction (bridges), stacks, towers, tanks, and similar structures]

HIGH WORK:
over 50 feet - $2.00 per hour additional
100 to 180 feet - $4.00 per hour additional
Over 180 feet - $6.00 per houir additional

PAIN0016-005 01/01/2013

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

	Rates	Fringes
DRYWALL FINISHER/TAPER	$ 36.24	18.67

PAIN0016-007 01/01/2013

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

	Rates	Fringes
Painters:	$ 29.06	15.98

SPRAY/SANDBLAST: $0.50 additional per hour.
EXOTIC MATERIALS: $1.00 additional per hour.
HIGH TIME: Over 50 ft above ground or water level $2.00 additional per hour. 100 to 180 ft above ground or water level $4.00 additional per hour. Over 180 ft above ground or water level $6.00 additional per hour.

PAIN0016-008 01/01/2013

MARIN, NAPA, SOLANO AND SONOMA COUNTIES

	Rates	Fringes
SOFT FLOOR LAYER	$ 44.87	17.98

PAIN0169-004 01/01/2013

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

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                                  Rates          Fringes

GLAZIER.........................$ 41.88           21.59
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* PAIN0567-001 07/01/2013

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


                                  Rates          Fringes

Painters:
     Brush and Roller............$ 23.30           10.19
     Spray Painter & Paperhanger.$ 24.15           10.19

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

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

-----------------------------------------------------------------
 PAIN0567-007 07/01/2013

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


                                  Rates          Fringes

SOFT FLOOR LAYER................$ 25.40           11.49
-----------------------------------------------------------------
 PAIN0567-010 07/01/2013

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


                                  Rates          Fringes

Drywall
     (1) Taper...................$ 27.07           11.14
     (2) Steeplejack - Taper,
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     over 40 ft with open space
     below.......................$ 28.57            11.14
-----------------------------------------------------------------
 PAIN0767-004 01/01/2013

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


                                  Rates          Fringes

GLAZIER.........................$ 32.24            19.88

  PAID HOLIDAYS: New Year's Day, Martin Luther King, Jr. Day,
  President's Day, Memorial Day, Independence Day, Labor Day,
  Veteran's Day, Thanksgiving Day, and Christmas Day.

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

-----------------------------------------------------------------
 PAIN1176-001 07/01/2013

HIGHWAY IMPR0VEMENT

                                  Rates          Fringes

Parking Lot Striping/Highway
Marking:
     GROUP 1.....................$ 28.27            11.65
     GROUP 2.....................$ 28.60            11.65
     GROUP 3.....................$ 26.96            11.65

CLASSIFICATIONS

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

  GROUP 2: Gamecourt & Playground Installer

  GROUP 3: Protective Coating, Pavement Sealing

-----------------------------------------------------------------
 PAIN1237-001 01/01/2013

ALPINE; COLUSA; EL DORADO (west of the Sierra Nevada
Mountains); GLENN; LASSEN (west of Highway 395, beginning at
Stacey and including Honey Lake); MODOC; NEVADA (west of the
Sierra Nevada Mountains); PLACER (west of the Sierra Nevada
Mountains); PLUMAS; SACRAMENTO; SHASTA; SIERRA (west of the
Sierra Nevada Mountains); SISKIYOU; SUTTER; TEHAMA; TRINITY;
YOLO AND YUBA COUNTIES


                                  Rates          Fringes

SOFT FLOOR LAYER................$ 28.25            16.73
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 PLAS0300-003 07/01/2009

                                  Rates          Fringes

PLASTERER
     AREA 295: Alpine, Amador,
     Butte, Colusa, El Dorado,
     Glenn, Lassen, Modoc,
     Nevada, Placer, Plumas,
     Sacramento, Shasta,
     Sierra, Siskiyou, Solano,
     Sutter, Tehema, Trinity,
     Yolo & Yuba Counties........$ 32.82            15.10
     AREA 355: Marin, Napa &
     Sonoma Counties.............$ 32.82            15.30
----------------------------------------------------------------
 PLAS0300-005 06/28/2010

                                  Rates          Fringes

CEMENT MASON/CONCRETE FINISHER...$ 28.65            18.56
----------------------------------------------------------------
 PLUM0038-002 07/01/2013

MARIN AND SONOMA COUNTIES

                                  Rates          Fringes

PLUMBER (Plumber,
Steamfitter, Refrigeration
Fitter)
     (1) Work on wooden frame
     structures 5 stories or
     less excluding hgih-rise
     buildings and commercial
     work such as hospitals,
     prisons, hotels, schools,
     casinos, wastewater
     treatment plants, and
     resarch facilities as well
     as refrigeration
     pipefitting, service and
     repair work - MARKET
     RECOVERY RATE...............$ 62.00            42.39
     (2) All other work - NEW
     CONSTRUCTION RATE...........$ 62.00            42.39
----------------------------------------------------------------
 PLUM0038-006 07/01/2013

MARIN & SONOMA COUNTIES

                                  Rates          Fringes

Landscape/Irrigation Fitter
(Underground/Utility Fitter).....$ 52.70            31.45
----------------------------------------------------------------
 PLUM0228-001 07/01/2013

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

PLUMBER.........................$ 36.70            24.69
----------------------------------------------------------------
 PLUM0343-001 07/01/2013

NAPA AND SOLANO COUNTIES

                                  Rates          Fringes

PLUMBER/PIPEFITTER
     Light Commercial............$ 30.60            19.40
     All Other Work..............$ 47.50            28.20

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

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

----------------------------------------------------------------
 PLUM0350-001 01/01/2011

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


                                  Rates          Fringes

PLUMBER/PIPEFITTER..............$ 34.60            10.50
----------------------------------------------------------------
 PLUM0355-001 07/01/2013

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


                                  Rates          Fringes

Underground Utility Worker
     /Landscape Fitter...........$ 28.55             8.30
----------------------------------------------------------------
 PLUM0442-003 07/01/2013
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AMADOR (South of San Joaquin River) and ALPINE COUNTIES

	Rates	Fringes
PLUMBER	$ 37.00	22.59

PLUM0447-001 07/01/2013

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

	Rates	Fringes
PLUMBER/PIPEFITTER		
Journeyman	$ 41.77	22.35
Light Commercial Work	$ 32.23	17.22

ROOF0081-006 08/01/2011

MARIN, NAPA, SOLANO AND SONOMA COUNTIES

	Rates	Fringes
Roofer	$ 33.16	10.90

ROOF0081-007 08/01/2012

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

	Rates	Fringes
Roofer	$ 32.33	11.97

SFCA0483-003 01/01/2014

MARIN, NAPA, SOLANO AND SONOMA COUNTIES

	Rates	Fringes
SPRINKLER FITTER (Fire Sprinklers)	$ 52.42	25.62

SFCA0669-003 07/01/2013

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

	Rates	Fringes
SPRINKLER FITTER	$ 34.19	19.37

SHEE0104-006 07/01/2013

MARIN, NAPA, SOLANO SONOMA & TRINITY COUNTIES

	Rates	Fringes
Sheet Metal Worker		
Mechanical Contracts		
$200,000 or less	$ 51.30	35.96
All other work	$ 52.80	34.46

SHEE0104-009 07/01/2013

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

	Rates	Fringes
SHEET METAL WORKER	$ 38.43	29.31

SHEE0104-010 07/01/2013

ALPINE COUNTY

	Rates	Fringes
SHEET METAL WORKER	$ 35.87	26.88

SHEE0104-011 07/01/2013

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

	Rates	Fringes
Sheet Metal Worker (Metal decking and siding only)	$ 38.43	29.31

SHEE0104-014 07/01/2013

MARIN, NAPA, SOLANO, SONOMA AND TRINITY COUNTIES

	Rates	Fringes
SHEET METAL WORKER (Metal Decking and Siding only)	$ 52.80	34.46

SHEE0104-019 07/01/2013

BUTTE, GLENN, LASSEN, MODOC, PLUMAS, SHASTA, SIERRA, SISKIYOU AND TEHAMA COUNTIES

	Rates	Fringes
SHEET METAL WORKER		
Mechanical Jobs $200,000 & under	$ 29.54	27.16

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     Mechanical Jobs over
     $200,000....................$ 38.43            29.31
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 TEAM0094-001 07/01/2013

                                  Rates          Fringes

Truck drivers:
     GROUP 1.....................$ 27.44            23.69
     GROUP 2.....................$ 27.74            23.69
     GROUP 3.....................$ 28.04            23.69
     GROUP 4.....................$ 28.39            23.69
     GROUP 5.....................$ 28.74            23.69

FOOTNOTES:
  Articulated dump truck; Bulk cement spreader (with or without
  auger); Dumpcrete truck; Skid truck (debris box); Dry
  pre-batch concrete mix trucks; Dumpster or similar type;
  Slurry truck: Use dump truck yardage rate.
  Heater planer; Asphalt burner; Scarifier burner; Industrial
  lift truck (mechanical tailgate); Utility and clean-up
  truck: Use appropriate rate for the power unit or the
  equipment utilized.


TRUCK DRIVER CLASSIFICATIONS

  GROUP 1: Dump trucks, under 6 yds.; Single unit flat rack (2-
  axle unit); Nipper truck (when flat rack truck is used
  appropriate flat rack shall apply); Concrete pump truck
  (when flat rack truck is used appropriate flat rack shall
  apply); Concrete pump machine; Fork lift and lift jitneys;
  Fuel and/or grease truck driver or fuel person; Snow buggy;
  Steam cleaning; Bus or personhaul driver; Escort or pilot
  car driver; Pickup truck; Teamster oiler/greaser and/or
  serviceperson; Hook tender (including loading and
  unloading); Team driver; Tool room attendant (refineries)

  GROUP 2: Dump trucks, 6 yds. and under 8 yds.; Transit
  mixers, through 10 yds.; Water trucks, under 7,000 gals.;
  Jetting trucks, under 7,000 gals.; Single-unit flat rack
  (3-axle unit); Highbed heavy duty transport; Scissor truck;
  Rubber-tired muck car (not self-loaded); Rubber-tired truck
  jumbo; Winch truck and "A" frame drivers; Combination winch
  truck with hoist; Road oil truck or bootperson;
  Buggymobile; Ross, Hyster and similar straddle carriers;
  Small rubber-tired tractor

  GROUP 3: Dump trucks, 8 yds. and including 24 yds.; Transit
  mixers, over 10 yds.; Water trucks, 7,000 gals. and over;
  Jetting trucks, 7,000 gals. and over; Vacuum trucks under
  7500 gals. Trucks towing tilt bed or flat bed pull
  trailers; Lowbed heavy duty transport; Heavy duty transport
  tiller person; Self- propelled street sweeper with
  self-contained refuse bin; Boom truck - hydro-lift or
  Swedish type extension or retracting crane; P.B. or similar
  type self-loading truck; Tire repairperson; Combination
  bootperson and road oiler; Dry distribution truck (A
  bootperson when employed on such equipment, shall receive
  the rate specified for the classification of road oil
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trucks or bootperson); Ammonia nitrate distributor, driver and mixer; Snow Go and/or plow

GROUP 4: Dump trucks, over 25 yds. and under 65 yds.; Water pulls - DW 10's, 20's, 21's and other similar equipment when pulling Aqua/pak or water tank trailers; Helicopter pilots (when transporting men and materials); Lowbedk Heavy Duty Transport up to including 7 axles; DW10's, 20's, 21's and other similar Cat type, Terra Cobra, LeTourneau Pulls, Tournorocker, Euclid and similar type equipment when pulling fuel and/or grease tank trailers or other miscellaneous trailers; Vacuum Trucks 7500 gals and over and truck repairman

GROUP 5: Dump trucks, 65 yds. and over; Holland hauler; Low bed Heavy Duty Transport over 7 axles

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is union or non-union.

Union Identifiers

An identifier enclosed in dotted lines beginning with characters other than "SU" denotes that the union classification and rate have found to be prevailing for that classification. Example: PLUM0198-005 07/01/2011. The first four letters , PLUM, indicate the international union and the four-digit number, 0198, that follows indicates the local union number or district council number where applicable , i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2011, following these characters is the effective date of the most current negotiated rate/collective bargaining agreement which would be July 1, 2011 in the above example.

Union prevailing wage rates will be updated to reflect any changes in the collective bargaining agreements governing the

rates.

0000/9999: weighted union wage rates will be published annually each January.

Non-Union Identifiers

Classifications listed under an "SU" identifier were derived from survey data by computing average rates and are not union rates; however, the data used in computing these rates may include both union and non-union data. Example: SULA2004-007 5/13/2010. SU indicates the rates are not union majority rates, LA indicates the State of Louisiana; 2004 is the year of the survey; and 007 is an internal number used in producing the wage determination. A 1993 or later date, 5/13/2010, indicates the classifications and rates under that identifier were issued as a General Wage Determination on that date.

Survey wage rates will remain in effect and will not change until a new survey is conducted.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

ATTACHMENT D

Department of Fish and Wildlife Grant Funding Outreach Requirements

1. INTRODUCTION

A. Funding for this project comes in part from a grant from the California Department of Fish and Wildlife Fisheries Restoration Grant Program, which requires outreach to minority, women, small, and disabled veteran's businesses.

B. The goal of this document is to notify Contractor of compliance measures required under federal and state regulations. However, this document shall not operate to relieve Contractor of its duty to become fully informed regarding applicable state and federal regulations.

C. Reporting of outreach efforts for both state and federal funding requirements can be combined on the reporting forms described in this document.

D. The following acronyms are sometimes used in this document and on related forms to describe various minority, women, small, and disabled veteran's businesses:

DBE Disadvantaged Business Enterprise:

For the purposes of this Contract, a DBE means a business enterprise that is owned and controlled by one or more socially and economically disadvantaged persons as defined by the Small Business Administration, Environmental Protection Agency, or US Department of Transportation.

SBE Small Business Enterprise:

For the purposes of this Contract, an SBE means a business enterprise that is independently owned and operated, not dominant in field operations, and has fewer than 100 employees as defined by the California Department of General Services, Small Business Eligibility Requirements. *See:* http://www.dgs.ca.gov/pd/programs/osds/sbeligibilitybenefits.aspx

DVBE Disabled Veteran Business Enterprise:

For the purposes of this Contract, a DVBE means a business enterprise that is owned and controlled by a veteran of the U.S. military, naval, or air service with a service- connected disability as defined by the California Department of General Services, Disabled Veteran Business Enterprise Eligibility Requirements. *See* http://www.dgs.ca.gov/pd/Programs/OSDS/DVBEEligibilityBenefits.aspx

E. The following acronyms are sometimes used in this document and on related forms to describe federal and state agencies that provide resources that should be used to conduct outreach efforts described in Section 2 (Outreach Requirements):

1. Small Business Administration (SBA)
2. Minority Business Development Agency (MBDA)

3. State of California Office of Small Business & Disabled Veteran Business Enterprise Services (OSDS)

F. To qualify as a DBE, a business must be certified by the U.S. EPA, U.S. Small Business Association, U.S. Department of Transportation, or by another state, local, tribal, or private entity whose certification criteria match those maintained by these federal agencies. To qualify as a SBE/DVBE, a business must be certified by the State of California Office of Small Business and DVBE Certification (OSDS). Evidence of such certification is required and shall be provided to the Owner with Document 00454 (Summary of Subcontractors/Suppliers/Vendors/Service Providers Hired).

2. OUTREACH REQUIREMENTS

A. Contractor must take the following affirmative steps during bidding and throughout the life of the Project to assure that DBE/SBE/DVBE firms are used whenever possible. Documentation of compliance with each step is required, as further specified in Section 5, below (How to Document Your Efforts).

B. Contractor shall take, and shall require all lower tier contractors suppliers, manufacturers, and consultants to take, the following steps, each time it or any of them is procuring services, supplies, or equipment for the duration of the Project:

STEP 1: Include qualified DBE/SBE/DVBE enterprises on solicitation lists.
Contractor shall ensure DBE/SBE/DVBE enterprises are made aware of contracting opportunities to the fullest extent possible through outreach and recruitment activities. For example, publish notices in trade papers or newspapers and advertise on the websites of the following agencies: SBA and MBDA. Additional online resources are listed in Paragraph 8, below.
STEP 2: Assure that DBE/SBE/DVBE enterprises are solicited whenever they are potential sources.
Solicitation should be as broad as possible and should occur throughout the life of the Project whenever procuring supplies, construction, or services. (See Step 5, below, for solicitation-related requirements.)
STEP 3: Divide the total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by DBE/SBE/DVBE enterprises.
Consider in the scope of work whether portions of the work could be feasibly procured with DBE/SBE/DVBE enterprises. This will include dividing total requirements into smaller tasks or quantities to permit maximum participation by DBE/SBE/DVBEs.

STEP 4: Establish delivery schedules, where the requirements of the work permit, which will encourage participation by DBE/SBE/DVBE enterprises.
Make information on opportunities available to DBE/SBE/DVBE enterprises well in advance, arrange time frames for contracts and establish delivery schedules in a way that encourages and facilitates participation by DBE/SBE/DVBEs.
STEP 5: In soliciting qualified firms, search and advertise with the U.S. Small Business Administration (SBA), the Minority Business Development Agency (MBDA), and the State Office of Small Business and Disabled Veteran Business Enterprise Certification (OSDS).
These agencies offer several services that are provided at no cost, including Internet access to databases of DBE/SBE/DVBE enterprises and, in the case of SBA and MBDA, the ability to post an advertisement seeking qualified DBE firms. Contractor must provide evidence (documentation) to Owner that SBA, MBDA, and OSDS were each used to solicit qualified DBE/SBE/DVBE enterprise bids. See Table 1 below for website addresses.
STEP 6: Require all subcontractors, suppliers and vendors to implement steps (1) through (5) above for procuring services, supplies, or equipment.
Contractor shall, at a minimum, insert language requiring compliance with this Section 1415, including all attachments thereto, in all agreements, contracts, purchase orders, or other such documents used to memorialize transactions with lower tier contractors suppliers, manufacturers, and consultants.

TABLE 1. ACCESSING REQUIRED RESOURCES AND PRODUCING DOCUMENTATION

Required Resources
1. Small Business Administration (SBA) A. Contractor shall search and advertise for DBE services and supplies at the SBA website. Documentation, including negative reports, is required. ➢ To perform searches for DBE firms, go to: ✓ http://web.sba.gov/pro-net/search/dsp_dsbs.cfm ➢ To document searches: Print Adobe PDF copy of search results from the website, showing website address, description of work, search criteria, and date of search. Use reasonably broad search criteria for geographic boundaries and work descriptions to maximize the probability of generating a list of qualified DBE/SBE/DVBEs. Contractor shall, as a minimum, seek DBE firms working in the same geographic area in which Contractor seeks subcontractors/services for a given solicitation. ➢ To post opportunities for DBE firms (registration required) go to: ✓ http://web.sba.gov/subnet ➢ To document postings: ✓ Print Adobe PDF copy of posting from the website, showing website address and date of post. B. Contractor shall send each entity on the list of qualified DBE from the search results above a solicitation. Documentation, including negative reports, is required. • Evidence that qualified DBE from the search results were solicited. Evidence may be in the form of emails, faxes, letters, or phone logs.

Required Resources

2. U.S. Department of Commerce Minority Business Development Agency (MBDA):

A. Contractor shall search and advertise for DBE services and supplies at the MBDA website. Documentation, including negative reports, is required.

- To perform searches for DBE firms, go to:
  - ✓ http://www.mbda.gov/index.cfm?fuseaction=bls.main
- To document searches:
  - ✓ Print Adobe PDF copy of search results from the website, showing website address, description of work, search criteria, and date of search. Use reasonably broad search criteria for geographic boundaries and work descriptions to maximize the probability of generating a list of qualified DBEs. Contractor shall, as a minimum, seek firms working in the same geographic area in which Contractor seeks subcontractors/services for a given solicitation.
- To post opportunities for DBE firms (registration required), go to:
  - ✓ www.mbda.gov/
- To document postings:
  - ✓ Print Adobe PDF copy of posting from the website, showing website address and date of post.

B. Contractor shall send each entity on the list of qualified DBEs from the search results above a solicitation. Documentation, including negative reports, is required:

- Evidence that qualified DBEs from the search results were solicited. Evidence may be in the form of emails, faxes, letters, or phone logs.

Required Resources

3. State of California Office of Small Business & Disabled Veteran Business Enterprise Services (OSDS):

A. Contractor shall search for SBE/DVBE services and supplies at the OSDS website. Documentation, including negative reports, is required.

- To perform searches for SBE/DVBE firms, go to:
  - ✓ http://www.dgs.ca.gov/pd/programs/osds.aspx.
- To document searches:
  - ✓ Print Adobe PDF copy of search results from the website, showing website address, description of work, search criteria, and date of search. Use reasonably broad search criteria for geographic boundaries and work descriptions to maximize the probability of generating a list of qualified SBE/DVBEs. Contractor shall, as a minimum, seek SBE/DVBE firms working in the same geographic area in which Contractor seeks subcontractors/services for a given solicitation.

B. Contractor shall send each entity on the list of qualified SBE/DVBEs from the search results above a solicitation. Documentation, including negative reports, is required:

- Evidence that qualified SBE/DVBEs from the search results were solicited. Evidence may be in the form of emails, faxes, letters, or phone logs.

C. OSDS site does not provide the ability to post opportunities.

5. REQUIRED DOCUMENTATION OF OUTREACH EFFORTS

A. Owner requires evidence that Contractor has followed the affirmative steps above.

B. Prior to Bid, use Document 00457 (Affirmative Steps Checklist) to document your DBE/SBE/DVBE enterprises solicitation efforts. Read it carefully, follow its directions, and attach required backup documentation described in Table 1 above.

C. After issuance of Notice of Intent to Award and for the duration of Project, use Document 00454 (Summary of Subcontractors/Suppliers/Vendors/Service Providers Hired) to document your DBE/SBE/DVBE enterprises solicitation efforts. Read it carefully, follow its directions, and attach required backup documentation described in Table 1 above.

D. In addition to the foregoing documentation requirements, Contractor shall provide semiannual reports on DBE/SBE/DVBE enterprises utilization using Document 00459 (Semi-Annual DBE/SBE/DVBE Procurement Report).

6. ADMINSTRATIVE REQUIREMENTS

A. Contractor shall pay its subcontractors/suppliers/vendors for satisfactory performance no more than 30 days from the Contractor's receipt of payment from the Owner; and

B. If a DBE/SBE/DVBE subcontractor/supplier/vendor fails to complete work under the subcontract for any reason, Contractor shall undertake the outreach steps described in Section 2, above, if soliciting a replacement subcontractor/supplier/vendor.

7. FAILURE TO COMPLY WITH REQUIREMENTS

A. Failure to comply with these requirements is a material breach of the Contract Documents, which may result in termination and/or such other remedies as Owner may deem appropriate.

8. OTHER USEFUL RESOURCES

The web sites in the table below offer resources for expanding searches for eligible DBEs beyond those required sources listed above.

Other Useful DBE Resources
California Public Utilities Commission (CPUC) CPUC maintains a database of DBE-owned business enterprises and serves to inform the public. http://www.cpuc.ca.gov/puc/supplierdiversity
California Department of Transportation (Caltrans) Based on the federal Disadvantaged Business Enterprises (DBE) program, Caltrans maintains a database and provides directories of minority and woman-owned firms. Always print the search results page(s) and keep them with the rest of the documentation. www.dot.ca.gov/hq/bep
North American Industry Classification System (NAICS Code Search Tools) Search by keyword or SIC code to get NAICS code http://www.naics.com/search.htm
U.S. EPA Office of Small, Disadvantaged Business Utilization (OSDBU) OSDBU's mission includes "fostering opportunities for partnerships, contracts, sub-agreements, and grants for small and socioeconomically disadvantaged concerns." One of the resources to assist prime contractors is a listing of small and disadvantaged businesses (a vendor profile system) registered with OSDBU. http://cfpub.epa.gov/sbvps/

SECTION 01416

REGULATORY REQUIREMENTS - LABOR COMPLIANCE

1.1 APPLICABILITY

A. This Project is funded in part through Proposition 84 (Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006), and as such requires the Owner to implement a Labor Compliance Program (LCP) approved by the Department of Industrial Relations.

1.2 GENERAL

A. Due to Proposition 84 funding for Project, Owner is required to operate a State-approved LCP pursuant to California Labor Code sections 1771.5 and 1771.7. All Contractors and Subcontractors shall be required to comply with Owner's LCP, as may be amended from time to time by Owner. If Owner adopts an amended or new LCP, Contractor will be provided with a copy of the new LCP, which shall be effective within 10 Days of Contractor's receipt thereof.

B. Contractor and Subcontractors are responsible for complying with each and every applicable prevailing wage law and Owner's Labor Compliance Program. Strict adherence to all provisions of the LCP is mandatory.

1.3 LABOR COMPLIANCE STANDARDS

A. Owner's LCP contains the labor compliance standards required by state and federal laws, regulations, and directives, as well as Owner policies and contract provisions, which include, but are not limited to, the following:

1. Payment of applicable general prevailing wage rates.
2. Record-keeping.
3. Employment of properly registered apprentices.
4. Providing certified payroll records upon request but not less than weekly.
5. Monitoring construction sites for the verification of proper payments of prevailing wage rates and work classification.
6. Pre-job conferences with contractors/subcontractors.
7. Communications with the State addressing and resolving noncompliance issues.
8. Withholding contract payments and imposing penalties for noncompliance.
9. Preparation and submittal of annual reports.

END OF SECTION

SECTION 01420

REFERENCES AND DEFINITIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Reference standards, abbreviations, symbols, definitions, and terminology used in Contract Documents.
B. Full titles are given in this Section for standards cited in other Sections of Specifications.
C. Material and workmanship specified by reference to number, symbol, or title of specific standard such as state standard, commercial standard, federal specifications, technical society, or trade association standard, or other similar standard, shall comply with requirements of standards except when more rigid requirements are specified or required by applicable codes.
D. Standards referred to, except as modified herein, shall have full force and effect as though printed in the Contract Documents. Standards are not furnished to Contractor because manufacturers and trades involved are assumed to be familiar with their requirements.

1.2 REFERENCE TO STANDARDS AND SPECIFICATIONS OF TECHNICAL SOCIETIES; REPORTING AND RESOLVING DISCREPANCIES

A. 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 (including all amendments, changes, errata, addenda, and supplements) in effect at the time of opening of Bids, except as may be otherwise specifically stated in the Contract Documents.
   1. When an edition or effective date of a reference is not given, it shall be understood to be the current edition or latest revision published as of the date of opening Bids.
      a. Exception: Comply with issues in effect as listed in governing legal requirements.
B. If during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents or between the Contract Documents and any provision of any such law or regulation applicable to the performance of the Work or of any such standard, specification, manual, or code, or of any instruction of any supplier, report it in writing at once by submitting a RFI to Owner, and do not proceed with the Work affected thereby until consent to do so is given by Owner.
C. Except as otherwise specifically stated in the Contract Documents or as may be provided by Change Order, CCD, or Supplemental Instruction, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:
   1. The provisions of any such standard, specification, manual, code, or instruction (whether or not specifically incorporated by reference in the Contract Documents); or
   2. The provisions of any such laws or regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such law or regulation).
D. No provision of any such standard, specification, manual, code, or instruction shall be effective to change the duties and 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 it be effective to assign to Owner, Engineer, or any of their consultants, agents, representatives or employees any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

E. Comply with the applicable portions of standards and specifications published by the technical societies, institutions, associations, and governmental agencies referred to in Specifications.

F. Referenced Grades, Classes, and Types: Where an alternative or optional grade, class, or type of product or execution is included in a reference but is not identified in Drawings or in Specifications, provide the highest, best, and greatest of the alternatives or options for the intended use and prevailing conditions.

G. Jobsite Copies:
   1. Obtain and maintain at the Site copies of reference standards identified on Drawings and in Specifications in order to properly execute the Work.
   2. At a minimum, the following shall be readily available at the Site:
      a. Safety Codes: State of California, Division of Industrial Safety regulations.

H. ASTM and ANSI References: Specifications and Standards of the American Society for Testing and Materials International (ASTM International) and the American National Standards Institute (ANSI) are identified in the Drawings and Specifications by abbreviation and number only and may not be further identified by title, date, revision, or amendment. It is presumed that Contractor is familiar with and has access to these nationally- and industry-recognized specifications and standards.

1.3 ABBREVIATIONS

A. Listed hereinafter are the various organizations or references which may appear in the Contract Documents, along with their respective acronyms and/or abbreviations:

AA	Aluminum Association
AABC	Associated Air Balance Council
AAMA	Architectural Aluminum Manufacturers Association
AAP	Affirmative Action Program
AASHTO	American Association of State Highway and Transportation Officials
AB	Aggregate Base
ABMA	American Bearing Manufacturers Association
ABPA	American Board Products Association
ACI	American Concrete Institute
ADA	Americans with Disabilities Act
AED	Association of Equipment Distributors
AFBMA	Anti-friction Bearing Manufacturers Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association, Inc.
ANSI	American National Standards Institute (formerly American Standards Association)
APA	American Plywood Association

API	American Petroleum Institute
ARI	Air-Conditioning and Refrigeration Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	ASTM International
AWCI	Association of the Wall and Ceiling Industries
AWG	American Wire Gauge
AWPA	American Wood-Preservers' Association
AWPB	American Wood Preservers Bureau
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIL	Basic Insulation Level
BOD	Biological Oxygen Demand
Cal/OSHA	California Occupational Safety and Health Administration
Caltrans	State of California, Department of Transportation
CBC	California Building Code
CCD	Construction Change Directive
CCR	California Code of Regulations
CEC	California Electric Code or California Energy Commission
CF	Cubic Foot or Cubic Feet
CFM	Cubic Feet per Minute
CFR	Code of Federal Regulations
CGA	Common Ground Alliance
CI	Chlorine Institute, Inc.
CISPI	Cast Iron Soil Pipe Institute
CL	Center Line
CLMFI	Chain Link Fence Manufacturers Institute
CMAA	Crane Manufacturers Association of America, Inc.
CMC	California Mechanical Code
CO	Change Order
COE	United States Army Corps of Engineers
CPC	California Plumbing Code
CPM	Critical Path Method
CPUC	California Public Utilities Commission
CRA	California Redwood Association
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standards, U.S. Department of Commerce
CSA	Canadian Standards Association
CY	Cubic Yard or Cubic Yards
DBE	Disadvantaged Business Enterprise
DFPA	Douglas Fir Plywood Institute
DFT	Dry Film Thickness
DHI	Door and Hardware Institute
EIA	Electronic Industries Association
EPA	Environmental Protection Agency

ETL	Electrical Testing Laboratories
FGMA	Flat Glass Marketing Association
FPS	Feet per Second or Fluid Power Society
FS	Federal Specifications
GA	Gypsum Association
GPM	Gallons Per Minute
Greenbook	Standard Specifications for Public Works Construction
HI	Hydraulic Institute
HMI	Hoist Manufacturer's Institute
HMMA	Hollow Metal Manufacturer's Association
HP	Horse Power
HPMA	Hardwood Plywood Manufacturers Association
HVAC	Heating, Ventilating and Air Conditioning
IACS	International Annealed Copper Standards
IAPMO	International Association of Plumbing and Mechanical Officials
ICBO	International Conference of Building Officials
ICEA	Insulated Cable Engineers Association
ID	Identification or Inside Diameter
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
ISA	International Society of Arboriculture
ISAS	Instrumentation, Systems, and Automation Society
ISO	International Organization for Standardization
JATC	Joint Apprenticeship Training Committee
JV	Joint Venture
LBE	Local Business Enterprise
LLC	Limited Liability Corporation or Company
LS	Lump Sum
M.I.	Middle Initial
M/WBE	Minority and/or Woman-Owned Business Enterprise
MBE	Minority Business Enterprise
MGD	Million Gallons per Day
MIA	Masonry Institute of America
MIA	Marble Institute of America
MLSFA	Metal Lath/Steel Framing Association
MS	Military Specifications
MSDS	Material Safety Data Sheet
MSS	Manufacturers Standardization Society of the Valve & Fitting Industry
NAAMM	National Association of Architectural Metal Manufacturers
NACE	National Association of Corrosion Engineers
NBS	National Bureau of Standards
NEC	National Electric Code
NEMA	National Electric Manufacturers Association
NESC	National Electrical Safety Code
NFoPA	National Forest Products Association
NFPA	National Fire Protection Association
NIC	Not In Contract
NIOSH	National Institute for Occupational Safety and Health

NIST	National Institute of Standards and Technology
NPT	National Pipe Thread
NRMCA	National Ready Mixed Concrete Association
NSF	National Sanitation Foundation
NTS	Not to Scale
NWWDA	National Wood Windows and Doors Association
OC	On Center
OD	Outside Diameter
OSHA	Occupational Safety and Health Administration
OSHPD	Office of Statewide Health Planning and Department
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PDI	Plumbing and Drainage Institute
PG&E	Pacific Gas and Electric Company
PL	Property Line
PLC	Programmable Logic Controller
PM	Preventive Maintenance
PPM	Parts per Million
PR	Proposal Request
PRMD	Permits and Resource Management Department, County of Sonoma
PS	Product Standard, U. S. Department of Commerce
PSF or psf	Pounds per Square Foot
PSI or psi	Pounds per Square Inch
PSIG	Pounds per Square Inch Gauge
PVC	Polyvinyl chloride
RC	Relative Compaction
RFI	Request for Information
RFP	Request for Proposals
RFS	Request for Substitution
RIS	Redwood Inspection Service
RPM	Revolutions per Minute
SAE	Society of Automotive Engineers
SDeI	Steel Deck Institute
SDoI	Steel Door Institute
SDR	Standard Dimension Ratio
SF	Square Foot or Square Feet
SFM	State of California, Office of State Fire Marshal
SIDR	Standard Inside Dimension Ratio
SIGMA	Sealed Insulating Glass Manufacturers Association
SJI	Steel Joint Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SPIB	Southern Pine Inspection Bureau
SSPC	Society for Protective Coating (formerly Steel Structures Painting Council)
SWI	Steel Window Institute
TCA	Tile Council of America
TIE	Time Impact Evaluation
TMS	The Masonry Society
TPI	Truss Plate Institute Inc.

UFC	Uniform Fire Code
UL	Underwriters' Laboratories, Inc.
UMC	Uniform Mechanical Code
UPC	Uniform Plumbing Code
USA	Underground Service Alert
USACE	United States Army Corps of Engineers
USC	United States Code
VOC	Volatile Organic Compounds
WBE	Women's Business Enterprise
WCLIB	West Coast Lumber Inspection Bureau
WHI	Warnock Hersey International
WIC	Woodwork Institute of California
WWPA	Western Wood Products Association
WWPI	Western Wood Preservers Institute

B. Abbreviations in Specifications:

cm	centimeter (centimeters)
Co.	Company
Corp.	Corporation
cu	Cubic
dia	diameter
Div	Division
ft	foot (feet)
g	gram (grams) or Standard Acceleration of Gravity
gal	gallon (gallons)
gpd	gallons per Day
hr	hour
in	inch (inches)
Inc.	Incorporated
kg	kilogram (kilograms)
km	kilometer (kilometers)
kVAR	kilovolts amperes reactive
kW	kilowatt
l	liter (liters)
lb(s)	Pound(s)
m	meter (meters)
mfr	manufacturer
mg	milligram (milligrams)
ml/mls	milliliter (milliliters)
mm	millimeter (millimeters)
No	number
sq	square
Sta	Station
T & G	tongue and groove
Typ	typical
US	United States
yd	yard (yards)

C. Abbreviations on Drawings:
   1. As listed for Specifications above.
   2. Additional abbreviations, used only on Drawings, are indicated thereon.

1.4 SYMBOLS

A. Symbols in Specifications:

:	"shall be" or "shall" - where used within sentences or paragraphs
#1	number
1#	pound
&	and
%	percent
C	Centigrade
F	Fahrenheit
°	degree
/	"per," except where used to combine words; example: power/fuel, and in that case it means "and"
"	inch (inches)
'	foot (feet)
@	at

B. Symbols on Drawings:
   1. As listed for Specifications above.
   2. Symbols, used only on Drawings, are indicated thereon.

1.5 DEFINITIONS

A. Wherever any of the words or phrases defined below, or a pronoun used in place thereof, is used in any part of the Contract Documents, it shall have the meaning here set forth. In the Contract Documents, the neuter gender includes the feminine and masculine, and the singular number includes the plural.

B. The following definitions shall apply regardless of capitalization unless the context otherwise requires:
   1. Wherever words "as directed," "as required," "as permitted," or words of like effect are used, it shall be understood that direction, requirements, or permission of Owner is intended. Words "sufficient," "necessary," "proper," and the like shall mean sufficient, necessary, or proper in judgment of Owner. Words "approved," "acceptable," "satisfactory," "favorably reviewed," or words of like import, shall mean approved by, or acceptable to, or satisfactory to, or favorably reviewed by Owner.
   2. Wherever the word "may" or "ought" is used, the action to which it refers is discretionary. Wherever the word "shall" or "will" is used, the action to which it refers is mandatory.
   3. Addenda: Written or graphic instruments issued prior to the opening of Bids, which clarify, correct, or change the bidding requirements or the Contract Documents. Addenda shall not include the minutes of the Pre-Bid Conference, if any, or Site Visit.

4. Agency: The Sonoma County Water Agency (SCWA), a public agency of the State of California, acting under and by virtue of the authority vested in the Owner by the laws of the State of California.
5. Agreement (Document 00520): Agreement is the basic Contract Document that binds the parties to construction Work. Agreement defines relationships and obligations between Owner and Contractor and by reference incorporates Conditions of Contract, Drawings, and Specifications and contains Addenda and all Modifications subsequent to execution of Contract Documents.
6. Alternate: Work added to or deducted from the base Bid, if accepted by Owner.
7. Application for Payment: Written application for monthly or periodic progress or final payment made by Contractor complying with the Contract Documents.
8. Approved Equal: Approved in writing by Owner as being of equivalent quality, utility and appearance.
9. Asbestos: Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by OSHA or Cal/OSHA.
10. Bid: The offer or proposal of the Bidder submitted on the prescribed form(s) setting forth the prices for the Work to be performed.
11. Bidder: One who submits a Bid.
12. Bidding Documents: All documents comprising the Project Manual (including all documents and Specification Sections listed in Document 00010 [Table of Contents]), including documents supplied for bidding purposes only and Contract Documents.
13. Board: The Board of Directors of the Owner.
14. Business Day: Any Day other than Saturday, Sunday, and the following days that have been designated as holidays by Owner. If a holiday falls on a Saturday, the preceding Friday will be the holiday. If a holiday falls on a Sunday, the following Monday will be the holiday.
    a. New Year's Day, January 1;
    b. Martin Luther King Jr.'s Birthday, third Monday in January;
    c. Lincoln's Birthday, February 12;
    d. Presidents' Day, third Monday in February;
    e. Memorial Day, last Monday in May;
    f. Independence Day, July 4;
    g. Labor Day, first Monday in September;
    h. Veterans' Day, November 11;
    i. Thanksgiving Day, as designated by the President;
    j. The Day following Thanksgiving Day;
    k. Christmas Day, December 25; and
    l. Each day appointed by the Governor of California and formally recognized by the Sonoma County Board of Supervisors as a day of mourning, thanksgiving, or special observance.
15. By Owner: Work that will be performed by Owner or its agents at the Owner's expense.

16. By Others: Work that is outside scope of Work to be performed by Contractor under this Contract, which will be performed by Owner, other contractors, or other means.
17. Change Order: A written instrument prepared by Owner and signed by Owner and Contractor, stating their agreement upon all of the following:
    a. a change in the Work;
    b. the amount of the adjustment in the Contract Sum, if any; and
    c. the amount of the adjustment in the Contract Time, if any.
18. Code Inspector: A local or state agency responsible for the enforcement of applicable codes and regulations.
19. Concealed: Work not exposed to view in the finished Work, including within or behind various construction elements.
20. Construction Change Directive ("CCD"): A written order prepared and signed by Owner, directing a change in the Work and stating a proposed basis for adjustment, if any, in the Contract Sum or Contract Time, or both.
21. Contract Conditions or Conditions of the Contract: Consists of two parts: General Conditions and Supplementary Conditions.
    a. General Conditions are general clauses that are common to the Owner Contracts, including Document 00700 (General Conditions).
    b. Supplementary Conditions modify or supplement General Conditions to meet specific requirements for these Contract Documents, including Document 00800 (Supplementary Conditions).
22. Contract Documents and Contract: Contract Documents and Contract shall consist of the documents identified as the Contract Documents in Document 00520 (Agreement), plus all changes, Addenda, and Modifications thereto.
23. Contract Modification: Either:
    a. a written amendment to Contract signed by Contractor and Owner; or
    b. a Change Order; or
    c. a Construction Change Directive; or
    d. a written directive for a minor change in the Work issued by Owner.
24. Contract Sum: The sum stated in the Agreement and, including authorized adjustments, the total amount payable by Owner to Contractor for performance of the Work and the Contract Documents. The Contract Sum is also sometimes referred to as the Contract Price or the Contract Amount.
25. Contract Time: The number or numbers of Days or the dates stated in the Agreement:
    a. to achieve Substantial Completion of the Work or designated Milestones; and/or
    b. to complete the Work so that it is ready for final payment and is accepted.
26. Contractor: The person or entity identified as such in the Agreement and referred to throughout the Contract Documents as if singular in number and neutral in gender. The term "Contractor" means the Contractor or its authorized representative.
27. Contractor's Employees: Persons engaged in execution of Work under Contract as direct employees of Contractor, as Subcontractors, or as employees of Subcontractors.
28. Day: One calendar day of 24 hours measured from midnight to the next midnight, unless the word "day" is specifically modified to the contrary.

29. Defective: An adjective which, when modifying the word "Work," refers to Work that is unsatisfactory or unsuited for the use intended, faulty, or deficient, that does not conform to the Contract Documents, or does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents (including but not limited to approval of Samples and "or equal" items), or has been damaged prior to final payment (unless responsibility for the protection thereof has been assumed by Owner). Owner is the judge of whether Work is Defective.
30. Drawings: The graphic and pictorial portions of Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.
31. Engineer: If used elsewhere in the Contract Documents, "Engineer" shall mean a person holding a valid California State Architect's or Engineer's license representing the Owner in the administration of the Contract Documents. Engineer may be an employee of or an independent consultant to Owner. When Engineer is referred to within the Contract Documents and no Engineer has in fact been designated, then the matter shall be referred to Owner. The term Engineer shall be construed to include employees of Engineer and/or employees that Engineer supervises. When the designated Engineer is an employee of Owner, his or her authorized representatives on the Project will be included under the term Engineer. If Engineer is an employee of Owner, Engineer is the beneficiary of all Contractor obligations to Owner, including without limitation, all releases and indemnities.
32. Equal: Equal in opinion of Owner. Burden of proof of equality is responsibility of Contractor.
33. Exposed: Work exposed to view in the finished Work, including behind louvers, grilles, registers and various other construction elements.
34. Final Acceptance or Final Completion: Owner's acceptance of the Work as satisfactorily completed in accordance with Contract Documents. Requirements for Final Acceptance/Final Completion include, but are not limited to:
    a. All systems having been tested and accepted as having met requirements of Contract Documents.
    b. All required instructions and training sessions having been given by Contractor.
    c. All required permitting reports.
    d. All Project Record Documents having been submitted by Contractor, reviewed by Owner, and accepted by Owner.
    e. All punch list Work, as directed by Owner, having been completed by Contractor.
    f. Generally all Work, except Contractor maintenance after Final Acceptance/Final Completion, having been completed to satisfaction of Owner.
35. Force Account: Work directed to be performed without prior agreement as to lump sum or unit price cost thereof, and which is to be billed at cost for labor, materials, equipment, taxes, and other costs, plus a specified percentage for overhead and profit.
36. Furnish: Supply only, do not install.
37. Indicated: Shown or noted on the Drawings.
38. Install: Install or apply only, do not furnish.

39. Latent: Not apparent by reasonable inspection, including but not limited to, the inspections and research required as a condition to bidding under Document 00700 (General Conditions).
40. Law: Unless otherwise limited, all applicable laws including without limitation all federal, state, and local laws, statutes, standards, rules, regulations, ordinances, and judicial and administrative decisions.
41. Material: This word shall be construed to embrace machinery, manufactured articles, materials of construction (fabricated or otherwise), and any other classes of material to be furnished in connection with Contract, except where a more limited meaning is indicated by context.
42. Milestone: A principal event specified in Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all Work.
43. Modification: Same as Contract Modification.
44. Not in Contract: Work that is outside the scope of Work to be performed by Contractor under Contract Documents.
45. Notice of Completion: Shall have the meaning provided in California Civil Code Section 9204, and any successor statute.
46. Off Site: Outside geographical location of the Project.
47. Owner: The Agency.
48. Owner-Furnished, Contractor-Installed: Items furnished by Owner at its cost for installation by Contractor at its cost under Contract Documents.
49. Owner's Representative(s): See Document 00520 (Agreement).
50. Partial Utilization: Use by Owner of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all of the Work.
51. PCBs: Polyclorinated byphenyls.
52. Phase: A specified portion of the Work (if any) specifically identified as a Phase in Document 00520 (Agreement) or Document 01100 (Summary).
53. Product Data: That information (brochures, catalog sheets, manufacturer's cut sheets, etc.) supplied by vendors having technical and commercial characteristics of the supplied equipment or materials and accompanying commercial terms such as warranties, instructions, and manuals.
54. Progress Report: A periodic report submitted by Contractor to Owner with progress payment invoices accompanying progress schedule. See Section 01320 (Progress Schedules and Reports) and Document 00700 (General Conditions).
55. Project: Total construction of which Work performed under Contract Documents may be whole or part.
56. Project Float: As defined in paragraph 1.2.B.3, Section 01320 (Progress Schedules and Reports).
57. Project Manual: Project Manual consists of Bidding Requirements, Agreement, Bonds, Certificates, Contract Conditions, Drawings, and Specifications.
58. Project Record Documents: All Project deliverables required under Sections 01700 et seq., including without limitation, as-built drawings; Project Record Specifications; Installation, Operation, and Maintenance Manuals; and Machine Inventory Sheets.

59. Provide: Furnish and install.
60. Request for Information ("RFI"): A document prepared by Contractor requesting information regarding the Project or Contract Documents as provided in Section 01250 (Modification Procedures). The RFI system is also a means for Owner to submit Contract Document clarifications or supplements to Contractor.
61. Request for Proposals ("RFP"): A document issued by Owner to Contractor whereby Owner may initiate changes in the Work or Contract Time as provided in Contract Documents. See Section 01250 (Modification Procedures).
62. Request for Substitution ("RFS"): A document prepared by Contractor requesting substitution of materials as permitted and to the extent permitted in Contract Documents. See Section 01600 (Product Requirements).
63. RFI-Reply: A document consisting of supplementary details, instructions, or information issued by Owner that clarifies or supplements Contract Documents, and with which Contractor shall comply. RFI-Replies do not constitute changes in Contract Sum or Contract Time except as otherwise agreed in writing by Owner. RFI-Replies will be issued through the RFI administrative system.
64. Samples: Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.
65. Sanitation Standards: The Sonoma County Water Agency Design and Construction Standards for Sanitation Facilities.
66. Shop Drawings: All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.
67. Shown: As indicated on Drawings.
68. Site: The particular geographical location of Work performed pursuant to Contract Documents.
69. Specifications: The written portion of the Contract Documents consisting of requirements for materials, equipment, construction systems, standards, and workmanship for the Work; performance of related services; and are contained in Divisions 1 through 16.
70. Specified: As written in Specifications.
71. Subcontractor: A person or entity that has a direct contract with Contractor to perform a portion of the Work at the Site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and neutral in gender and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.
72. Substantial Completion: The Work (or a specified part thereof) has progressed to the point where, in the opinion of Owner as evidenced by a Certificate of Substantial Completion, the Work is sufficiently complete, in accordance with Contract Documents, so that the Work (or specified part) can be utilized for the purposes for which it is intended; or if no such certificate is issued, when the Work (or specified part) is complete and ready for final payment as evidenced by written recommendation of

Owner for final payment. The terms "Substantially Complete" and "Substantially Completed" as applied to all or part of the Work refer to Substantial Completion thereof.

73. Superintendence: Executive oversight and charge of the main aspects of construction, including scheduling, sequence of subcontractor Work, and quality control.
74. Supplemental Instruction: A written directive from Owner to Contractor ordering alterations or Modifications that do not result in change in Contract Sum or Contract Time, and do not substantially change Drawings or Specifications. See Section 01250 (Modification Procedures).
75. Testing and special inspection agency: An independent entity engaged by Owner to inspect and/or test the workmanship, materials, or manner of construction of buildings or portions of buildings, to determine if such construction complies with the Contract Documents and applicable codes.
76. Underground Facilities: All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities that have been installed underground to furnish any of the following services or materials: Electricity, gases, chemicals, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems, or water.
77. Unit Price Work: Shall be the portions of the Work for which a unit price is provided in Document 00520 (Agreement) or Section 01100 (Summary).
78. Work: The entire completed construction, or the various separately identifiable parts thereof, required to be furnished under the Contract Documents within the Contract Time. Work includes and is the result of performing or furnishing labor and furnishing and incorporating materials and equipment into the construction, and performing or furnishing services and furnishing documents, all as required by the Contract Documents including everything shown in the Drawings and set forth in the Specifications. Wherever the word "work" is used, rather than the word "Work," it shall be understood to have its ordinary and customary meaning.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01450

QUALITY CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Contractor's Quality Control
B. Quality of the Work
C. Inspections and Tests by Governing Authorities
D. Inspections and Tests by Serving Utilities
E. Inspections and Tests by Manufacturer's Representatives
F. Tests and Inspections by Owner or Owner's Independent Testing and Inspection Agency
G. Additional Testing and Inspection

1.2 CONTRACTOR'S QUALITY CONTROL

A. Contractor's Quality Control: Ensure that products, services, workmanship, and Site conditions comply with requirements of Drawings and Specifications by coordinating, supervising, testing, and inspecting the Work and by utilizing only suitably qualified and appropriately audited, licensed, or trained personnel.
B. Quality Requirements: Work shall be accomplished in accordance with quality requirements of Drawings and Specifications, including, by reference, all codes, laws, rules, regulations, and standards. When no quality basis is prescribed, the quality and testing procedures shall be in accordance with the best-accepted practices of the construction industry for the locale of the Project, for projects of this type, or standards set by engineering or technical societies (e.g., ASTM or ASHRAE), whichever is more stringent.
C. Quality Control Personnel: Employ and assign knowledgeable and skilled personnel as necessary to perform quality control functions to ensure that the Work is provided as required.
D. At Contractor's expense, Contractor may employ a certified independent testing agency to perform compaction tests where there is disagreement. Owner may consider such tests, but will have the authority to make the final determination of relative compaction.
E. At Contractor's expense, Contractor may employ a certified independent welding inspection agency to perform welding inspections. Owner may consider such tests, but will have the authority to make the final determination of welding quality.

1.3 QUALITY OF THE WORK

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 indicated 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 advance 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. Cooperate by making Work available for inspection.
   2. Such verification may include mill, plant, shop, or field inspection as required.
   3. Provide access to all parts of the Work, including plants where materials or equipment are manufactured or fabricated.
   4. Provide all information and assistance as required, including that by and from subcontractors, fabricators, materials suppliers and manufacturers, for verification of quality by Owner.
   5. Applicable provisions of the Contract Documents shall govern Contract Modifications, if any, resulting from such verification activities.
G. Observations by Owner's Consultants: Periodic and occasional observations of Work in progress will be made by Owner and Owner's consultants as deemed necessary to review progress of Work and general conformance with design intent.
H. Limitations on Inspection, Test, and Observation: Neither employment of independent testing and inspection agency nor observations or tests by Owner and Owner's consultants shall in any manner relieve Contractor of obligation to perform Work in full conformance to all requirements of Contract Documents.
I. Owner's Acceptance and Rejection of Work: Owner reserves the right to reject all Work not in conformance with the requirements of the Drawings and Specifications, or otherwise Defective.
J. Correction of Defective Work: Defective Work shall be modified, replaced, repaired or redone by the Contractor at no change in Contract Sum or Contract Time.
K. Acceptance of Defective Work: Acceptance of Defective Work, without specific written acknowledgement and approval of Owner, shall not relieve the Contractor of the obligation to correct such Work.
L. Contract Adjustment for Defective Work: Should Owner determine that it is not feasible or in Owner's interest to require Defective Work to be repaired or replaced, an equitable reduction in Contract Sum shall be made by agreement between Owner and Contractor. If equitable amount cannot be agreed upon, a Construction Change Directive will be issued and the amount in dispute resolved in accordance with applicable provisions of Document 00700 (General Conditions).
M. Non-Responsibility for Defective Work: Owner and Owner's consultants disclaim any and all responsibility for Work produced not in conformance with the Drawings and Specifications.
N. Responsibility for Defective Work: Contractor shall have full responsibility for all consequences resulting from Defective Work, including without limitation all delays, disruptions, extra inspection and correction costs by Contractor and Owner and re-Work, and extra time and costs of all types. Contractor waives excuses for Defective Work relating to Owner's prior review of Submittals and/or prior failure to notice Defective Work in place on inspection.

1.4 INSPECTIONS AND TESTS BY GOVERNING AUTHORITIES

A. Regulatory Requirements for Testing and Inspection: Comply with CBC requirements and all other requirements of governing authorities having jurisdiction.
B. Inspections and Tests by Governing Authorities: Cause all tests and inspections required by governing authorities having jurisdiction to be made for Work under this Contract.
   1. Such authorities may include, but are not limited to PRMD, Fire Department, and similar agencies.
   2. Except as specifically noted, scheduling, conducting and paying for such inspections shall be solely the Contractor's responsibility.

1.5 INSPECTIONS AND TESTS BY SERVING UTILITIES

A. Inspections and Tests by Serving Utilities: Cause all tests and inspections required by serving utilities to be made for Work under this Contract. Scheduling, conducting, and paying for such inspections shall be solely the Contractor's responsibility.

1.6 INSPECTIONS AND TESTS BY MANUFACTURER'S REPRESENTATIVES

A. Inspections and Tests by Manufacturer's Representatives: Cause all tests and inspections specified to be conducted by materials or systems manufacturers to be made. Additionally, all tests and inspections required by materials or systems manufacturers as conditions of warranty or certification of Work shall be made, the cost of which shall be included in the Contract Sum.

1.7 TESTS AND INSPECTIONS BY OWNER OR OWNER'S INDEPENDENT TESTING AND INSPECTION AGENCY

A. Owner may conduct or Owner may select an independent testing and inspection agency or agencies to conduct tests and inspections as indicated on Drawings, in Specifications, and as required by governing authorities having jurisdiction.
B. Responsibility for payment for such tests and inspections shall be as indicated in paragraph 1.7D below. All time and costs for Contractor's service related to such tests and inspections shall be included in Contract Time and Contract Sum.
C. Contractor shall pay for all additional charges by testing and inspection agencies and governing authorities having jurisdiction due to the following:
   1. Contractor's failure to properly schedule or notify testing and inspection agency or authorities having jurisdiction.
   2. Changes in sources, lots, or suppliers of products after original tests or inspections.
   3. Changes in means, methods, techniques, sequences, and procedures of construction that necessitate additional testing, inspection, and related services.
   4. Changes in mix designs for concrete and mortar after review and acceptance of submitted mix design.
   5. Contractor-submitted requests to change materials or products, which are accepted, but require testing and/or reinspection beyond original design.
D. In addition to tests to be performed by Contractor (and to be paid by Contractor) as required elsewhere in Contract Documents, tests and special inspections that may be performed by Owner or Owner's independent testing and inspection agency or agencies and paid by Owner include, but are not limited to, the following:

SECTION	TESTS
02300	Relative compaction
"	Sieve analysis
"	Sand equivalence
"	Durability index
"	Liquid limit
"	Plasticity index
02316	Relative compaction
"	Sieve analysis
"	Sand equivalence
"	Durability index
03308	Concrete slump
"	Concrete compressive strength
03311	Waterstop fittings
15050	Bacteriological test

E. Owner may perform tests at any time at its discretion.

F. California Test Method No. 216 (Relative Compaction of Untreated and Treated Soils and Aggregates) and 231 (Relative Compaction of Untreated/Treated Soils and Aggregates [Area Concept Utilizing Nuclear Gauges]) may be modified as follows:
   1. In lieu of the specified 10-pound hammer, a Test Lab Model No. F-590 Mechanical Compactor (or equal) with a 10-pound hammer will be used.
   2. In lieu of the specified split cylindrical mold, a non-split cylindrical mold of the same diameter and wall thickness will be used.
   3. Any of the provisions of Test Method No. 216 which conflict with the use of such equipment described in (1) and (2) are considered void to the extent they preclude the use of such equipment.
   4. In lieu of the specified test form, an Owner standard form will be used.
   5. Correction for oversize material may be obtained from a table based upon the given equations and the coefficient for +3/4-inch aggregate will be computed from the following formulae:

      $Y = 1.0$ for $P = 10$ to 20
      $Y = 1.0 - .002 (P - 20)$ for $P = 20$ to 50

      where:

      Y = coefficient for 3/4" aggregate
      P = percent retained on 3/4" screen

   6. In lieu of the sand cone method of determination of in-place density, the method described in Part 1 of California Test Method 231 will be used except that the mode of operation and the probe depth will be determined by Owner.
   7. In-place density and relative compaction will be determined on the basis of individual test sites in lieu of the area concept.

G. Test and Inspection Reports: After each inspection and test by an independent testing and inspection agency or agencies, one copy of report shall be promptly submitted to Owner, who will distribute copies to Contractor and any agency having jurisdiction (if required by Code).
   1. Reports shall clearly identify the following:

a. Date issued.
b. Project name and number.
c. Identification of product and Specifications Section in which Work is specified.
d. Name of inspector.
e. Date and time of sampling or inspection.
f. Location in Project where sampling or inspection was conducted.
g. Type of inspection or test.
h. Date of test.
i. Results of tests.
j. Comments concerning conformance with Contract Documents and other requirements.

2. Test reports shall indicate specified or required values and shall include statement whether test results indicate satisfactory performance of products.
3. Samples taken but not tested shall be reported.
4. Test reports shall confirm that methods used for sampling and testing conform to specified test procedures.
5. When requested, testing and inspection agency shall provide interpretations of test results.

H. Contractor Responsibilities for Inspections and Tests:
1. Unless specified otherwise, notify Owner and testing agency 72 hours in advance of expected time of each test and inspection, and for all other operations requiring inspection and testing services, by submitting Contractor's inspection request in writing (or, if Owner provides a specific form, on that form).
   a. When tests or inspections cannot be performed after such notice, due to Contractor's negligence, reimburse Owner for testing and inspection agency personnel and travel expenses incurred.
2. Deliver to laboratory or designated location, adequate samples of materials proposed to be used that require advance testing, together with proposed mix designs.
3. Cooperate with testing and inspection agency personnel, Owner, and Owner's consultants. Provide access to Work areas and off-Site fabrication and assembly locations, including during weekends and after normal Work hours.
4. Provide incidental labor and facilities to provide safe access to Work to be tested and inspected, to obtain and handle Samples at the Site or at source of products to be tested, and to store and cure test Samples.
5. Provide, at least 15 Days in advance of first test or inspection of each type, a schedule of tests or inspections indicating types of tests or inspections and their scheduled dates.

1.8 ADDITIONAL TESTING AND INSPECTION

A. If initial tests or inspections made by Owner or the testing and inspection agency reveal that materials do not comply with Contract Documents, or if Owner has reasonable doubt that materials do not comply with Contract Documents, additional tests and inspections shall be made as directed.
1. If additional tests and inspections establish that materials comply with Contract Documents, Owner shall pay all costs for such tests and inspections.
2. If additional tests and inspections establish that materials do not comply with Contract Documents, all costs of such tests and inspections shall be deducted from Contract Sum.

3. If Work requiring inspection is covered by follow-on or follow-up Work before it is inspected, uncover Work so proper inspections can be performed. All costs of such tests and inspections shall be deducted from Contract Sum.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01500

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Temporary Electricity
2. Temporary Telephone
3. Temporary Water
4. Temporary Sanitary Facilities
5. Temporary Barriers and Enclosures
6. Tree and Plant Protection
7. Water Control
8. Noise Control
9. Storm Water Pollution Prevention Plan
10. Removal of Temporary Facilities and Controls

1.2 DEFINITIONS

A. Dripline: The area on the ground from the trunk of any tree to the point directly below the outermost tips of the foliage of that tree.

B. Tree damage: Tree damage shall include, but not be limited to, the following: significant injury to the root system or other parts of a tree including burning, application of toxic substances, damaging through contact with equipment or machinery, changing the natural grade within the Dripline, compacting the soil within the Dripline, interfering with the normal water requirements of the tree, unauthorized trenching or excavating within the Dripline, or unauthorized removal of more than 1/3 of the live wood, foliage, or roots.

1.3 SUBMITTALS

A. Tree Protection Plan, prepared by a Certified Arborist

1.4 TEMPORARY ELECTRICITY

A. Provide, maintain, and pay for electrical power at the Site for construction purposes.

1.5 TEMPORARY TELEPHONE

A. Provide, maintain, and pay for telephone service to field office at time of Project mobilization.

1.6 TEMPORARY WATER

A. Provide, maintain, and pay for suitable quality water service required for construction operations.

1.7 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required temporary buildings with sanitary toilets for use of all workers.

B. Comply with all minimum requirements of the Health Department or other public agency having jurisdiction; maintain in a sanitary condition at all times.

1.8 TEMPORARY BARRIERS AND ENCLOSURES

A. Provide barriers to prevent unauthorized entry to construction areas, to allow for Owner's use of Site, and to protect existing facilities and adjacent properties from damage from construction operations.
B. Provide barricades required by governing authorities to control public access to existing buildings.
C. Protect vehicular traffic, stored materials, Site, and structures from damage.
D. Provide temporary construction fence around active construction areas, including excavations, construction equipment, stockpile, and storage areas to exclude unauthorized access.

1.9 TREE AND PLANT PROTECTION

A. Root protection:
   1. No storage of materials or equipment will be allowed within the Dripline.
   2. Whenever possible, excavation shall be on a radial line, diverging from the tree trunk.
B. Exposure to harmful substances: No storage or dumping of any substances that may be harmful to trees shall occur at any location on the Site.
C. Where construction is to be performed in the vicinity of trees and shrubbery, the Work shall be carried on in a manner that will cause minimum damage. Owner will designate trees that are to be removed. Under no circumstances are additional trees to be removed without written permission from Owner. Trees and shrubbery that are not to be removed shall be protected from injury or damage resulting from Contractor's operations.
D. Limb Protection: Use small construction equipment as necessary to minimize removal of or avoid damage to overhanging tree branches. Remove limbs only when directed by Owner. Prune or remove limbs, if authorized, in accordance with ANSI A300. Owner will provide a copy of the guidelines upon request. "Heading" of any tree will not be permitted.
E. All damage shall be immediately reported to Owner, who will file a report so that remedies may be determined.
F. For any tree that is removed without Owner's permission or is irreparably damaged, in the opinion of Owner, Owner may elect to pursue any of the following remedies in its sole discretion:
   1. Require Contractor to repair by pruning, if possible, or replace trees not intended for removal. Whether or not a tree can be repaired by pruning will be determined by Owner. Subsequent pruning, if appropriate, shall be conducted by a Certified Arborist at Contractor's expense.
   2. Require Contractor to remove trees that cannot be repaired by pruning, and replace with new trees of minimum 4 inch caliper.
G. Assess money damages in the amount of $27.00 per square inch of cross section, measured at 4 ½ feet above ground, but not less than $250.00, which damages shall be deducted from monies due or to become due under the Contract. If tree protection is not performed or is not performed adequately, and Owner determines that a tree has been irreparably damaged, Owner may assess the same damages as for unauthorized removal of a tree.

1.10 WATER CONTROL

A. See Section 02240 (Dewatering) for information on ground and surface water control/diversion.

1.11 NOISE CONTROL

A. Work that produces noise levels above ambient in the nearby neighborhood will not be permitted between the hours of 5 p.m. and 7 a.m.

1.12 STORM WATER POLLUTION PREVENTION PLAN

A. Prior to commencement of Work at the Site, obtain Owner approval on a Storm Water Pollution Prevention Plan (SWPPP) prepared in accordance with:
   1. The Caltrans Storm Water Quality Handbooks:
      a. Storm Water Pollution Prevention Plan (SWPPP) and Water Pollution Control Program (WPCP) Preparation Manual; and
      b. Construction Site Best Management Practices (BMPs) Manual.
   2. State Water Resources Control Board (SWRCB), Order No. –2009-0009 – DWQ, National Pollutant Discharge Elimination System (NPDES), General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Construction General Permit). The permit is available at Owner's office or is available online at: http://www.swrcb.ca.gov/water_issues/programs/stormwater/constpermits.shtml. The requirements of this order replace and supersede State Water Board Orders No 99-08-DWQ and 2003-0007-DWQ.

B. Develop and implement a monitoring program in accordance with the requirements of the General Permit to verify compliance with the General Permit.

C. Submit SWPPP to Owner for review in accordance with Section 01330 (Submittal Procedures). Provide the SWPPP to Owner prior to commencement of Work at the Site.

D. The SWPPP shall include all of the requirements in paragraphs 1.12A, 1.12B, and 1.12C of this Section 01500. Particular attention shall be paid to:
   1. Site Map
   2. Locations of all equipment and materials storage
   3. Location and containment for fueling area, construction entrances, and concrete washouts
   4. Locations of all other staging areas, stockpile areas, and disposal sites.
   5. Location of sanitation facilities
   6. All erosion and sediment control BMPs, as well as non-storm water BMPs
   7. Dewatering plan
   8. Dust control on levee roads, utilizing magnesium chloride concentrate

E. Water Pollution Control Drawings shall be of sufficient size and scale to detail BMP locations. Remove all extraneous information from the base sheets to improve clarity, including geometric equations, notes, details, and all data not related to water pollution control work. Use a copy of the appropriate Drawing(s) as a base sheet(s) with the pertinent stage of construction drawn in as an overlay to accurately reflect Site conditions at various phases of construction. Provide enlarged detail mapping as necessary to detail BMP locations.

F. Revise and update the SWPPP whenever there is a change in construction operations that may affect the Site drainage patterns or discharge of pollutants to surface waters, groundwaters, or a separate municipal storm sewer system.

G. Failure to fully comply with the requirements of the General Permit shall subject Contractor to all fines, damages, and job delays incurred due to failure to implement the SWPPP.

H. Keep a copy of the General Permit, together with updates and revisions at the Site.

I. Furnish SWPPP to Owner upon Owner's request.

1.13 REMOVAL OF TEMPORARY FACILITIES AND CONTROLS

A. Remove temporary utilities, equipment, facilities, and materials prior to final inspection.
B. Clean and repair damage caused by installation or use of temporary Work.
C. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01540

SITE SECURITY AND SAFETY

PART 1 GENERAL

1.1 SUBMITTALS

A. Safety Program.
B. Fire Protection Plan.

1.2 PROTECTION

A. Continuously maintain protection as necessary to protect the Work, as a whole and in part, and adjacent property and improvements from accidents, injuries or damage.
B. Properly protect the Work:
   1. With lights, guard rails, temporary covers and barricades.
   2. Enclose excavations with proper barricades.
   3. Brace and secure all parts of the Work against storm and accident.
   4. Provide such additional forms of protection that may be necessary under existing circumstances.
C. Provide and maintain in good condition all protective measures required to adequately protect the public from hazards resulting from the Work and to exclude unauthorized persons from the Work. When regulated by Building Code, Cal OSHA, or other authority, such legal requirements for protection shall be considered as minimum requirements. Be responsible for the protection in excess of such minimum requirements as required.

1.3 CONTROL OF SITE

A. Ensure that no alcohol, firearms, weapons, or controlled substance enters or is used at the Site. Immediately remove from the Site and terminate the employment of any employee found in violation of this provision.

1.4 SAFETY PROGRAM

A. Prior to starting any Work at the Site, submit a Safety Program that has been reviewed and approved by an Industrial Hygienist certified by the American Board of Industrial Hygiene or by a Certified Safety Professional. The Safety Program shall include the name, certification number, and certification seal of the Industrial Hygienist or Certified Safety Professional. Comply with the Safety Program and all applicable federal, state, and local regulation codes, rules, law and ordinances.
B. Receipt and/or review of the Safety Program by Owner, Engineer or Owner's Representative shall not relieve Contractor of any responsibility for complying with all applicable safety regulations.
C. It is essential that Contractor and each Subcontractor implement an effective and vigorous Safety and Health Program to cover their respective portions of the Work. Subject to Contractor's overall responsibility for Project safety, it shall be understood that the full responsibility for providing a safe place to work with respect to their respective portions of the Work rests with each individual Contractor and Subcontractor.
D. Safety Program components:
   1. Injury and Illness Prevention Program (IIPP): Conforming to the General Industrial Safety Orders (CCR Title 8, Division 1, Chapter 4, Subchapter 7, Section 3203), and the California Labor Code (Section 6401.7).

2. Site-Specific Safety and Health Plan (SSHP): Describing health and safety procedures that shall be implemented during the Work in order to ensure safety of the public and those performing the Work. Follow the guidelines for a SSHP listed in CCR Title 8, Division 1, Chapter 4, Subchapter 7, Section 5192, Item (b)(4) f.

E. The wearing of hard hats shall be mandatory at all times for personnel on Site. Supply sufficient hard hats to equip properly all employees and visitors.

F. Whenever an exposure exists, appropriate personal protective equipment (PPE) shall be used by all affected personnel. Supply PPE to all personnel under Contractor's direction.

1.5 SAFETY REQUIREMENTS

A. Standards: Maintain the Project in accordance with state and local safety and insurance standards.

B. Hazards Control:
   1. Store volatile wastes in covered metal containers and remove from premises daily.
   2. Prevent accumulation of wastes that create hazardous conditions.
   3. Provide adequate ventilation during use of volatile or noxious substances.
   4. Contact the local fire agency and the Sonoma County Department of Environmental Health for any Site-specific requirements regarding hazardous materials or hazardous waste containment or handling.

C. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
   1. Do not burn or bury rubbish or waste material on the Site.
   2. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
   3. Do not dispose of wastes into streams or waterways.

D. Provide accident information on the forms provided by Contractor. This information shall be provided on the same Day as the occurrence of said incident.

1.6 SITE SAFETY OFFICER

A. Designate one of Contractor's staff as "Site Safety Officer" whose duties shall include the responsibility for enforcing the environmental protection provisions of the Contract Documents including safety and health, the requirements of the Occupational Safety and Health Act, and other applicable federal, state and local standards. Submit for review by Owner Contractor's intended traffic flow plan, security plan, program for temporary structures, housecleaning plan, demolition program, and environmental safety and health plan. After review by Owner, the implementation and enforcement of these plans shall become the responsibility of the Site Safety Officer. Any changes in the plans shall be requested by Contractor through the Site Safety Officer for written concurrence by Owner.

B. Owner's risk management representative(s) shall be allowed access to accident/injury and illness reports, inspection reports, scheduling and construction meetings, and safety meetings.

1.7 FIRE PROTECTION PLAN

A. Prior to starting any Work at the Site, submit a fire protection plan that has been reviewed and approved by the Forestville Fire Protection District. It is recommended that the plan include, but not be limited to, a discussion of the following items:
   1. Equipment spark arresters
   2. Fire-extinguishing equipment on hand
   3. Method of operation in case of fire

4. Notification to authorities of any fire
5. Access available during performance of Work
6. Educating workers of fire protection plan
7. Storage protection for flammable materials
8. Ventilation and illumination equipment

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01600

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products
B. Product Options and Substitutions
C. Product Delivery Requirements
D. Product Storage and Handling

1.2 PRODUCTS

A. Products: New material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying, and erection of the Work. Products may also include existing materials or components required for reuse.
B. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.
C. For similar components, provide interchangeable components of the same manufacturer.

1.3 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Summary:
   1. This paragraph 1.3 describes procedures for selecting products and requesting substitutions of unlisted materials in lieu of materials named in the Specifications or approved for use in Addenda that were not already the subject of a Document 00660 (Substitution Request Form) submittal as provided in Document 00200 (Instructions to Bidders).
B. For products specified by naming one manufacturer only, Owner believes that the manufacturer listed is capable of producing equipment or products that will satisfy the requirements of the associated Specification. This statement, however, shall not be construed as an endorsement of a particular manufacturer's product, nor shall it be construed that a named manufacturer's standard product will comply with the requirements of the associated Specification. In such cases, the Owner is not aware of an equal manufacturer.
C. Contractor's Options:
   1. For products specified only by reference standard: Select any product meeting that standard.
   2. For products specified by naming one or more products or manufacturers:
      a. Select products of any named manufacturer meeting Specifications.
      b. If product becomes unavailable due to no fault of Contractor or if the product specified no longer complies with local regulations or laws, submit Request for Substitution (RFS), including all information contained in this Section 01600 and a fully executed Document 00660 (Substitution Request Form), but using the term "Contractor" each place the term "Bidder" appears in that form.
D. Substitutions:
   1. Except as provided in Document 00200 (Instructions to Bidders) with respect to "or Approved Equal" items, Owner will consider Contractor's substitution requests only when product becomes unavailable due to no fault of Contractor or if the product

specified no longer complies with local regulations or laws. Requests for review of proposed substitute items will not be accepted from anyone other than Contractor. The RFS shall state the extent, if any, to which the evaluation and acceptance of the proposed substitute will prejudice Contractor's achievement of Substantial Completion on time, and whether or not acceptance of the substitute for use in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for work on the Project).

2. Submit separate RFS for each product and support each request with:
   a. Product identification.
   b. Manufacturer's literature.
   c. Samples, as applicable.
   d. Name and address of similar projects on which product has been used, and dates of installation.
   e. Name, address, and telephone number of manufacturer's representative or sales engineer.
   f. For construction methods: Detailed description of proposed method; drawings illustrating methods.
3. Where required, itemize a comparison of the proposed substitution with product specified and list significant variations including, but not limited to dimensions, weights, service requirements, and functional differences. If variation from product specified is not pointed out in submittal, variation will be rejected even though submittal was favorably reviewed. Identify all variations of the proposed substitute from that specified in the RFS and indicate available maintenance, repair, and replacement service.
4. State whether the substitute will require a change in any of the Contract Documents (or provisions of any other direct contract with Owner for work on the Project) to adapt the design of the proposed substitute, and whether or not incorporation or use of the substitute in connection with Work is subject to payment of any license fee or royalty. Submit data relating to changes in construction schedule.
5. Include accurate cost data comparing proposed substitution with product and amount of net change in Contract Sum including, but not limited to, an itemized estimate of all costs or credits that will result directly or indirectly from acceptance of such substitute, including costs of redesign and claims of other contractors affected by the resulting change, all of which will be considered by Owner in evaluating the proposed substitute. Owner may require Contractor to furnish additional data about the proposed substitute.
6. Owner will not consider substitutions for acceptance (or, in Owner's sole discretion, Owner may make Contractor solely responsible for all resulting costs, expenses and other consequences) when a substitution:
   a. Results in delay meeting construction Milestones or completion dates.
   b. Is indicated or implied on submittals without formal request from Contractor.
   c. Is requested directly by Subcontractor or supplier.
   d. Acceptance will require substantial revision of Contract Documents.
   e. Disrupts Contractor's job rhythm or ability to perform efficiently.
7. Substitute products shall not be ordered without written acceptance of Owner.
8. Owner will determine acceptability of proposed substitutions and reserve right to reject proposals due to insufficient information.
9. Accepted substitutions will be evidenced by a Change Order or a CCD. All Contract Document requirements apply to Work involving substitutions.

E. Contractor's Representation and Warranty:
   1. Contractor's RFS constitutes a representation and warranty that Contractor:
      a. Has investigated proposed product and determined that it meets or exceeds, in all respects, specified product.
      b. Will provide the same warranty for substitution as for specified product.
      c. Will coordinate installation and make other changes that may be required for Work to be complete in all respects.
      d. Waives claims for additional costs which may subsequently become apparent.
      e. Will compensate Owner for additional redesign costs associated with substitution.
      f. Will be responsible for Construction Schedule slippage due to substitution.
      g. Will be responsible for Construction Schedule delay due to late ordering of available specified products caused by requests for substitution that are subsequently rejected by Owner.
      h. Will compensate Owner for all costs; including extra costs of performing Work under Contract Documents, extra cost to other contractors, and any claims brought against Owner, caused by late requests for substitutions or late ordering of products.
F. Owner's Duties:
   1. Review Contractor's RFS with reasonable promptness.
   2. Notify Contractor in writing of decision to accept or reject requested substitution.
G. Administrative Requirements:
   1. Specified products, materials, or systems for Project may include engineering or on-file standards required by the regulatory agency. Contractor's substitution of products, materials or systems may require additional engineering, testing, reviews, approvals, assurances, or other information for compliance with regulatory agency requirements or both. Provide all agency approvals or other additional information required and pay additional costs for required Owner services made necessary by the substitution at no increase in Contract Sum or Contract Time, and as a part of substitution proposal.

1.4 PRODUCT DELIVERY REQUIREMENTS

A. Deliver products in accordance with manufacturer's instructions.
B. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

1.5 PRODUCT STORAGE AND HANDLING

A. Store products only in staging area per provisions of Section 01100 (Summary).
B. Handle, store, and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate-controlled enclosures.
C. For exterior storage of fabricated products, place on appropriate supports, above ground.
D. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.
E. Store loose granular materials on solid flat surfaces in a well-drained area.
F. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
G. Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01740

CLEANING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Progress Cleaning
   2. Final Cleaning

B. Related Sections:
   1. Section 01500 (Temporary Facilities and Controls)

1.2 PROGRESS CLEANING

A. Perform periodic cleaning to ensure that any streets and other Owner and public properties are maintained free from accumulation of waste materials, dust, mud, and debris.

B. Where required, wet down surfaces to lay dust and prevent the blowing of dust to nearby residences or public properties.

C. Keep all paved roads clean and free of dust, mud, and debris resulting from Contractor's operations. Daily cleanup throughout the job will be necessary as Contractor progresses with its Work, but extra attention to cleanup shall be made prior to weekends and holidays. Without limiting the foregoing, remove trench spoil along traveled ways daily; grade and vacuum broom surfaces initially where applicable and later water flush with high-pressure sprays, being careful to avoid downstream contamination.

D. All dust, mud, spoils, and construction debris shall be removed daily from all roadways, ditches, shoulders, and private property (fills or spoils placed on private property at private property owner's written request excepted).

E. Disposal of Materials:
   1. All waste materials, debris, and rubbish shall be disposed of at sites to be chosen by Contractor in accordance with applicable local, state, and federal regulations.
   2. Contractor is cautioned that the County of Sonoma and cities within the county have regulations governing the disposal of rubble, broken pavement, and similar materials.
   3. Become familiar with the requirements of the agency having jurisdiction over any contemplated disposal site and comply with all such requirements.

F. All excess soil from performance of Work shall be disposed at sites to be chosen by Contractor in accordance with applicable local, state, and federal regulations, and, if applicable, in accordance with Contractor's soil disposal plan. If Contractor elects to dispose of soil on any private property, prior to any such disposal, a letter allowing such disposal shall be obtained from the property owner and presented to Owner. The letter shall state that the property owner has complied with all necessary local, state, and federal laws with respect to disposal on property owner's property. Contractor is advised that the property owner is required to obtain a fill permit from PRMD. Regardless of the location of the disposal area, Contractor shall specify the location in the Storm Water Pollution Prevention Plan (SWPPP) if required under Section 01500 (Temporary Facilities and Controls). Any requirements in the SWPPP that pertain to the area of Work shall also apply to the disposal area. In addition, placement of fill in wetland areas is subject to permit procedures of the US Army Corps of Engineers. At the completion of Work, a letter from

each affected property owner will be required releasing Contractor, Owner, and any Owner consultant from future liability.

G. If Contractor does not properly clean the Site, in the opinion of Owner, then Owner shall have the option of using outside equipment to perform the cleanup and such cost will be withheld from the Contract Sum.

1.3 FINAL CLEANING

A. Execute final cleaning prior to final inspection, using only properly skilled workers.
B. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from exposed interior and exterior finished surfaces.
C. Repair, patch, and touch up marred surfaces to match adjacent finishes.
D. Clean interior and exterior surfaces exposed to view: remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
E. Clean equipment and fixtures to a sanitary condition, clean or replace filters of mechanical equipment operated during construction, clean ducts, blowers and coils of units operated without filters during construction.
F. Clean Site.
G. Mechanically sweep paved areas.
H. Remove waste and surplus materials, rubbish, and construction facilities from Site.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01741

CONSTRUCTION MATERIAL WASTE MANAGEMENT PLAN

PART 1 GENERAL

1.1 CONSTRUCTION MATERIAL WASTE MANAGEMENT PLAN

A. Submit Construction Material Waste Management Plan that includes, but is not limited to:
   1. Management monitoring program that includes, at a minimum, multiple recyclables containers. Goal is to divert 75 percent of materials waste to recycling instead of landfill. This applies only to materials that would typically be disposed via dumpster.
   2. Current recycling program used by each material supplier for materials listed in Divisions 1-16.
   3. Estimate of on-Site material reuse (native fill) in tons.
   4. Completed Self-Certification of Compliance for Contractor and each listed Subcontractor. Self-Certification of Compliance form is included at the end of this Section 01741.

B. Submit monthly progress reports updated with waste management log that includes which material containers have been removed, how many have been removed, and the weight of those containers.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SELF-CERTIFICATION OF COMPLIANCE FORM FOLLOWS THIS SECTION

SELF-CERTIFICATION OF COMPLIANCE WITH CONSTRUCTION MATERIAL WASTE PLAN

Firm Name: _____ Phone: _____

Address: _____

Principal Service or Product: _____

☐ Prime Contractor ☐ Supplier of Material/Service

☐ Subcontractor ☐ Broker

☐ Sole Ownership ☐ Corporation

☐ Partnership ☐ Joint Venture

I, Contractor/Subcontractor, hereby certify that I have read and understood, and agree to adopt and implement, the approved Construction Waste Management Plan for the Mirabel Fish Screen and Fish Ladder Replacement.

Certified by:

Name:_____ Title:_____

Signature:_____ Date:_____

SECTION 01750

STARTING AND ADJUSTING

PART 1 GENERAL - NOT USED

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 CHECKOUT PROCEDURES

A. Upon completion of installation, conduct an initial inspection and checkout of all mechanical and electrical equipment and devices.
   1. Clean the interior of piping, pumps, and other equipment and make free of foreign material. If applicable, lubricate equipment in accordance with the manufacturer's instructions.
   2. Clean screens, diffusers and porosity plates and make free of foreign material.
   3. To the extent practicable, turn rotating equipment, operate valves and gates, and operate other equipment by hand to check for binding, and interference.
   4. Check incoming electric power for voltage amplitude and voltage balance.
   5. Check electric motor-driven equipment for correct rotation.
   6. Check all safety guards to insure they are in place.

B. Conduct field tests including visual and mechanical inspection of the following:
   1. Proper grounding.
   2. Blockage of ventilating passageways.
   3. Operate motor operated valves both at valve through HOA switch and remotely.
   4. Check and calibrate water level signals from level transducers.
   5. Check and calibrate signals from Sonde unit.
   6. Test inflatable dam fill air and water lines and operation of U-tube.
   7. Test operation of inflatable dam drain lines, drain pump control panel, and operation of U-tube.
   8. Test elevation versus flowrates within fish ladder.
   9. Test flowrates through diffuser, porosity plates and auxiliary water supply.
   10. Check all electrical sockets.
   11. Check all lights for functionality and placement.
   12. Check operation of screen cleaner through HOA switch and programmable logic controller.
   13. Check for even flowrate distribution through screens
   14. Check 72" intake pipe for adequate flows to operate diversion pumps at maximum capacity.
   15. Check for properly functioning emergency well pumps.
   16. Check for proper fit of protective panels for windows and intake structure.
   17. Check proper operation of all valves.
   18. Check functionality of video equipment.
   19. Operation and calibration of meters and instruments.
   20. Verify functionality of low level alarm for sump pump.

END OF SECTION

SECTION 01770

CONTRACT CLOSEOUT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Description of Contract closeout procedures including:
      a. Removal of Temporary Construction Facilities
      b. Substantial Completion
      c. Final Completion
      d. Project Record Documents
      e. Project Guarantee
      f. Warranties
      g. Turn-In
      h. Computer Programs
      i. Release of Claims
      j. Fire Inspection Coordination
      k. Building Inspection Coordination

1.2 REMOVAL OF TEMPORARY CONSTRUCTION FACILITIES

A. Remove temporary materials, equipment, services, and construction prior to Substantial Completion inspection.
B. Clean and repair damage caused by installation or use of temporary facilities.
C. Restore permanent facilities used during construction to specified condition.
D. Comply with paragraph 1.13 of Section 01500 (Temporary Facilities and Controls).

1.3 SUBSTANTIAL COMPLETION

A. When Contractor considers Work or designated portion of the Work as Substantially Complete, submit timely written notice to Owner, with list of items remaining to be completed or corrected.
B. Within reasonable time, Owner will inspect to determine status of completion.
C. Should Owner determine that Work is not Substantially Complete, Owner will promptly notify Contractor in writing, listing all defects and omissions.
D. Remedy deficiencies and send a second written notice of Substantial Completion. Owner will reinspect the Work. If deficiencies previously noted are not corrected on reinspection, then Contractor shall pay the cost of the reinspection.
E. When Owner concurs that Work is Substantially Complete, Owner will issue a Certificate of Substantial Completion, accompanied by Contractor's list of items to be completed or corrected as verified by Owner.
F. Before a Certificate of Substantial Completion will be issued, Contractor must accomplish:
   1. Startup of manufactured units, equipment, and systems that require startup and run for periods prescribed by Owner.
   2. Commissioning.
   3. Training.
   4. Submittal of final Installation, Operation, and Maintenance Manuals.
G. A punch list examination will be performed upon Substantial Completion. One follow-up review of punch list items for each discipline will be provided. If further Site visits are

required to review punch list items due to incompleteness of the Work by Contractor, Contractor shall reimburse Owner for costs associated with these visits.

1.4 FINAL COMPLETION

A. Final Completion occurs when Work meets requirements for Owner's Final Acceptance. When Contractor considers Work is Finally Complete, submit written certification that:
   1. Contractor has inspected Work for compliance with Contract Documents, and all requirements for Final Acceptance have been met.
   2. Except for Contractor maintenance after Final Acceptance, Work has been completed in accordance with Contract Documents and deficiencies listed with Certificate of Substantial Completion have been corrected. Equipment and systems have been tested in the presence of Owner, and are operative.
   3. Work is complete and ready for final inspection.

B. In addition to submittals required by Contract Documents, provide submittals required by governing authorities and submit final statement of accounting giving total adjusted Contract Sum, previous payments, and sum remaining due.

C. When Owner finds Work is acceptable and final closeout submittals are complete, Owner will issue final Change Order reflecting approved adjustments to Contract Sum not previously made by Change Order. Should Owner determine that Work is incomplete or Defective:
   1. Owner promptly will so notify Contractor, in writing, listing the incomplete or Defective items.
   2. Promptly remedy the deficiencies and notify the Owner when it is ready for reinspection.
   3. When Owner determines that the Work is acceptable under the Contract Documents, Owner will request Contractor to make closeout submittals.

D. Final adjustments of accounts:
   1. Submit a final statement of accounting to Owner, showing all adjustments to the Contract Sum and complete and execute Document 00650 (Agreement and Release of Any and All Claims).
   2. If so required, Owner shall prepare a final Change Order for submittal to Contractor, showing adjustments to the Contract Sum that were not previously made into a Contract Modification.

1.5 PROJECT RECORD DOCUMENTS

A. Contract Documents will not be closed out and final payment will not be made until completion and submittal of Project Record Documents described in Section 01780 (Project Record Documents).

1.6 PROJECT GUARANTEE

A. Requirements for Contractor's guarantee of completed Work are included in Article 9 of Document 00700 (General Conditions). Guarantee Work done under Contract against failures, leaks, or breaks or other unsatisfactory conditions due to defective equipment, materials, or workmanship, and perform repair work or replacement required, at Contractor's sole expense, for period of one year from date of Final Acceptance.

B. Neither recordation of Final Acceptance nor final certificate for payment nor provision of the Contract nor partial or entire use or occupancy of premises by Owner shall constitute acceptance of Work not done in accordance with Contract Documents nor relieve Contractor

of liability in respect to express warranties or responsibility for faulty materials or workmanship.

C. Owner may make repairs to Defective Work as set forth in Document 00700 (General Conditions), paragraph 9.3.

D. If, after installation, operation, or use of materials or equipment to be provided under Contract proves to be unsatisfactory to Owner, Owner shall have right to operate and use materials or equipment until said materials and equipment can, without damage to Owner, be taken out of service for correction or replacement. Period of use of Defective materials or equipment pending correction or replacement shall in no way decrease guarantee period required for acceptable corrected or replaced items of materials or equipment.

E. Nothing in this Section 01770 shall be construed to limit, relieve, or release Contractor's, Subcontractors', and equipment suppliers' liability to Owner for damages sustained as result of latent defects in equipment caused by negligence of suppliers' agents, employees, or Subcontractors. Stated in another manner, warranty contained in the Contract Documents shall not amount to, nor shall it be deemed to be, waiver by Owner of any rights or remedies (or time limits in which to enforce such rights or remedies) it may have for Defective workmanship or Defective materials under laws of this State pertaining to acts of negligence.

1.7 WARRANTIES

A. Execute Contractor's Submittals and assemble warranty documents and operation and maintenance manuals executed or supplied by Subcontractors, suppliers, and manufacturers.
   1. Provide table of contents and assemble in 8½ inches by 11 inches three-ring binder with durable plastic cover, appropriately separated and organized.
   2. Assemble in Specification Section order.

B. Submit material prior to final Application for Payment.
   1. For equipment put into use with Owner's permission during construction, submit within 14 Days after first operation.
   2. For items of Work delayed materially beyond Date of Substantial Completion, provide updated Submittal within 14 Days after acceptance, listing date of acceptance as start of warranty period.

C. Warranties are intended to protect Owner against failure of Work and against deficient, Defective, and faulty materials and workmanship, regardless of sources.

D. Limitations: Warranties are not intended to cover failures that result from the following:
   1. Unusual or abnormal phenomena of the elements
   2. Vandalism after Substantial Completion
   3. Insurrection or acts of aggression including war

E. Related Damages and Losses: Remove and replace Work which is damaged as result of Defective Work, or which must be removed and replaced to provide access for correction of warranted Work.

F. Warranty Reinstatement: After correction of warranted Work, reinstate warranty for corrected Work to date of original warranty expiration or to a date not less than one year after corrected Work was done, whichever is later.

G. Replacement Cost: Replace or restore failing warranted items without regard to anticipated useful service lives.

H. Warranty Forms: Submit drafts to Owner for approval prior to execution. Forms shall not detract from or confuse requirements or interpretations of Contract Documents.

1. Warranty shall be countersigned by manufacturers.
2. Where specified, warranty shall be countersigned by Subcontractors and installers.

I. Rejection of Warranties: Owner reserves right to reject unsolicited and coincidental product warranties that detract from or confuse requirements or interpretations of Contract Documents.

J. Term of Warranties: For materials, equipment, systems, and workmanship, warranty period shall be one year minimum from date of Final Completion of entire Work except where:
1. Detailed Specifications for certain materials, equipment or systems require longer warranty periods.
2. Materials, equipment or systems are put into beneficial use of Owner prior to Final Completion as agreed to in writing by Owner.

K. Transfer of Warranties: Any warranty shall automatically transfer, without charge, to a subsequent owner who acquires the Project. Any transfer of the Project shall not extend the duration of any warranty.

L. Warranty of Title: No material, supplies, or equipment for Work under Contract shall be purchased subject to any chattel mortgage, security agreement, or under a conditional sale or other agreement by which an interest therein or any part thereof is retained by seller or supplier. Contractor warrants good title to all material, supplies, and equipment installed or incorporated in Work and agrees upon completion of all Work to deliver premises, together with improvements and appurtenances constructed or placed thereon by Contractor, to Owner free from any claim, liens, security interest, or charges, and further agrees that neither Contractor nor any person, firm, or corporation furnishing any materials or labor for any Work covered by Contract shall have right to lien upon premises or improvement or appurtenances thereon. Nothing contained in this paragraph, however, shall defeat or impair right of persons furnishing materials or labor under bond given by Contractor for their protection or any rights under law permitting persons to look to funds due Contractor in hands of Owner.

1.8 TURN-IN

A. Contract Documents will not be closed out and final payment will not be made until all keys and locks issued to Contractor during prosecution of Work and letters from property owners, if required under paragraph 1.2.F of Section 01740 (Cleaning), are turned in to Owner.

1.9 COMPUTER PROGRAMS

A. When any equipment requires operation by computer programs, submit the program, on appropriate electronic media, plus all user manuals and guides for operating the programs and making changes in the programs for upgrading and expanding the databases. Program shall be Windows 7 compatible. Provide required licenses to Owner at no additional cost.

1.10 RELEASE OF CLAIMS

A. Contract Documents will not be closed out and final payment will not be made until Document 00650 (Agreement and Release of Any and All Claims) is completed and executed by Contractor and Owner.

1.11 FIRE INSPECTION COORDINATION

A. Coordinate fire inspection and secure sufficient notice to Owner to permit convenient scheduling (if applicable).

1.12 BUILDING INSPECTION COORDINATION

A. Coordinate with Owner a final inspection for the purpose of obtaining an occupancy certificate (if applicable).

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01780

PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements for the following Project Record Documents:
      a. Project Record Drawings and Shop Drawings
      b. Project Record Specifications
      c. Miscellaneous Project Record Submittals
B. Specific Project Record Documents requirements that expand requirements of this Section may be included in the individual Sections of Divisions 2 through 16.

1.2 SUBMITTAL

A. During construction, bring hard-copy updates of the Project Record Drawings (Field Set) to monthly Progress Payment Meetings.
B. At completion of Project, deliver Project Record Documents to Owner. Project Record Documents required include:
   1. Marked-up copies of Drawings (Field Set)
   2. Final Project Record Drawings
   3. Marked-up copies of Specifications
   4. Marked-up copies of Shop Drawings, if applicable
   5. Miscellaneous Project Record Submittals
C. Accompany submittal with transmittal letter containing:
   1. Date
   2. Project title and Owner's Contract number
   3. Contractor's name and address
   4. Number and title of each Project Record Document
   5. Certification that each document as submitted is complete and accurate, and signature of Contractor or Contractor's authorized representative.

1.3 GENERAL

A. Prior to start of construction, Owner will provide one full size set of Drawings and one copy of the Project Manual for Contractor's use for recording as-built conditions.
B. Post changes and Modifications to the Contract Documents as they occur. Do not wait until the end of the Project. Owner will review Project Record Documents on a monthly basis to assure compliance with this requirement.
C. Refer instances of uncertainty to Owner for resolution.
D. Maintenance of Documents:
   1. Store Project Record Documents in the field office apart from Contract Documents used for construction.
   2. Do not permit Project Record Documents to be used for construction purposes.
   3. Maintain Project Record Documents in good order and in a clean, dry, neat, and legible condition.
   4. Make Project Record Documents available at all times for inspection by Owner.

1.4 PROJECT RECORD DRAWINGS AND SHOP DRAWINGS

A. Quality Draftsmanship: Project Record Drawings and Project Record Shop Drawings shall be prepared by competent drafters and shall be clear and fully legible. Owner shall be the sole judge of the acceptability of the Project Record Drawings and Project Record Shop Drawings.

B. Mark-up Procedure: During the construction period, maintain a set of full size prints of Drawings and Shop Drawings for Project Record Documents purposes ("Field Set"). Stamp each document (on each sheet or page) "PROJECT RECORD" in 2-inch high letters. Keep record documents current. Note: A reference by number to a Change Order, CCD, RFI, RFQ, RFP, Field Order or other such document is not acceptable as sufficient record information on any record document. Do not permanently conceal any Work until required information has been recorded.

1. Mark Drawings and Shop Drawings to indicate the actual installation where the installation varies appreciably from the installation shown originally. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later. Items required to be marked include but are not limited to:
   a. Dimensional changes to the Drawings and Shop Drawings
   b. Revisions to details shown on the Drawings and Shop Drawings
   c. Depths of various elements of foundation in relation to main floor level or survey datum
   d. Variable or concealed field conditions
   e. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements
   f. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure
   g. Locations of underground Work, points of connection with existing utilities, changes in direction, valves, manholes, catch basins, capped stub outs, invert elevations, and similar items
   h. Actual numbering and set points of each electrical circuit
   i. Field changes of dimension and detail
   j. Revisions to routing of piping and conduits
   k. Revisions to electrical circuitry
   l. Actual equipment locations
   m. Duct, conduit, and cable size and routing
   n. Changes made by Change Order or CCD
   o. Details not on original Drawings or Shop Drawings
2. Mark completely and accurately Drawings or Shop Drawings, whichever is the most capable of showing actual physical conditions. Where Shop Drawings are marked, show cross-reference on Drawings location.
3. Mark important additional information that was either shown schematically or omitted from original Drawings.
4. Use revision block to record information related to the mark-ups, including CCD numbers; Alternate numbers, Change Order numbers, and similar identification.
5. Mark Drawing and Shop Drawing sets with red, erasable colored pencil.
6. Responsibility for Mark-up: Where feasible, the individual or entity who obtained Project Record Drawing or Shop Drawing data, whether the individual or entity is the installer, Subcontractor, or similar entity, is required to prepare the mark-up on Project Record Drawings or Shop Drawings.

a. Accurately record information in an understandable and legible drawing technique.
b. Record data as soon as possible after it has been obtained. In the case of concealed installations, record and check the mark-up prior to concealment.

C. Preparation of Project Record Drawings and Project Record Shop Drawings: Immediately prior to inspection for Certification of Substantial Completion, review completed marked-up Project Record Drawings (Field Set)and Project Record Shop Drawings with Owner. When authorized, prepare final Project Record Drawings and Project Record Shop Drawings.
1. Project Record Drawings:
a. Prior to review of Contractor's Application for Payment, the Owner and Contractor will review updates to the Field Set of Project Record Drawings to verify that record documents are current.
b. Upon Certification of Substantial Completion, Contractor will transfer all updates from the "Field Set" to a clean set of full size contract drawings furnished by the Owner. Each sheet shall include a Project Record Drawing stamp which is dated and "wet signed" by the Contractor.
c. If Contractor chooses and Owner approves in advance, Contractor may submit electronic updates on final Project Record Drawings, so long as final Project Record Drawings preserve the integrity of the data and are compatible with Owner's software.
2. Project Record Shop Drawings:
a. Transfer all information previously marked on Field Set to a separate clean set of Shop Drawings provided by Owner. Erase, redraw, and add details and notations where applicable. Identify and date each Shop Drawing; include the printed designation "PROJECT RECORD SHOP DRAWING" in a prominent location on each Shop Drawing. Bind the set with durable paper cover sheets, with appropriate identification, including titles, dates, and other information on cover sheet.

D. In addition to requirements of this Section, comply with supplemental requirements of Divisions 15.
1. Division 15 of the Specifications may require the preparation of large scale, detailed layout drawings of the Work of that Division. These layout drawings are not Shop Drawings as defined by Section 01420 (References and Definitions), but together with Shop Drawings or layout drawings of all other affected Sections are used to check, coordinate, and integrate the work of the various Sections.
2. Include these layout drawings as part of the Project Record Documents.

1.5 PROJECT RECORD SPECIFICATIONS

A. During the construction period, maintain one copy of the Specifications, including Addenda and Modifications issued, for Project Record Documents purposes.

B. Mark the Project Record Specifications to indicate the actual installation where the installation varies substantially from that indicated in Specifications issued. Note related Project Record Drawing information, where applicable. Give particular attention to substitutions, selection of product options, Change Order and CCD Work, and information on concealed installation that would be difficult to identify or measure and record later.
1. In each Specification Section where products, materials or units of equipment are specified or scheduled, mark the copy with the proprietary name and model number of the product furnished.

2. Record the name of the manufacturer, catalog number, supplier and installer, and other information necessary to provide a record of selections made and to document coordination with Installation, Operation, and Maintenance Manuals.
3. For each principal product specified, indicate whether data has been submitted in Installation, Operation, and Maintenance Manuals.

C. Preparation of Project Record Specifications: Immediately prior to inspection for Certification of Substantial Completion, review completed Field Set Project Record Specifications with Owner. When authorized, prepare final Project Record Specifications.
1. After Substantial Completion and before Final Completion, carefully transfer all data shown on the Field Set to a separate clean set of Specifications provided by Owner. Include the printed designation "PROJECT RECORD SPECIFICATION" in a prominent location on the Specifications.

1.6 MISCELLANEOUS PROJECT RECORD SUBMITTALS

A. Refer to other Specification Sections for miscellaneous record keeping requirements and submittals in connection with various construction activities. Immediately prior to Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for use and reference. Submit to the Owner for Owner's records. Categories of requirements resulting in miscellaneous records may include, but are not limited to, the following:
1. List all products used in the Project, organized by Specification section and article. Product list shall be submitted in an electronic format, compatible with Microsoft Excel 2000.
2. Delivery records of materials incorporated into the Work
3. Records of product lot numbers and expiration dates
4. Quality Assurance/Quality Control records for field Work

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION – NOT USED

END OF SECTION

SECTION 01810

COMMISSIONING

PART 1 GENERAL

1.1 DEFINITIONS

A. Functional testing: testing necessary to determine if installed equipment and systems will operate in the manner in which they are intended to operate.

1.2 COMMISSIONING SUMMARY

A. Porosity plates on fish screen
B. Operation of screen cleaning equipment
C. Operation of diffuser

1.3 SYSTEM PERFORMANCE EVALUATION

A. Velocity distribution over screen face
B. Screen approach velocity versus sweeping velocity
C. Water elevation versus fish ladder flows

1.4 TESTING, ADJUSTING, AND BALANCING PROCEDURES

A. General:
   1. After the initial checkout has been completed to the satisfaction of Owner per Section 01750 (Starting and Adjusting), commence functional testing, including start up and operation of individual subsystems, pieces of equipment and instruments.
   2. Debug, tune-up, and adjust as necessary.
   3. In addition to functional tests, specific testing shall be required of installed equipment and systems as specified in individual Sections.
   4. Work will not be accepted until all functional and specific tests have been satisfactorily performed.
B. Screen flowrate testing as described in Section 05920 (Flat Panel Fish Screens and Associated Metal Works), Hydraulic Evaluation Plan.
C. Porosity plate adjusting as described in Section 05920 (Flat Panel Fish Screens and Associated Metal Works), Hydraulic Evaluation Plan
D. Screen certification as described in Section 05920 (Flat Panel Fish Screens and Associated Metal Works), Hydraulic Evaluation Plan
E. Auxiliary water supply meter testing and calibration.
F. Diffuser flow testing for minimum, average and maximum auxiliary water supply flows at a minimum.
G. Fish ladder flow versus pool water elevation testing. Fish ladder flows to be tested in 3 inch increments between pool elevations 36 to 38.
H. Screen cleaning system automatic starting operation as described in section 11296 (Fish Screen Cleaner)
I. U-tube proper overflow functionality.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01825

TRAINING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for training Owner's personnel, by persons retained by Contractor specifically for the purpose, on the proper operation and maintenance of the equipment and systems supplied under the Contract.

1.2 SUBMITTALS

A. Quality Assurance/Control Submittals:
   1. Lesson plans for each training session to be conducted by the manufacturer's representatives. Lesson plans shall include:
      a. Subject of each training session
      b. Identity and qualifications of individuals to be conducting the training
      c. Proposed schedule of each training session including date, time, instructor and topic
      d. All sessions shall be aligned with shift schedules of the operations and maintenance staff
   2. Provide an electronic version of all training materials.

1.3 TRAINING - GENERAL

A. Where specified, the Contractor shall conduct training sessions for Owner's personnel to instruct the staff on the proper operation, care, and maintenance of the equipment and systems installed under this Contract. Training shall take place under the conditions specified in the following paragraphs.

1.4 LOCATION

A. Unless otherwise approved by Owner, training sessions shall take place in a training room selected by Owner at the Site.

1.5 LESSON PLANS

A. Formal written lesson plans shall be prepared for each training session. Lesson plans shall contain an outline of the material to be presented along with a description of visual aids to be utilized during the session. Each plan shall contain a time allocation for each subject.
B. One complete set of originals of the lesson plans, training manuals, handouts, visual aids, and reference material shall be the property of Owner and shall be suitably bound for proper organization and easy reproduction. The Contractor shall furnish ten copies of necessary training manuals, handouts, visual aids, and reference materials at least 7 Days prior to each training session.

1.6 FORMAT AND CONTENT

A. Each training session shall be comprised of time spent both in the classroom and at the specific location of the subject equipment or system. As a minimum, training session shall cover the following subjects for each item of equipment or system:
   1. Familiarization:

a. Review catalog, parts lists, drawings, etc., which have been previously provided for the plant files and Installation, Operation, and Maintenance manuals.
b. Review the installation of the specific equipment items.
c. Demonstrate the unit and indicate how all parts of the Specifications are met.
d. Answer questions.

2. Safety:
   a. Using material previously provided, review safety references.
   b. Discuss proper precautions around equipment.
3. Operation:
   a. Using material previously provided, review reference literature.
   b. Explain all modes of operation (including emergency).
   c. Review with Owner's personnel proper use of the equipment.
4. Preventive Maintenance:
   a. Using material previously provided, review preventive maintenance (PM) lists including:
      1) Reference material.
      2) Daily, weekly, monthly, quarterly, semiannual, and annual jobs.
   b. Show how to perform PM jobs.
   c. Show Owner's personnel what to look for as indicators of equipment problems.
5. Corrective Maintenance:
   a. List possible problems.
   b. Discuss repairs; identify special problems.
   c. Open up equipment and demonstrate procedures, where practical.
6. Parts:
   a. Show how to use previously provided parts lists and order parts.
   b. Review spare parts on hand. Make recommendations regarding additional parts that should be available.
7. Local Representatives:
   a. Where to order parts: name, address, telephone.
   b. Service problems:
      1) Who to call.
      2) How to get emergency help.
8. Installation, Operation, and Maintenance Manuals:
   a. Review any other material submitted.
   b. Update material, as required.

1.7 VIDEO RECORDING

A. Owner may retain the services of a commercial video taping service to record each training session. After taping, Owner may edit and supplement material with professionally produced graphics to provide a permanent record. Advise all manufacturers providing training sessions that the material will be video taped.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. Training shall be conducted no earlier than seven Days after starting and adjusting commences. Classes shall be scheduled such that classroom sessions are interspersed with field instruction in logical sequence. The Contractor shall arrange to have the training conducted on consecutive Wednesdays and Thursdays, with no more than eight hours of classes scheduled for any one Day. Concurrent classes will not be allowed.

B. Visits to the Site by manufacturer's representatives for demonstration and training purposes shall be deemed to be a separate visit to the Site, independent of visits required for equipment checkout, testing, and startup unless prior approval of Owner is received to combine visits.

C. The following services shall be provided for each item of equipment or system as required in individual Specification sections. Additional services shall be provided, where specifically required in individual Specification sections.

1. Operations personnel classroom equipment training shall include, at a minimum:
   a. Using slides and drawings, discuss the equipment's specific location in the plant and an operational overview.
   b. Purpose and function of the equipment (or systems).
   c. A working knowledge of the operating theory of the equipment.
   d. Start-up, shutdown, normal operation, and emergency operating procedures, including a discussion on system integration and electrical interlocks, if any.
   e. Identify and discuss safety items and procedures.
   f. Routine preventative maintenance, including specific details on lubrication and maintenance of corrosion protection of the equipment and ancillary components.
   g. Operator detection, without test instruments, of specific equipment trouble symptoms.
   h. Required equipment exercise procedures and intervals.
   i. Routine disassembly and assembly of equipment if applicable for purposes such as operator inspection of equipment.
   j. Routing tests of electrical equipment, including schedule of tests.
2. Operations personnel hands-on equipment training shall include, at a minimum:
   a. Identify location of equipment and review the purpose.
   b. Identifying piping and flow options.
   c. Identifying valves and their purpose.
   d. Identifying instrumentation:
      1) Location of primary element.
      2) Location of instrument readout.
      3) Discuss purpose, basic operation, and information interpretation.
   e. Discuss, demonstrate, and perform standard operating procedures and operators' round checks.
   f. Discuss and perform the preventative maintenance activities.
   g. Discuss and perform start-up and shutdown procedures.
   h. Perform the required equipment exercise procedures.
   i. Perform routine disassembly and assembly of equipment if applicable.
   j. Identify and review safety items and perform safety procedures, if feasible.

   k. Routine tests of electrical equipment.
   l. Operation of electrical equipment and appurtenances.
3. Maintenance and repair personnel classroom equipment training shall include, at a minimum:
   a. Theory of operation.
   b. Description and function of equipment.
   c. Start-up and shutdown procedures.
   d. Normal and major repair procedures.
   e. Equipment inspection and troubleshooting procedures including the use of applicable test instruments and the "pass" and "no pass" test instrument readings.
   f. Routine and long-term calibration procedures.
   g. Safety procedures.
   h. Preventative maintenance such as lubrication; normal maintenance such as belt, seal, and bearing replacement; and up to major repairs such as replacement of major equipment part(s) with the use of special tools, bridge cranes, welding jigs, etc.
   i. Discuss preventative maintenance Work based on hours of run time.
   j. Discuss predictive maintenance.
   k. Maintenance and repair of electrical equipment and appurtenances.
4. Maintenance and repair personnel hands-on equipment training shall include, at a minimum:
   a. Locate and identify equipment components.
   b. Review the equipment function and theory of operation.
   c. Review normal repair procedures.
   d. Perform start-up and shutdown procedures.
   e. Review and perform the safety procedures.
   f. Perform routine assembly and disassembly of equipment if applicable.
   g. Identify and review safety items and perform safety procedures, if feasible.
   h. Perform Owner-approved practice maintenance and repair job(s), including mechanical and electrical adjustments and calibration and troubleshooting equipment problems.

END OF SECTION

DIVISION 2

SITE CONSTRUCTION

SECTION 02072

DEMOLITION, CUTTING, AND PATCHING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Demolition, cutting and patching of existing construction as indicated, or as required to accommodate new Work shown or specified.

1.2 SUBMITTALS

A. Product Data:
   1. Indicating manufacturer and type of:
      a. Proposed nonshrink grout.
      b. Epoxy bonding adhesive.
      c. Proposed materials and methods to be used for matching and repairing existing construction.

1.3 DELIVERY, STORAGE, AND HANDLING

A. General:
   1. Salvage items, designated for Owner's salvage, as a functional unit.
   2. Clean, list and tag for storage.
   3. Protect from damage and deliver to location designated.
   4. Salvage each item with auxiliary or associated equipment required for operation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Nonshrink grout:
      a. Supreme Grout by Gifford Hill.
      b. Masterflow 713 by Master Builders.
      c. Sika Grout 212 by Sika.
      d. Or Approved Equal.
   2. Epoxy bonding adhesive:
      a. Euco No.452 MV by Euclid Chemical Co.
      b. Sikadur 32, Hi-Mod by Sika Corporation.
      c. Or Approved Equal.

2.2 MATERIALS

A. Nonshrink Grout:
   1. Nonmetallic, noncorrosive and nonstaining.
   2. Premixed with only water to be added in accordance with manufacturer's instructions at jobsite.
   3. Grout to produce a positive but controlled expansion. Mass expansion not to be created by gas liberation or by other means.
   4. Minimum compressive strength at 28 Days to be 6500 psi.

B. Epoxy Bonding Adhesive:
   1. Two component, moisture insensitive adhesive manufactured for the purpose of bonding fresh concrete to hardened concrete.

PART 3 EXECUTION

3.1 PREPARATION

A. Provide safety lights as required.

3.2 INSTALLATION

A. Cutting and Removal:
   1. Remove existing Work indicated to be removed, or as necessary for installation of new Work.
   2. Neatly cut and remove materials, and prepare all openings to receive new Work.
   3. Remove concrete in small sections.
   4. Coat exposed edges of grout with a cure/seal compound recommended by grout manufacturer.
   5. Existing stairwell shall be disconnected from existing concrete pad without damage to the concrete pad at the base of the existing stairwell.
B. Salvaged Items:
   1. Thoroughly dry and clean all metal surfaces.
   2. Prime all bare metal in accordance with Section 09905 (Painting and Protective Coatings).
   3. Dispose of items or materials not designated for Owner's salvage or reuse. Promptly remove from Site.
   4. Do not store or sell Contractor salvaged items or materials on Site.
   5. Existing stairwell shall be salvaged at Owner’s storage yard.
   6. Existing flow meter, water quality probe, and drain pump shall be salvaged in working condition, provided to the Owner for storage, and re-installed as indicated.
C. Clean Up:
   1. Transport debris and legally dispose of off Site.

END OF SECTION

SECTION 02100

CONTROLLED DENSITY FILL (CDF)

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Controlled density fill for backfill, trench dams, and abandonment grout.

B. The Contractor shall furnish all labor, equipment and materials to provide controlled low-strength material (CDF) and shall mix, place, finish, and do all other work as required to produce a cementitious, excavatable mixture of aggregate, cement, pozzolan (fly ash), water, and admixtures used as pipe zone backfill, structure backfill, trench dams, and abandonment grout, in accordance with the Contract Documents.

C. Related Sections:
   1. Section 02300 (Earthwork).

1.2 REFERENCES

A.	ACI 229	Controlled Low Strength Materials.
B.	ACI 232	Fly Ash/Other Pozzolans in Concrete.
C.	ASTM C31	Practices for Making and Curing Concrete Test Specimens in the Field.
D.	ASTM C39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
E.	ASTM C42	Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
F.	ASTM C94	Specifications for Ready-Mixed Concrete.
G.	ASTM C150	Specification for Portland Cement.
H.	ASTM C260	Specification for Air-Entraining Admixtures for Concrete.
I.	ASTM C494	Specification for Chemical Admixtures for Concrete.
J.	ASTM C618	Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Filler in Portland Cement Concrete.
K.	ASTM D1586	Method of Penetration Test and Split Barrel Sampling of Soils.
L.	ASTM D1633	Test Method for Compressive Strength of Molded Soil-Cement Cylinders.
M.	ASTM D2922	Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow-Depth).

1.3 SUBMITTALS

A. Product Data:
   1. Mix Design: CDF mix designs that shall show the proportions and gradations of all materials proposed for each class and type of CDF specified herein. An independent testing laboratory shall test the mix designs for properties specified herein.
   2. Procedures, methods, and calculations showing that the pipe will not float or be displaced during CDF placement.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cement:
   1. Cement shall be Type II in accordance with the requirements of ASTM C150 and shall be from a single source.
B. Pozzolan (fly ash):
   1. Pozzolan shall be added to improve the flowability and shall be in accordance with the requirements of ASTM C 618.
C. Fine Aggregate:
   1. Fine aggregates shall consist of clean, sharp, natural sand, size 7, and shall conform to ASTM C33. All fine aggregates shall be furnished from one source.
D. Coarse Aggregate
   1. Coarse aggregates shall consist of natural gravels, combinations of gravels and crushed gravels, crushed stone, or a combination of these materials.
   2. 1-IN maximum grading.
E. Admixtures:
   1. Air entraining admixtures shall be added to improve the workability and shall be in accordance with the requirements of ASTM C 260.
   2. Water reducing agent shall be added to improve the workability and shall be in accordance with the requirements of ASTM C 494.
   3. Any accelerating agents to be added shall be free of calcium chloride and any other materials that may be corrosive to the pipe or anything in the surrounding area. All accelerators shall be in accordance with the requirements of ASTM C 494.
   4. Admixtures shall be submitted as part of the mix design.
F. Water:
   1. Water shall be clean and potable containing less than 50 ppm of chlorides.

2.2 CDF COMPRESSIVE STRENGTH

A. The minimum and maximum 28-day compressive strength shall conform to the following table:

Application	Minimum Compressive Strength (psi)	Maximum Compressive Strength (psi)
Initial Backfill	100	300
Trench Dam	100	300
Structure backfill	50	150
Utility Encasement	50	150
Filling of Boreholes	50	150

2.3 TESTING

A. CDF quality testing will be performed by Owner as follows:
   1. Frequency of sampling: Cast a minimum of five (5) cylinders from each 50 cubic yards, or fraction thereof, of CDF placed in any one day. Sampling and curing shall conform to ASTM D4832.
   2. Test results for strength that are not within the specified range shall be removed and replaced with material conforming to the specifications. All work associated with the

removal and replacement including any other impacts to the work shall be the sole responsibility of the Contractor at no additional cost to the Owner.

PART 3 EXECUTION

3.1 GENERAL

A. The subgrade and compacted fill and/or trench to receive CDF shall be complete and acceptable in accordance with Section 02300 (Earthwork).
B. The Contractor is hereby advised that flotation or displacement of the pipe could result during installation of the CDF. The Contractor shall make necessary provisions to prevent flotation and ensure that the pipe is installed in accordance with the Contract Documents.

3.2 DELIVERY, STORAGE, AND HANDLING

A. CDF shall be batched by a ready-mix batching plant acceptable to the Owner or by the Contractor's own mixing plant only after the Contractor provides proof through acceptable test batches of the CDF and with the acceptance by the Owner.
B. CDF shall be delivered to the work in standard transit mix trucks.
C. CDF shall be placed within ninety (90) minutes after introduction of the cement to the aggregate.

3.3 PLACING CDF

A. CDF shall be delivered in place by means of tailgate discharge, conveyor belts, pumped in place, tremie pipes or other means acceptable to the Owner. Placement shall not cause the material to fall and separate/segregate. A vertical drop of no more than 5 FT will be allowed.
B. CDF shall be directed in place by means of a vibrator to ensure that all voids, crevices, and pockets are filled with CDF. Foreign material that falls into the trench prior to or during placing of the CDF shall be immediately removed. Care shall be taken to avoid over-consolidation of the material. The CDF shall be thoroughly settled and compacted through the entire depth of the layer that is being consolidated into a dense, homogeneous mass. When used as pipe bedding, CDF placement shall not disjoint or shift pipelines.
C. CDF shall be continuously placed against fresh material, unless otherwise approved by the Owner. Where new CDF must be placed against existing CDF, the placement area shall be clean of all loose and foreign material. The surface of existing CDF shall be soaked with water a minimum of one (1) hour before placement of fresh CDF. No standing water will be allowed before starting placement of fresh CDF.

3.4 FINISHING CDF

A. The finish surface of CDF shall be smooth and to the grade shown or directed by the Owner. Finishing by wood float, steel trowel, or other similar methods is not required.

3.5 PROTECTING CDF

A. CDF shall be protected from running water, rain, freezing, or other conditions that could damage the material until the material has been accepted for backfill placement.

3.6 TRENCH BACKFILL

A. No equipment, traffic, or backfill shall be allowed on the CDF until the surface of the CDF is able to withstand loading without displacement or damage in accordance with ASTM

D 6024. If necessary, the Contractor shall provide steel trench plates that span the trench, as specified in Section 02210, Earthwork, until the CDF has reached the required strength.

3.7 BACKFILL BEHIND SHORING

A. Any void left behind shoring systems or voids left by the removal of shoring systems shall be filled with controlled density fill as approved by the Owner to provide soil support between the backfill zone and the native soil.

END OF SECTION

SECTION 02140

DEWATERING

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. Groundwater levels can be expected to be at or near river levels, and can be expected to respond rapidly to changes in river levels. Because the material to be excavated is highly permeable, significant volumes of infiltrating groundwater can be expected in excavations that extend below river level.
B. Provide pumps, piping, drains, well points, wells, and other facilities for the control, collection and disposal of groundwater or surface water for the proper construction of all Work specified herein.
C. Maintaining foundations and other parts of the Work free from water as required for constructing each part of the Work.
D. Records regarding anticipated dewatering flow rates and groundwater flow rates within the construction area are available from the Owner.
E. See Section 02170 (Cofferdams and Protective Works) for Work intended serve to exclude surface water from the areas of construction by bounding the areas to be dewatered.

1.2 DEFINITIONS

A. Special Dewatering: Dewatering by single- or multiple-stage well points or deep wells.
B. Hydrostatic Groundwater Level: The groundwater level at any location at the time of construction and prior to dewatering.

1.3 SUBMITTALS

A. Work Plans:
   1. A dewatering plan that includes details regarding the anticipated types and locations of various dewatering facilities and appropriate design calculations required to substantiate the dewatering plan.
      a. Prepared and signed by a Professional Engineer or a certified hydrogeologist, licensed in the state of California.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. The Contractor shall, at all times during construction, provide ample means and devices to remove promptly and dispose of properly all water entering excavations. Bottoms of the excavations shall be kept firm and acceptably free of standing water until the structures to be built therein are completed. The pumping and dewatering operations shall be carried out in such a manner that no disturbance to the bearing soil or to soil supporting overlying and adjacent structures from this or any other Work will result. Water from dewatering operations may be discharged to the Owner's infiltration pond located north of the Site. This discharge shall not cause siltation or other negative environmental impacts to natural waterways or other property and shall be in accordance with applicable Federal, State and

local regulations. At streamside construction and other locations where siltation or erosion may occur, hay-bale silt fencing and/or other control measures shall be installed, as required, to control and prevent siltation and excessive turbidity.

B. Discharge from dewatering operations shall be routed to the north, over the berm, and shall terminate at the concrete weir structure at the RDS outfall in the sedimentation pond area.
C. Contractor shall install a temporary flap gate structure on the RDS outfall weir structure to prevent water from re-entering the construction site.
D. Precautions must be taken to ensure that partially completed structures will not float during construction. For structures, dewatering must be continuous, or other positive measures must be taken to prevent flotation or uplift of the structures until they are sufficiently heavy or strong to resist water pressures.
E. When failure to provide adequate dewatering and drainage causes disturbance of the soils below bottom grade, the Contractor must provide adequate dewatering, and excavate and refill the disturbed areas at no additional cost to Owner.

3.2 DEWATERING REQUIREMENTS

A. The Contractor shall design, furnish, install, maintain, and operate a temporary dewatering system which shall prevent loss of fines, boiling, quick conditions, or softening of foundation strata and maintain stability of bottoms of excavations so that every phase of the Work can be performed in the dry. The dewatering operations shall be such that the bottoms of all excavations shall be kept at all times firm, and in all respects acceptable to the Owner as good foundation.
B. The dewatering system shall lower the groundwater level in the entire excavation at least 1 foot below bottom grade or the bottom of over excavation of unsuitable material.
C. Special dewatering may be required to prevent boiling or other disturbance to the sub-soils and/or walls of the excavation.
D. Pressure grouting methods may not be used in the saturated aquifer.
E. Water from dewatering operations may be discharged to the Owner's infiltration pond adjacent to the Site. The discharge shall not cause siltation or other negative environmental impacts on the Owner's infiltration pond system, natural waterways, or other property and shall comply with applicable Federal, State and Local regulations.

3.3 INSTALLATION AND OPERATION

A. The location of every element of the temporary dewatering system shall be such that interference with excavation and construction activity is minimized.
B. Prior to any excavation below the hydrostatic groundwater level, the dewatering system shall be placed into operation to lower the water levels as required and then shall be operated continuously 24 hours per day, 7 days per week until all facilities and structures affected by the dewatering have been satisfactorily constructed, including placement of fill materials to an elevation above the hydrostatic groundwater level and concrete has achieved 80% design strength. In any event, the Contractor shall maintain the water levels low enough to fulfill the requirements of this Section and shall not allow the water level to rise until the constructed facilities are so complete that the water can be allowed to rise without damaging the facilities, their foundation, or surrounding areas and structures. The Contractor shall provide continuous superintendence during all periods of dewatering.
C. The Contractor shall provide complete standby equipment and power sources available for immediate operation as may be required, to adequately maintain the dewatering on a continuous basis in the event that all or any part of the dewatering system may become inadequate or fail.

D. At Contractor's option, the existing channel on the East side of the inflatable dam may be used to bypass river flows. Material shall be excavated and stored in a location approved by Owner. Restore cofferdam channel to pre-construction condition prior to Final Completion.
E. The Contractor may use sheeting to help achieve the dewatering requirement as specified in this Section. If the Contractor uses sheeting, he shall submit a sheeting design by a structural engineer, registered in the state of California. This sheeting plan shall be included within the Work Plan submittal.
F. When the temporary dewatering system does not meet the specified requirements, and as a consequence loosening or disturbance of the foundation's strata, instability of the slopes or damage to the foundations or structures occur, the Contractor shall at its own expense supply all materials, labor and perform all Work required for restoration of foundation soil, slopes, foundation, or structures, to the satisfaction of the Owner.

3.4 REMOVAL

A. An adequate weight of backfill material to prevent flotation of pipes or structures shall be in place before any dewatering systems are shut off.
B. At the completion of the dewatering Work, all units of the temporary dewatering system installed by the Contractor shall be removed and the holes backfilled with clean sand or cement grout.

END OF SECTION

SECTION 02170

COFFERDAMS AND PROTECTIVE WORKS

PART 1 GENERAL

1.1 SYSTEM DESCRIPTION

A. The Owner's inflatable dam, which will be inoperable for the majority of the Work, is currently used to create backwater and provide a constant elevation head on the aquifer for the Owner's collection system.
B. Contractor shall provide cofferdam, including temporary fishway bypass channel, as specified herein, upstream of Wohler Bridge to provide backwater in lieu of the inflatable dam. This cofferdam is not intended to provide dry conditions downstream of cofferdam.
C. The Contractor shall design, install, operate, and remove a cofferdam system, and associated dewatering system, to provide dry conditions for construction of the rock slope protection, intake structure, fish outfall and fish ladder. The cofferdam system shall be designed by a professional engineer licensed in the State of California.
D. Construction of the shoreline bank improvements via dredging or in-water excavation will not be allowed. The cofferdam system shall be installed prior to any in-water Work. The cofferdam system shall comply with project permits. The contractor shall be responsible for preparing a storm water pollution prevention plan (SWPPP).
E. The type of construction used for cofferdams, protective works and diversions shall be at the choice of the Contractor, provided that the selected alternative fulfills the requirements of the Contract Documents.
F. Cofferdams, protective works and diversions shall be constructed, maintained, and removed using materials and methods which do not produce siltation or other degradation of the water quality which exceeds the limits of applicable federal, state and local regulations.

1.2 SCHEDULING

A. Contractor shall ensure that the temporary fishway bypass channel is operational before the cofferdam upstream of Wohler Bridge is constructed.
B. Initial installation: per Milestone 1, as described in Document 00520 (Agreement).
C. Subsequent installations: by July 1 of each year.
D. Remove cofferdam at the beginning of each rainy season to prevent loss of property and additional upstream flooding, before river flows reach 2,000 cfs.

1.3 SUBMITTALS

A. Work Plan, including:
   1. Materials to be used. Treated wood is not allowed.
   2. Method of installation. Pile or impact hammering or jetting is not allowed. If pile driving is used, hydro acoustic monitoring is required.
   3. Method of anchoring.
   4. Method of tying into the river bank and redirecting river flow at cofferdam ends.
   5. Calculations for sizing the diversion, structure design, and prediction of scour on river side of structure.
   6. Dewatering plan, including water removal methods, water treatment measures, and discharge location and method.

7. Reference to and coordination with storm water pollution prevention plan (SWPPP) and measures.
8. Sequence of work.
9. Height of impounded water.
10. Foundation system.
11. Schedule for cofferdam installation, operation, and removal.
12. Methods for screening of structures and intakes to prevent passage of fish.
13. Daily monitoring of cofferdam system for stability, scour, seepage, dewatering, water treatment, and discharge.
14. Safety measures.
15. Contingency plans for:
    a. overflow of cofferdam
    b. interior seeps or boils,
    c. scour in excess of 1 foot below the original river bed elevation on the river side of the cofferdam
    d. failure of structure or anchorage, and
    e. accumulation of sediment and/or woody debris.
16. Methods and sequence for removal of system and restoration of river bed and other disturbed area, including re-watering of the area, in a manner that minimizes erosion and turbidity. All bank stabilization measures shall be fully in place and approved by Owner prior to removing the cofferdam system. Remove and properly dispose of off-site all cofferdam system components.

B. The submittal shall be prepared and signed by a Professional Engineer registered in the State of California and experienced with cofferdam design.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Provide hydroaccoustic monitoring during initial steel pile driving operations.
    a. Maximum noise level allowed: 180db
    b. Provide sound attenuation if necessary to reduce noise level

PART 2 PRODUCTS

2.1 SANDBAGS IN WATER

A. All temporary sandbags, if used to be placed in water, shall conform to all applicable federal, state and local laws and regulations.

PART 3 EXECUTION

3.1 COFFERDAMS

A. The upstream cofferdam shall impound water to an elevation of 38 FT as indicated.
B. Cofferdams shall be designed and construction methods shall be selected by the Contractor.
C. Cofferdams shall be dewatered such that the bottoms of the excavations within the cofferdams are firm, free of standing water, and in all respects acceptable to the Owner as foundation. Dewatering shall be performed in accordance with the requirements of Section 02140 (Dewatering).
D. Any loss of water and any damage to ground, structures, facilities, agricultural projects, fishery resources, or any other existing items that may be affected by the Contractor's

cofferdam operations, shall be the responsibility and liability of the Contractor and shall be repaired or restored by the Contractor as required, to the Owner's satisfaction. Any damage or injury to a person directly or indirectly caused by the Contractor's cofferdam operations shall be the responsibility of the Contractor.

E. It is the Contractor's responsibility to design, install, and maintain functionally effective and structurally sound cofferdams. The failure of the cofferdam either in function or structurally for any reason, subsurface conditions inclusive, and the consequences of such a failure and liability for such a failure, shall be the responsibility of the Contractor. In the event the cofferdam has failed or is not functional as designed, the Contractor shall repair or rebuild the cofferdam at no additional cost to the Owner.

F. The Owner shall be notified if any fish are trapped or there is a potential for fish to be trapped inside the cofferdam.

G. A temporary fish bypass channel shall be constructed as indicated before the placement of the upstream cofferdam structure to allow migration of aquatic species.

END OF SECTION

SECTION 02230

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Site clearing, stripping and grubbing.

1.2 DEFINITIONS

A. Stripping: Stripping shall consist of the removal and stockpile of crops, weeds, grass, and other vegetative materials to the ground surface and removal of surface soil to the depth specified herein or as indicated.
B. Unsuitable Debris: Material containing roots greater than ½ inch diameter and/or 6 inches long, debris, rubble, trash or other deleterious items shall be classified as unsuitable debris.

1.3 SUBMITTALS

A. Work Plan: Waste Material Disposal Plan.
   1. At a minimum, the Waste Material Disposal Plan shall include:
      a. Schedule of activities.
      b. Method of clearing and grubbing and equipment to be used.
      c. Identify all disposal sites.
      d. Describe the method of disposal.
      e. Provide written permission from disposal site owner.
      f. Provide permits, as applicable.
      g. Survey drawings with associated acreage calculations.

1.4 SURVEYS

A. Surveys shall be performed immediately prior to clearing and grubbing to determine the acreage to be cleared and grubbed. The Contractor shall provide plan layout sheets for all cleared and grubbed areas.

1.5 ORDER OF WORK

A. Work shall be carried out within the limits of Clearing and Grubbing as indicated and shall be limited to the actual areas necessary to complete the Work.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 PREPARATION

A. Locate, and protect from damage and displacement, all utilities, structures, benchmarks, and other improvements not otherwise designated for removal or demolition.
B. Protect existing improvements, utility, and other facilities to remain so as to prevent damage.

C. Protect existing trees and other vegetation to remain against damage.
   1. Do not smother trees by stockpiling construction materials or excavated materials within drip line.
   2. Avoid foot or vehicular traffic or parking of vehicles within drip line.
   3. Provide temporary construction fence as necessary.

3.2 DEMOLITION SEQUENCING

A. Conduct demolition operations in a manner that maintains utility services to the Mirabel Facility, the river diversion structure and the inflatable dam operations at all times and is consistent with procedures outlined in Section 02072 (Demolition, Cutting and Patching).
B. Perform demolition of surface improvements concurrent with the construction of the new facilities.
C. Immediately repair damage done to existing utilities to limit disruption to Owner's operations.

3.3 SURFACE IMPROVEMENT REMOVAL

A. Retain and have a locating service mark all existing utilities.
B. Pothole each existing utility that intersects with the new Work to confirm the actual locations and depths.

3.4 CLEARING

A. General:
   1. The clearing operations shall consist of the complete removal of all vegetation within the limits of Clearing and Grubbing.
   2. All trees, stumps, down timber, snags, brush, vegetation, old piling, stone, concrete rubble, abandoned structures, and similar debris shall be cleared within the limits of construction as indicated.
   3. Vegetation:
      a. Vegetation to be removed shall consist of all heavy growth of brush and woody vegetation.
      b. Vegetation may be chipped and spread on site as directed by Owner.
   4. Tree removal:
      a. Tree removal shall consist of removing the canopy and tree trunk to a point 0.5 feet above the ground surface.
   5. Miscellaneous debris:
      a. The Contractor shall also remove debris, and other materials within the limits of clearing and grubbing and in areas which will be covered with embankment, and as indicated.

3.5 GRUBBING

A. General:
   1. Grubbing shall consist of the removal of all stumps, roots, buried logs, old piling, old paving, and other unsuitable debris as defined in these specifications and to the limits of construction as indicated.
B. Filling of Holes:
   1. All holes caused by grubbing operations shall be excavated with 3 to 1 (horizontal to vertical) side slopes. The excavations shall then be backfilled with compacted soil in conformance with Section 02300 (Earthwork).

3.6 STRIPPING

A. General:
   1. After inspection and approval of cleared and grubbed areas, stripping may proceed.
B. Description of Work:
   1. Strip within limits of construction heavy growth of crops, grass weeds and other vegetation to a depth of 0.5 feet.
      a. No stripped or excavated material shall be stockpiled on existing slopes.
      b. Construct stockpiles to freely drain surface water.
      c. Cover inactive storage piles to prevent erosion.
C. Relocation and Placement of Material:
   1. The stripped surface soil and organic materials shall not be incorporated into the embankment.

3.7 DISPOSAL REQUIREMENTS

A. Cleared and Grubbed Material:
   1. Except as hereinafter specified, all logs, limbs, slash, and other debris which are the products of the clearing and grubbing operations shall be disposed of. The Contractor shall remove any or all of the products of clearing and grubbing operations from the Site and dispose of the materials at locations or through other sources arranged for, by and at the expense of the Contractor and approved by Owner.
   2. Do not burn combustible materials on Site.
   3. Do not bury organic matter on Site.
   4. All cleared, grubbed, and stripped material that is not designated for re-use, is waste material and becomes property of the Contractor.
   5. Remove all waste material from the Site and dispose of in accordance with the accepted Disposal Plan, all permits, codes, laws, rules and regulations.

3.8 FIELD QUALITY CONTROL

A. Clearing and Grubbing:
   1. The Contractor shall establish and maintain quality control for clearing and grubbing operations to assure compliance with Contract Documents, and maintain record of the quality control for all construction operations.

3.9 CLEAN UP

A. Remove all debris and stains resulting from the work of this section.

3.10 ACCEPTANCE

A. Upon completion of the site clearing, obtain Owner's written acceptance of clearing.

END OF SECTION

SECTION 02270

SOIL EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.1 REFERENCES

A. SS21-1.02 P Caltrans Standard Specification.

PART 2 PRODUCTS

2.1 MATERIALS

A. Fiber rolls, per Caltrans Standard Specification SS 21-1.02 P.
B. Stone for Stone Filter: 2 IN graded gravel or crushed stone.

PART 3 EXECUTION

3.1 PREPARATION

A. Prior to General Stripping Topsoil and Excavating:
   1. Install perimeter dikes and swales.
   2. Excavate and shape sediment basins and traps.
   3. Construct pipe spillways and install stone filter where required by Owner.
   4. Machine compact all berms, dikes and embankments for basins and traps.
   5. Install straw bales where directed by Owner.
      a. Provide two stakes per bale.
      b. First stake angled toward previously installed bale to keep ends tight against each other.
B. Construct sediment traps during rough grading as grading progresses.

3.2 DURING CONSTRUCTION PERIOD

A. Maintain Basins, Dikes, Traps, Stone Filters, Straw Bales:
   1. Inspect regularly especially after rainstorms.
   2. Repair or replace damaged or missing items.
B. Construct inlets as soon as possible.
   1. Excavate and tightly secure straw bales completely around inlets as directed by Owner.
C. Provide necessary swales and dikes to direct all water towards and into sediment basins and traps.
D. Do not disturb existing vegetation (grass and trees).
E. Excavate sediment out of basins and traps when capacity has been reduced by 50 percent.
   1. Remove sediment from behind bales to prevent overtopping.
F. Topsoil and Fine Grade Slopes and Swales:
   1. Seed and mulch as soon as areas become ready per Section 02935 (Hydroseeding).

3.3 NEAR COMPLETION OF CONSTRUCTION

A. Eliminate basins, dikes, traps.
B. Grade to finished or existing grades.

C. Fine grade all remaining earth areas, then seed and mulch per Section 02935 (Hydroseeding).

END OF SECTION

SECTION 02271

ROCK SLOPE PROTECTION

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Stone revetment (rip rap) for protection of slopes against erosion.

1.2 REFERENCES

A. ASTM C127 — Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate

1.3 SUBMITTALS

A. Shop Drawings:
   1. Layout drawings.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
   3. Certifications.
   4. Test reports.
   5. Submit all tests and certification in a single coordinated submittal.
      a. Partial submittals will not be accepted.

1.4 QUALITY ASSURANCE

A. Perform all tests at an approved independent laboratory.
B. Source Tests:
   1. Supply certified tests and service records to determine acceptability and application of stone materials.
   2. In event suitable test reports or a service record that is satisfactory are not available, as in case of newly operated sources, subject material to tests necessary to determine its acceptability for use.
   3. Tests to which materials to be subjected include:
      a. Specific gravity.
C. Specific Gravity Test:
   1. Conform with ASTM C127.
   2. Not less than 2.40 minimum.

PART 2 PRODUCTS

2.1 MATERIALS

A. Stone:
   1. Durable broken quarry run stone.
   2. Does not disintegrate on exposure to water or weathering.
   3. Free from structural fractures and defects.
   4. Not containing shale, unsound sandstone, or other material which will disintegrate.
   5. Graded within limits specified.

6. Breadth and thickness of any stone: Not less than one-third of its length.
7. Ensure that dirt and fines accumulated from interledge layers or from blasting or handling operation is less than 2 percent by weight.
8. ¼ Ton Rock Slope Protection will comply with gradation specified below:

Rock Size	Gradation %
1,000 LB (90 kg)	0 – 5
500 LB (34 kg)	50 – 100
150 LB (11.3 kg)	90 - 100

9. Geotextile fabric, Type SAS, Nonwoven 180M (or equivalent).

PART 3 EXECUTION

3.1 PREPARATION

A. Trim and dress all areas to receive rock slope protection.
B. Bring areas that are below allowable minus tolerance limit to grade by filling with material similar to adjacent material.

3.2 PLACING

A. Place rock material on prepared foundation within limits indicated.
B. Place on prepared base to produce a well-graded mass of stone with minimum percentage of voids.
C. Place to required thickness and grades.
D. Place to full thickness in a single operation to avoid displacing the underlying material.
E. Distribute entire mass to conform to gradation specified.
F. Do not place rock by dumping into chutes or by similar method likely to cause segregation.
G. Keep finished rock free from objectionable pockets of small stones or clusters of larger stone.
H. Hand place as necessary to obtain a well-graded distribution.
I. Ensure a final tolerance of within 3 IN from indicated slope and grade lines.
J. Place rock in conjunction with embankment construction to prevent mixture of embankment and rock slope protection.
K. Maintain until accepted.
L. Replace any displaced material to lines and grades shown.

END OF SECTION

SECTION 02300

EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. Related Section:
   1. Section 02140 (Dewatering).
   2. Section 02370 (Soil Erosion and Sedimentation Control).

1.2 REFERENCES

A.	ASTM D1557	Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (56,000 ft-lbf/ft^3) (2700 kN-m/m^3)
B.	ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.3 DEFINITONS

A. Foundations: Includes footings, base slabs, foundation walls, mat foundations, grade beams, piers and any other support placed directly on soil.
B. Soil: Includes any type that may be present at or below existing subgrade levels.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
   2. Certifications.
   3. Test reports:
      a. Soils inspection and testing results.
      b. Fill Material shall be approved by Owner prior to placement.
   4. Contractor to submit Grading Operations Plan for embankment construction and excavation. Plan to include anticipated methodology for excavations and placement of fill materials. Contractor to identify access route for import or export material if import or export material is anticipated.
B. Samples:
   1. Submit samples and source of backfill materials proposed for use.
   2. Submit samples and source of borrow materials proposed for use.

PART 2 PRODUCTS

2.1 MATERIALS

A. Fill: Selected material approved by Owner from off Site borrow.
   1. Import fill material (as necessary):
      a. Free of deleterious and organic matter.
      b. Expansion Index of 30 or less.
      c. Provide approved fill material which is free from roots, organic matter, trash, material, and stones having maximum dimension greater than 3 IN.

PART 3 EXECUTION

3.1 SITE EXCAVATION AND GRADING

A. Excavation and Grading:
   1. Contractor shall construct surfaces to lines and grades indicated.
      a. Stake all units, structures, piping, roads, parking areas and walks and establish their elevations.
      b. Perform other layout Work required.
   2. Preparation of ground surface for structures and embankments:
      a. Before fill is placed, scarify all areas to receive fill to a minimum depth of 6 IN.
   3. Protection of finish grade:
      a. During construction, shape and drain embankment and excavations.
      b. Maintain ditches and drains to provide drainage at all times.
      c. Protect graded areas against action of elements prior to acceptance of Work.
      d. Reestablish grade where settlement or erosion occurs or where vegetation has been grubbed.
   4. Surplus material from Site excavation may be placed at "Fill Pond 5," indicated on the location map included on Drawing Number G1. Surplus material placed at this location shall be spread out and graded to drain toward the west.

B. Construct embankments and fills per approved Grading Operations Plan.
   1. Do not place material in layers greater than 8 IN loose thickness.
   2. Place layers horizontally and compact each layer prior to placing additional fill.
   3. Compact by sheepsfoot, pneumatic rollers, vibrators, or by other equipment as required to obtain specified density.
      a. Control moisture for each layer necessary to meet requirements of compaction.

3.2 USE OF EXPLOSIVES

A. Blasting with any type of explosive is prohibited.

3.3 FIELD QUALITY CONTROL

A. Compaction testing will be as necessary to ensure compliance with Specifications.
B. Atterberg Limits laboratory test per ASTM D4318 shall be performed for every 50 cubic yards of material placed for imported fill materials.
C. Give minimum of 48 HR advance notice to Owner when ready for compaction or subgrade testing and inspection.
D. Should any compaction density test, Atterberg Limits test, or subgrade inspection fail to meet Specification requirements, perform corrective Work as necessary.
E. Contractor shall pay for all costs associated with corrective Work and retesting resulting from failing compaction density or Atterberg Limits tests.

3.4 COMPACTION DENSITY REQUIREMENTS

A. Obtain approval from Owner with regard to suitability of soils and acceptable subgrade prior to subsequent operations.
B. Remove loose, wet, or soft material and replace with approved material as directed by Owner.
C. Stabilize subgrade with well graded granular materials as directed by Owner.
D. Ensure by results of testing that compaction densities comply with the following requirements:

1. Embankments:

LOCATION	COMPACTION DENSITY
Fill:	90 percent per ASTM D1557 at 0 percent to +3 percent optimum moisture content.

3.5 EXCAVATION, FILLING, AND BACKFILLING FOR STRUCTURES

A. Excavation Requirements for Structures:
   1. General:
      a. Do not commence excavation until Owner approves:
         1) The removal of topsoil and other unsuitable and undesirable material from existing subgrade.
      b. Owner grants approval to begin excavations.
   2. Removal of obstructions and undesirable materials in excavation includes, but is not necessarily limited to, removal of old foundations, existing construction, unsuitable subgrade soils, expansive type soils, and any other materials which may be concealed beneath present grade, as required to execute Work as indicated.
      a. If undesirable material and obstructions are encountered during excavation, remove material and replace as directed by Owner.
   3. Level off bottoms of excavations to receive compacted fill.
      a. Remove loose materials and bring excavations into approved condition to receive fill material.
      b. Temporary excavation slopes shall not be steeper than 2 : 1 (horizontal : vertical).
      c. Top of excavations shall be set back from all existing structures minimum of 5 FT horizontal.
   4. Make excavations large enough for working space and inspection.
   5. Protection of structures:
      a. Prevent new and existing structures from becoming damaged due to construction operations or other reasons.
      b. Prevent subgrade existing foundations from becoming wet and undermined during construction due to presence of surface or subsurface water or due to construction operations.
   6. Drainage:
      a. Control grading so that ground is pitched to prevent water from running into excavated areas or damaging structures.
      b. Maintain excavations where equipment support pads or fill material are to be placed free of water.
      c. Provide pumping required to keep excavated spaces clear of water during construction. See Section 02140 (Dewatering).
      d. Provide free discharge of water by trenches, pumps, wells, well points, or other means as necessary and drain to point of disposal that will not damage existing or new construction or interfere with construction operations.
B. Fill:
   1. General:
      a. Subgrade to receive fill or backfill shall be free of undesirable material as determined by Owner and scarified to a depth of 6 IN, moisture conditioned to near optimum moisture content, and compacted to at least 90 percent relative compaction.

b. Do not place any fill or backfill material until subgrade under fill or backfill has been inspected and approved by Owner as being free of undesirable material and compacted to specified density.

2. Fill and backfill placement:
   a. Place fill and backfill material in thin lifts as necessary to obtain required compaction density.
   b. Compact material by means of equipment of sufficient size and proper type to obtain specified density.
   c. Do not place fill and backfill when the temperature is less than 40 DegF and when subgrade to receive fill and backfill material is frozen, wet, loose, or soft.

3.6 SPECIAL REQUIREMENTS

A. Erosion Control:
   1. Conduct Work to minimize erosion of Site per Section 02370 (Soil Erosion and Sedimentation Control).
   2. Construct stilling areas to settle and detain eroded material.
   3. Remove eroded material washed off Site.

END OF SECTION

SECTION 02315

DRIVEN STEEL PILING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Driven open or closed end concrete filled pipe piling.

B. Related Sections:
   1. Section 02100 (Controlled Density Fill [CDF]).
   2. Section 03208 (Reinforcement).
   3. Section 03308 (Concrete, Materials and Proportioning).
   4. Section 03311 (Concrete Mixing, Placing, Jointing, and Curing).
   5. Section 03350 (Testing).
   6. Section 09905 (Painting and Protective Coatings).

1.2 REFERENCES

A.	AISC	Manual of Steel Construction.
B.	ASTM A36	Standard Specification for Carbon Structural Steel.
C.	ASTM A252	Standard Specification for Welded and Seamless Steel Pipe Piles.
D.	ASTM A615	Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement (Including Supplementary Requirements S1).
E.	ASTM C33	Standard Specification for Concrete Aggregates.
F.	ASTM C150	Standard Specification for Portland Cement.
G.	ASTM D1143	Standard Test Method for Piles Under Static Axial Compressive Load.
H.	ASTM D3689	Standard Test Method for Individual Piles Under Static Axial Tensile Load.
I.	AWA D1.1	Structural Welding Code – Steel.
J.	Building Code	California Building Code.

1.3 DEFINITIONS

A. Soils Engineer: Independent geotechnical engineer, registered in the State of California, hired to monitor project execution.

B. Certified Welder: Meeting the qualification requirements of AWS D1.1.

1.4 SUBMITTALS

A. Product Data:
   1. Steel pile type, size, dimensions and grade of steel.
   2. Pile tip protection/closure device.
   3. Manufacturer and type of pile splicing device.
   4. Concrete mix design including submittal information defined in Section 03308 (Concrete, Materials and Proportioning).

B. Shop Drawings:
   1. Provide a plan indicating all pile types, materials, locations, dimensions, splice (if any), and actual deviation of driven pile with respect to original location per plans.
C. Quality Assurance/Control Submittals:
   1. Design Data:
      a. As-built pile location drawing(s):
         1) Sealed by licensed land surveyor registered in the state of California.
         2) Include deviations beyond acceptable tolerances from specified locations.
   2. Test Reports:
      a. Wave equation analysis for proposed installation equipment and piling material.
         1) Calculations shall be performed and sealed by a professional engineer licensed in the state of California.
         2) Pile compressive stresses must be limited to allowable values during installation.
      b. Results of concrete strength tests.
      c. Results of pile load tests.
      d. Pile reports.
   3. Certificates:
      a. Welder's certification and welding procedure.
      b. Evidence that the Land Surveyor is licensed to practice in the State of California.
      c. Submit evidence of Soils Engineer licensed as a geotechnical engineer, registered in the State of California
      d. Welding Inspector qualifications

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Welders and welding processes to be qualified in accordance with AWS D1.1 requirements.
      a. Welders to have been qualified during the 12 month period prior to commencement of welding.
   2. Welding inspectors shall be certified in accordance with AWS standards.

1.6 SITE CONDITIONS

A. Do not begin pile installation until the earthwork in the area where piles are to be driven has been completed as shown in the Contract Documents.
B. All work shall comply with referenced Building Code.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Pile tip protection device:
      a. Pipe piles: As manufactured by Skyline Steel, or Approved Equal.
   2. Pile splice device:
      a. Pipe piles: As manufactured by Skyline Steel or Approved Equal.

2.2 MATERIALS

A. Pipe Piles:
   1. ASTM A252, Grade 3, with a minimum yield strength of 50,000 psi.

2. Inside diameter: 18 IN.
3. Pipe wall thickness: Minimum of 3/8 IN, unless otherwise specified.

B. Pile Splice Device:
1. Steel with minimum yield strength of 50,000 psi.
2. Minimum wall thickness of 3/8 IN.
3. Shape:
   a. Circular for pipe piles.
      1) Sleeves limited to 3/8 IN projection beyond pipe O.D., otherwise place on inside of pipe.
4. Capable of being welded to piles.
   a. After welding completed, being capable of developing the full tensile strength of the pile.

C. Pile Tip Protection Device:
1. Shape:
   a. Pipe piles: Conical in shape making an angle of 60 degrees with the horizontal.
2. Steel with a minimum yield strength of 50,000 psi.
3. Of sufficient thickness and strength to be able to be driven through soils encountered without deformation to end of pile.
4. Capable of being welded to the pile.

D. Pile Tension Device:
1. Steel, ASTM A572, Grade 50 or equal.
2. Install as specified on Drawings.

E. Concrete Placed in Pipe Piles:
1. Minimum 28 day compressive strength: 4500 psi. See Drawings for additional requirements.
2. Aggregates:
   a. ASTM C33, Size #67.
   b. Aggregates to be natural not manufactured.
3. Cement: ASTM C150, Type II.
4. Fly ash: Required per Section 03308 (Concrete, Materials and Proportioning).
5. See Section 03308 (Concrete, Materials and Proportioning) for additional requirements.

F. Reinforcing Steel:
1. ASTM A615, Grade 60.
2. See Section 03208 (Reinforcement) for other requirements.

G. Coal Tar Epoxy: See Section 09905 (Painting and Protective Coatings) for additional requirements.

H. Controlled Density Fill: See Section 02100 (Controlled Density Fill [CDF]).

2.3 PILE CAPACITY

A. Allowable working compression capacity of all piles shall be 65 Tons.

B. Allowable working uplift capacity of all piles shall be 38.9 Tons.

2.4 FABRICATION

A. Ends of piles to be machine cut and square making an angle of 90 degrees with the longitudinal axis of the pile. For battered piles, cut on a horizontal plane.

B. Tolerances:
1. Pipe piles: Conform to requirements of ASTM A252.

PART 3 EXECUTION

3.1 INSPECTION

A. Pile Fabrication: Provide inspection per CBC Chapter 1704 & Inspection Tables on sheet S-2. Nondestructive examination (NDE) shall be as follows:
   1. Tests
      a. Butt joint and seam welds shall be visually examined to confirm code and engineering requirements for materials, components, dimensions, joint preparation, alignment, welding and assembly. Welds shall then be radiographically inspected for 100% of their circumference in accordance with API 1104.
      b. Perform dye penetrant test for all other applicable non-joint welds.
   2. Test coupons: In accordance with ASTM E8.
      a. Welded seam shall develop full strength of adjacent steel sheet or plate.
      b. Take two test coupons upon commencement of pipe welding on a sample joint.
         1) Perform tensile test
         2) Perform bend test

B. Pile Installation: Provide inspection services indicated herein to be performed by the Soils Engineer.

3.2 LINES AND LEVELS

A. Complete necessary excavation and furnish lines and levels as required to accurately install piles at their indicated locations.

3.3 PILE TIP PROTECTION

A. To tips of all piles attach a steel protection/closure device.
   1. Weld device to tip of pile in accordance with manufacturer's instructions.
   2. Welding to be performed by certified welding operators.

3.4 PILE WELDING AND SPLICING

A. Piles shall be installed as one (1) continuous member unless splices are approved by Owner.
   1. Use proprietary splicing device to hold pile sections in true alignment.
   2. Weld splicing device to piles per manufacturer's instructions.
   3. Weld pile sections to each other by means of a weld which will provide the full tensile strength of the pile at the splice location.
   4. Use E70 Series electrodes meeting requirements of AWS D1.1.
   5. Welders to be certified to perform welding specified.

B. Maximum of 1 splice shall be allowed per pile.

C. No separate payment shall be made for splices.

3.5 PILE CUT OFF ELEVATIONS

A. Obtain cut off elevations from Foundation Plan(s) and details.

B. Make all cuts on horizontal plane.

3.6 DETERMINATION OF INSTALLED PILE LENGTH(S)

A. Actual pile lengths to be installed shall be as directed by the Soils Engineer from criteria established in the field.
   1. The driving of the first two (2) pile(s) to be witnessed by the Soils Engineer and by means of a pile driving formula or by other means, the final pile tip elevation or final driving resistance for all piles to be installed to then be established by the Soils Engineer.

2. The final tip elevation or final driving resistance established by the Soils Engineer for the piling to provide for the piling the allowable working capacities as required in this Section 02315 with a factor of safety of at least 2.
3. Maximum pile vertical movement when supporting the required allowable working capacity not to exceed 1/2 IN.

B. Prior to installing the first pile, by means of soundings or other methods, establish the actual elevation of the top surface of the river bed at each pile location
1. If the top surface at any pile is more than 1 foot higher or lower than shown on Drawings, notify Owner so that piling and supported structure above can be redesigned if necessary.
2. Do not install any piling until redesign is received from Owner.
3. Allow minimum of 5 Business Days to receive result of redesign.

3.7 DETERMINATION OF INSTALLED PILE LENGTH(S) BY PILE LOAD TESTS

A. Perform minimum of two (2) load tests each to determine allowable working downward load carrying capacity and allowable uplift working capacity of piles.
1. Tests for uplift working capacity are required only when uplift capacity is required for the piling as indicated on the plans and in this Section 02315.
2. Install test piles in locations and to tip elevations or to driving resistances as directed by Soils Engineer.
3. When approved by Owner, test piles may be placed at locations required for piling to support the structure(s).
   a. If test piles are placed at these locations and for any reason, the test piles should be found to be inadequate, place additional pile or piles adjacent to the inadequate pile as directed by the Owner to support the structure.
   b. Provide additional foundation as directed by Owner due to the placement of additional piles.
   c. Additional piles and foundations shall be installed at no additional expense to Owner.

B. Pile testing shall be under the direction and supervision of the Soils Engineer.
1. Make downward load carrying tests in accordance with ASTM D1143 and Building Code.
2. Provide tests of platform or anchor type.
3. Locate piles required for load tests as directed by Soils Engineer.
4. Entire apparatus required for load testing to be designed and supplied by Contractor.

C. When approved by Soils Engineer, tests for uplift working capacity may be performed on piles used in the downward load carrying tests.
1. Make uplift working capacity tests in accordance with ASTM D3689.

D. In the event anchor piles are employed, provide reaction through a steel beam of sufficient structural strength adequately secured to anchor piles.

E. Provide a calibration chart not more than 20 days old for the hydraulic jack and pressure gage assembly to be used for the tests.
1. Entire load test setup to have adequate capacity for testing piles to twice their specified required allowable working capacities.
2. Provide dial gages to measure settlement and uplift.
3. Record uplift measurements on anchor piles and on piles being tested for uplift capacity.
4. Readings will be taken by Soils Engineer, verified and signed by Contractor, with a copy sent to Owner.

F. Load test piles to a minimum of twice the required highest specified allowable working capacity(ies) as stated in this Section 02315.
G. In the event of failure of the testing system before tests are completed, repeat load test at no additional expense to Owner.
   1. In the event of failure of anchor pile or test pile before tests are completed, install new anchor or test piles at no additional expense to Owner.
H. Criteria for establishing failure of test piles for determination of required allowable working capacities will be as determined by Soils Engineer.
   1. Maximum pile vertical movement when supporting the required allowable working capacities not to exceed 1/2 IN.
I. Based on the results of the load tests, the final tip elevation or elevations or final driving resistances for all piling to be installed will be as established by the Soils Engineer.
J. If during installation of piling required for support of the structure(s), conditions are found to be different from those encountered during installation of test piles, revise final tip elevation or final driving resistance of the piling being installed as directed by Soils Engineer.

3.8 PAINTING OF PILING AND ACCESSORIES

A. Prepare and paint entire exterior surface of all pipe piles and accessories as follows:
   1. Use paint system as indicated in Section 09905 (Painting and Protective Coatings).
   2. Prior to painting, prepare surface in accordance with paint manufacturer's instructions.
   3. Do not paint surfaces to receive field welds.
B. Prior to installing piles, paint or repaint areas as follows:
   1. All scratched or abraded areas.
   2. All conical tip protection devices along with required welds.
   3. All splicing devices along with required welds.
   4. Any bare areas not previously painted.
   5. Use same paint, surface preparation and paint thicknesses as indicated in paragraph 3.8 A.
   6. Allow paint to fully dry prior to installing piles.
C. After piling are installed and filled with concrete, paint or repaint areas as follows:
   1. All scratched or abraded areas.
   2. Any bare areas not previously painted.
   3. All steel plates and shapes connected to the piling including all associated bolts and welds.
   4. Use same paint, surface preparation and paint thicknesses as indicated in Paragraph 3.8 A.

3.9 ADDITIONAL TEST PILES AND LOAD TESTS

A. In addition to test piles and load tests required by the Contract Documents, additional test piles and load tests may be required as directed by Soils Engineer.
   1. Such may be considered extra work and paid accordingly.

3.10 PILE DRIVING

A. Obtain approval for hammer type and energy prior to start driving piles.
B. Accurately locate and drive piles by such methods and equipment so as not to impair the pile strength or damage piles or adjacent construction in any way.
   1. Adequately support and hold piles in correct vertical position during driving by means of driving equipment.

2. Provide pile driving with fixed heads which will hold pile firmly in position and provide axial alignment with hammer.
3. Provide suitable driving heads to prevent damage to pile butts.
4. Drive piles with steam, air, or diesel hammer capable of driving piles to required tip elevation or elevations or to required final driving resistances.

C. No predrilling to aid installation shall be allowed, unless specifically approved by Owner.

D. Allow each pile installation to be witnessed by the Soils Engineer who will determine that the required final driving resistance or final tip elevation has been obtained and if necessary may revise the initially determined final driving resistance or tip elevation depending on driving conditions encountered.

E. Retap all piles to at least the pile's original tip elevation or final driving resistance.
1. Pile over driving will only be allowed when approved.
2. Remove any soil that has heaved during or after pile driving as necessary to maintain lines and levels in finished work.

F. Drive all piles to tip elevation or to final driving resistance as established by Soils Engineer.

3.11 CUSHION OR CAP BLOCKS

A. Protect tops of piles during driving by means of cushion or cap blocks with loss of hammer energy held to a minimum.
1. Do not provide continuous or frequent introduction of materials to cushion hammer blows.
2. Provide cushion or cap blocks of solid block of hardened or laminated softwood of proper shape and dimensions to fit hammer.
3. Strength of laminated materials to be equal to or greater than one (1) solid block.
4. Position grain of block parallel to axis of pile.

3.12 DRIVING AND PLACEMENT TOLERANCES

A. Drive piles at locations shown on Drawings.
1. Unless otherwise specified all piles are vertical.
2. Observe any indicated batters.
3. Maximum horizontal deviation of any pile from its required cut-off location shall not exceed 3 IN.
4. Pile centerline shall not deviate more than 2-1/2 IN in 10 FT of pile length from theoretical centerline.
5. Contractor to pay for cost of foundation revision and/or additional piles due to original pile(s) being driven beyond specified tolerance limits.

3.13 OBSTRUCTIONS

A. Should any obstruction including but not limited to boulders, rocks, rubble, fill, existing foundations or timbers be encountered which prevent driving of pile to its required tip elevation and/or final driving resistance, threaten pile damage or cause pile to drift from required location horizontally and/or vertically, cease driving and take corrective action as directed by Owner.

3.14 DAMAGED PILES

A. Replace damaged piles as directed by Soils Engineer at no additional expense to Owner.

B. Each pile to be free from defects and damage due to construction, fabrication, delivery, installation or other causes.

C. Damaged piles include but not necessarily limited to piles bent, buckled, cracked, with fabrication tolerances beyond those indicated, or with any other defect as determined by Owner that would weaken the pile.
D. Should any pile as determined by Owner be damaged, be too short to develop required final driving resistance or to reach required tip elevation or otherwise not conform to this Section 02315, withdraw pile and drive another pile in its place.
   1. If it is impossible to withdraw damaged or rejected pile, install another pile at location indicated by Owner.
   2. Revise foundation as directed by Owner as required by new location of pile.
   3. Additional pile and foundation to be at Contractor's expense.
E. Correct to satisfaction of Owner at no additional cost to Owner any pile or other construction that has been damaged by pile installation.

3.15 FILLING PILES WITH CONCRETE

A. Do not begin filling pipe piles with concrete until:
   1. All pipe piles within 50 FT radius have been driven to tip elevations or final driving resistances established by Soils Engineer.
   2. Pile concrete mix design has been approved by Owner.
   3. All standing water at bottom has been removed.
   4. Piles have been cut off.
   5. Owner gives approval to begin concrete placement.
B. After installing a pipe pile and prior to filling with concrete, cover open top of pile to prevent water, snow, ice or any other foreign material from entering the open pipe.
C. Place concrete in piles using tremie pipe in such a manner to prevent:
   1. Aggregate segregation.
   2. Bleed water collecting on top surface of concrete.
   3. Voids, honeycomb or air pockets from forming.
   4. Infiltration of any foreign materials.
D. Vibrate top 10 FT of concrete.
   1. Vibrate each 2 FT lift of this top 10 FT prior to subsequent concrete being placed.
E. Surface of concrete filled pipe pile at cut off elevation to be level with top surface of concrete flush with top of pipe.
F. Cure top surface of concrete for minimum of seven (7) days and protect against temperature extremes.
   1. Curing and protecting to be in accordance with Section 03311 (Concrete Mixing, Placing, Jointing, and Curing).
G. Concrete Strength Tests:
   1. Make four (4) 6 IN DIA x 12 IN high concrete test cylinders for each group of five (5) consecutive pipe piles filled with concrete, but make no less than one set of four cylinders per day.
   2. Along with each set of four (4) cylinders, make one (1) test each for slump, air content, and concrete temperature.
   3. Make all cylinders and perform all tests in accordance with requirements of Section 03350 (Testing).
   4. On test report, note which five (5) piles the tests represent.
   5. Test one (1) cylinder at seven (7) days for information and two (2) cylinders at 28 days for test strength result.

   a. Strength test result to be the average of strengths of two (2) cylinders from the same sample tested at 28 days.
   b. Hold one (1) cylinder in reserve.
6. Submit test results to Owner immediately after they are obtained.
7. Concrete strength test results which do not meet the compressive strength acceptance level criteria indicated in Section 03350 (Testing) will be cause for rejection of piling.
   a. Install additional piling and foundation when directed to do so by Owner due to low concrete strength test results at no expense to Owner.
8. Where shown on Drawings, install tension/uplift device and/or rebars extending out of tops of piles.
   a. See Section 03208 (Reinforcement) for rebar requirements.

3.16 PILE REPORT

A. Provide Owner with a copy of a pile report for all driven pile providing the following information:
   1. Pile location and number.
   2. Date driven.
   3. Length of pile (tip to cut off).
   4. Description of piles that were rejected (pile number, location, reason for rejection).
   5. Pile tip elevation.
   6. Hammer blow count for full length of pile.
      a. Penetration of last foot of driving in blows per inch.
   7. Volume of concrete placed in each pile.

END OF SECTION

SECTION 02316

TRENCHING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Excavation, trenching, backfilling and compacting for all underground utilities.
   2. Regulations: The Contractor is cautioned that the County of Sonoma and cities within the County have regulations governing the disposal of rubble, broken pavement, and similar materials. The Contractor shall become familiarized with the requirements of the agency having jurisdiction over any contemplated disposal site and shall comply with all such requirements.

B. Related Sections:
   1. Section 02300 (Earthwork).

1.2 REFERENCES

A. ASTM D1557 — Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft lb/fp^3)

1.3 SUBMITTALS

A. Shop Drawings:
   1. Submit respective pipe or conduit manufacturer's data, bedding material, methods of installation, and general recommendations.

B. Product Data:
   1. Acknowledgement that products submitted meet requirements of standards referenced.

C. Quality Assurance/Control Submittals:
   1. Test Reports:
      a. Submit test reports and fully document each with specific location or stationing information, date, and other pertinent information.
   2. Certificates:
      a. Current certification of trench shields (trench boxes) if employed for trench shoring.
   3. Design Calculations:
      a. Calculations and plans stamped and signed by a civil or structural engineer registered as a Professional Engineer in the State of California, for any trench shoring that varies from the shoring system standards.

1.4 SITE CONDITIONS

A. To avoid overloading or surcharge, maintain a sufficient distance back from edge of excavation to prevent slides or caving. Maintain and trim excavated materials in such manner to be as little inconvenience as possible to public and adjoining property owners.

PART 2 PRODUCTS

2.1 MATERIALS

A. Trench Backfill Material:
   1. Meeting requirements of engineered fill per Section 02300 (Earthwork).

B. Pipe Embedment Materials:
   1. Pipe embedment shall match the soil matrix and classification of the surrounding native materials.

PART 3 EXECUTION

3.1 TRENCH EXCAVATION

A. Excavation:
   1. Remove rock excavation, clay, silt, gravel, hard pan, loose shale, and loose stone as directed by Owner.
B. Excavation for Appurtenances:
   1. 12 IN (minimum) clear distance between outer surface and embankment.
   2. See Section 02300 (Earthwork) for applicable requirements.
C. Trench Excavation:
   1. Excavate trenches by open cut method to depth as indicated on Drawings and necessary to accommodate work.
   2. Any trench or portion of trench, which is opened and remains idle for 7 Days, or longer, as determined by the Owner, may be directed to be immediately refilled, without completion of work, at no additional cost to Owner. Said trench may not be reopened until Owner is satisfied that work associated with trench will be prosecuted with dispatch.
   3. Observe following trenching criteria:
      a. Trench size.
         1) Excavate width to accommodate free working space.
         2) Maximum trench width at top of conduit may not exceed outside diameter of utility service by more than 18 IN.
         3) Cut trench walls vertically from bottom of trench to 6 IN above top of pipe, conduit, or utility service.
         4) Keep trenches free of water.
D. Trenching for Electrical Installations:
   1. Comply with paragraph 3.2 C above except as modified by the following:
      a. Open no more than 600 lineal feet of trench for trenches more than 12 IN but not more than 30 IN wide.
      b. Any length of trench may be opened for trenches which are 12 IN wide or less.
      c. Do not over excavate trench.
      d. Cut trenches for electrical runs with minimum 30 IN cover, unless otherwise specified.
      e. See Division 16 (Electrical) for additional requirements.

3.2 PREPARATION OF FOUNDATION FOR PIPE LAYING

A. Subgrade Stabilization:
   1. Stabilize the subgrade when directed by the Owner.
   2. Observe the following requirements when unstable trench bottom materials are encountered.
      a. Notify Owner when unstable materials are encountered.
         1) Define by drawing station locations and limits.
         2) Stabilize subgrade as directed by Owner.

b. Remove unstable trench bottom caused by Contractor failure to dewater, rainfall, or Contractor operations.
   1) Replace with subgrade stabilization with no additional compensation.

3.3 BACKFILLING METHODS

A. Do not backfill until required submittals have been approved and show system is in full compliance to specified requirements.
B. Pipe Embedment:
   1. Comply with the following:
      a. Place backfill in lifts not exceeding 8 IN (loose thickness).
      b. Hand place, shovel slice, and pneumatically tamp all carefully compacted backfill.
      c. Comply with specific manufacturer's recommendations regarding backfilling and compaction.
      d. Compact each lift to specified requirements.
C. Trench Backfill:
   1. Perform in accordance with the following:
      a. Place backfill in lift thicknesses capable of being compacted to densities specified.
      b. Comply with specific manufacturer's recommendations regarding backfilling and compaction.
      c. Avoid displacing joints and appurtenances or causing any horizontal or vertical misalignment, separation, or distortion.
D. Water flushing for consolidation is not permitted.

3.4 COMPACTION

A. General:
   1. Place and assure embedment and backfill materials achieve compaction requirements specified below.
B. Compaction Requirements:

MINIMUM COMPACTIONS		
LOCATION	**SOIL TYPE**	**DENSITY**
1. Pipe Embedment Material:		
All Locations	Cohesionless Soils	90 percent of max relative density by ASTM D1557
2. Trench Backfill:		
Under pavement, gravel , roadway surfaces, and structures	Cohesive soils (within 3 feet of finished grade)	95 percent of max relative density by ASTM D1557
Under non-traffic areas	Cohesive soils	90 percent of max relative density by ASTM D1557

3.5 FIELD QUALITY CONTROL

A. Owner Testing:
   1. Owner may perform in-place moisture-density tests after receiving written request from Contractor.
   2. Minimum compaction requirements as stated in Paragraph 3.5 are maximum dry density. Owner may test compaction using wet density relationships. If wet density testing is to be utilized, the Contractor will be responsible for providing conversion charts between dry/wet density compaction requirements.

END OF SECTION

SECTION 02363

SOIL ANCHORS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. All anchors indicated on the drawings or specified to be soil anchors ("tiebacks") obtaining their required tension load carrying capacity from embedment into cohesive and/or granular soils.

1.2 REFERENCES

A.	AISC 325	Manual of Steel Construction.
B.	ASTM A36	Standard Specification for Carbon Structural Steel.
C.	ASTM A325	Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
D.	ASTM A572	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
E.	ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
F.	ASTM A722	Standard Specification for Uncoated High-Strength Steel Bar for Prestressing Concrete.
G.	ASTM C31	Standard Practice for Making and Curing Concrete Test Specimens in the Field.
H.	ASTM C33	Standard Specification for Concrete Aggregates.
I.	ASTM C39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
J.	ASTM C150	Standard Specification for Portland Cement.
K.	PTI	Post-Tensioning Manual: Chapter 4, Recommendations for Prestressed Rock and Soil Anchors.

1.3 DEFINITIONS

A. Anchor Bond Length: That length of anchor which is bonded to a passive subgrade zone and which transmits the required anchor tension load to subgrade.
B. Anchor Embedment Length: That portion of the total length of anchor extending into and surrounded by subgrade soil material.
C. Production Anchors: Anchors indicated on Drawings or otherwise required for support of structural members.
D. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

1.4 SUBMITTALS

A. Product Data:
Submit manufacturer and type of proposed anchor along with proposed anchor corrosion protection.

2. Submit manufacturer and type of proposed epoxy resin.
3. Submit manufacturer and type of proposed fast setting leveling grout.
4. Submit concrete grout mix design.
   a. Mix design to contain the following information:
      1) Sieve analysis and source of aggregates.
      2) Test for aggregate organic impurities.
      3) Proportioning of all materials.
      4) Type of cement along with mill certificate for the cement.
      5) One (1) seven (7) day and two (2) 28-day compression test results using 6 IN DIA by 12 IN high cylinders for testing.

B. Shop Drawings:
1. Submit Shop Drawings indicating proposed sizes and types of steel anchor or baseplates.
2. Submit Shop Drawings showing all bracing members and their connections.

C. Quality Assurance/Control Submittals:
1. Submit evidence of Soils Engineer license as a geotechnical engineer, registered in the State of California.
2. Submit results of all anchor load tests.
3. Submit strength test results of concrete grout placed in the field.
4. Submit recommended anchor embedment and bond length into soil to achieve specified loads as established by Soils Engineer.
5. Submit anchor report for all in place production anchors.
   a. Submittal is for information only.

1.5 QUALITY ASSURANCE

A. Qualifications:
1. Anchor installer to have a minimum of five (5) years of experience in the installation and construction of the type of anchors shown on the Drawings and required by the Specification Sections.

1.6 PROJECT CONDITIONS

A. Project Environmental Requirements:
1. Do not begin anchor installation until the earthwork in the area where anchors are to be installed has been completed as shown on the drawings and indicated in this Section 02363.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Soil anchors:
   a. Dywidag threadbar reinforcing steel. Dywidag threadbar prestressing steel as manufactured by Dywidag Systems International, USA, Inc., or Approved Equal.
2. Fast setting leveling grout under steel anchor or base plates:
   a. Super Por-rok as manufactured by Hallemite, Lehn and Fink Industrial Products Division of Sterling Drug Inc., or Approved Equal.
3. Epoxy resin for coating and bonding anchors to subgrade:

a. Celltite by Celltite, Inc. , or Approved Equal.

2.2 MATERIALS

A. Soil Anchors:
   1. Threadbar prestressing steel anchors conforming to ASTM A722, diameter as indicated.
B. Steel Anchor or Baseplates: ASTM A36 or ASTM A572.
C. Washers Under Anchor Locking Nuts:
   1. Beveled washers: Steel or malleable iron of sufficient strength to prevent gouging of washer while tightening locking nut.
   2. Flat washers: ASTM A325.
D. Fast setting leveling grout under steel anchor or baseplates: Minimum 28-day compressive strength to be 5000 psi.
E. Concrete grout for coating and bonding anchors to subgrade:
   1. Cement: ASTM C150, Type II, or III.
   2. Aggregates:
      a. ASTM C33 well graded from fine to coarse.
      b. Aggregates to be natural not manufactured.
   3. Water: Potable, clean, free of oils, acids, and organic matter.
   4. Water content to be minimum necessary for proper pumping of grout with a maximum water cement ratio by weight of 0.45.
   5. Minimum 28-day compressive strength to be 5000 psi with a higher 28-day compressive strength provided if required to allow anchors to be post tensioned to specified tension loads.
   6. Do not use expansive agents or admixtures in the grout mix.

2.3 ANCHOR CAPACITY

A. Test loads are indicated and allowable working tension load carrying capacity for each production anchor is approximately one half of load indicated.

PART 3 EXECUTION

3.1 INSPECTION

A. Furnish and pay for inspection services indicated herein to be performed by the Soils Engineer. Soils Engineer shall be a licensed Geotechnical Engineer in the State of California.

3.2 LINES AND LEVELS

A. Complete necessary excavation and furnish all lines and levels necessary for completion of anchor installation.

3.3 DETERMINATION OF ANCHOR LENGTH(S) TO BE INSTALLED

A. Perform no less than two (2) load tests on anchors to determine required anchor bond length and embedment length into subgrade necessary to provide required allowable working tension load carrying capacity.
   1. Perform load tests prior to installing production anchors.
      a. Install test anchors at locations with anchor bond length and embedment length into subgrade all as determined and directed by Soils Engineer.
   2. All components and details of the test anchors to be the same as proposed and required for use in production anchors.

3. When approved, test anchors may be placed at locations required for production anchors.
    a. If test anchors are placed at these locations and for any reason should be found to be inadequate, install additional anchor or anchors adjacent to the inadequate anchor as directed by Owner.
    b. Provide additional structural members as required due to the location of an additional anchor or anchors and as directed by Owner.
    c. Additional anchors and structural members to be provided and installed at no additional expense to Owner.

B. Entire anchor load testing program to be under the direction and supervision of the Soils Engineer.
1. When establishing anchor bond length and anchor embedment length into subgrade for test anchors, take into account the reduced tension capacity of an anchor due to "group action" caused by the close proximity of the locations of adjacent production anchors.
2. Apparatus for load testing anchors to be of such design that not only is the anchor tested for its capability of supporting the required loading but also that the subgrade material surrounding the anchor is tested for its capability of supporting the required loading.
3. Contractor to design test anchor setup.
    a. Entire apparatus for load testing anchors to be supplied by Contractor.

C. Load test anchors in accordance with the PTI's "Recommendations for Prestressed Rock and Soil Anchors."
1. Provide a calibration chart not more than 20 days old for hydraulic jack and pressure gage used for the load tests.
2. Entire load test setup to have adequate capacity for testing anchors to twice their specified allowable working tension load carrying capacity.
3. Provide a dial gage to measure anchor movement during load testing.
    a. All readings, taken by Soils Engineer, to be verified and signed by Contractor, and a copy sent to Owner for information.
4. Do not begin load tests until material used to bond anchors to subgrade has cured sufficiently to be capable of transferring the required test loads from the anchor to the subgrade.

D. Load test anchors to a minimum of twice the specified allowable working tension load carrying capacity as stated in this Specification Section.

E. Criteria for establishing failure of test anchors will be as determined by Soils Engineer.

F. In the event of failure of test anchor apparatus setup, repeat load test at no additional expense to Owner.

G. Based on the results of the anchor load tests, the anchor bond length and anchor embedment length into subgrade for production anchors to be installed at required locations to be as directed by the Soils Engineer.
1. Send anchor load test results to Owner for information.

H. If, during the installation of the production anchors, subgrade conditions are found to be different from those encountered during installation of the test anchors, or if production anchors are not capable of being post tensioned to the required loads as specified herein, revise the anchor bond length and/or the anchor embedment length into subgrade for the anchor being installed as directed by the Soils Engineer.
1. If anchor is found to be not capable of being post tensioned to the required loads, install additional anchor or anchors as directed by Owner with anchor bond length and embedment length as directed by Soils Engineer.

2. Install additional structural members required by placement of additional anchor or anchors as directed by Owner.
   a. Allow Soils Engineer to witness installation of all production anchors.

3.4 ADDITIONAL ANCHOR LOAD TESTS

A. Provide installation and testing of additional test anchors, if required by Soils Engineer, loaded and tested in accordance with requirements of this Specification Section.

3.5 ANCHOR INSTALLATION AND DETAIL REQUIREMENTS

A. Equipment:
   1. Drilling equipment shall be adequate for providing the required bore holes in the subgrade encountered.
   2. All drilling is to be done by rotary drilling.
   3. Grouting equipment to be capable of continuous mechanical mixing that will produce a uniform and thoroughly mixed grout at the required pressures.
   4. Post tensioning of anchors to be accomplished by use of a hydraulic jack properly calibrated, capable of applying the required tension loads and including appropriate gages to indicate the load applied and to measure anchor elongation and movements.
B. Anchor Corrosion Protection:
   1. All installed anchors for their entire length shall be covered with a polyvinyl chloride (PVC) sheathing gastight to prevent corrosive substances reaching the anchor steel.
   2. A PVC seal end cap to be placed over the bottom end of each anchor along with a gastight PVC sealing cap placed over the anchor nut at each anchor.
   3. PVC required protection for anchors to be as standard with anchor manufacturer subject to review and approval by Owner.
C. Anchor Placement:
   1. Before anchor placement, each anchor to be thoroughly cleaned to permit adequate bonding of the anchor to the bonding material.
   2. Do not install any anchors which are bent, cracked, of insufficient length, of reduced cross section due to any reason, or damaged in any way which would decrease the tension load carrying capacity of the anchor.
   3. Install anchors at the indicated locations, to the embedment length as directed by the Soils Engineer and at the indicated angle of inclination.
      a. Where the angle of inclination is not shown on the Drawings, an anchor shown horizontally shall be placed at 90 degrees with true vertical and an anchor shown vertically shall be placed at 90 degrees with true horizontal.
      b. A tolerance of +3 degrees will be allowed on the indicated or specified angle of inclination.
   4. All anchors to be continuous full length without splices.
   5. Provide a washer under the anchor locking nut.
      a. Washer to be beveled where anchor is not 90 degrees to anchor plate.
   6. Locking nuts shall be hexagonal head of the heavy duty type, conforming to the requirements of or in accordance with the manufacturer's specification for special nuts to be used with anchors supplied.
      a. Nuts to be capable of developing an ultimate strength of not less than 125 percent of the minimum yield strength of the anchor to which it is attached.
D. Epoxy Resin for Coating and Bonding Anchors to Subgrade:
   1. The epoxy resin to be packaged in cartridge form with cartridges placed in the bore hole prior to placement of the anchor.

2. Install sufficient number of resin cartridges into the bore hole so that the entire embedded length and circumference of anchor is entirely coated with the epoxy resin.
3. Use fast setting resin for required anchor bond length and a slow setting resin for remainder of embedment length to accommodate stressing and to provide corrosion protection.
4. Install anchors through the resin cartridges to full length of required embedment in accordance with the anchor manufacturer's instructions.
5. Do not post tension anchors until epoxy resin has cured sufficiently to be capable of transferring the required post tensioning loads from the anchor to the adjacent subgrade material.

E. Concrete Grout for Coating and Bonding Anchors to Subgrade:
1. Place grout continuously from bottom of hole to top of hole using tremie method until grout overflows top of hole.
   a. Place grout in such a manner to ensure that grout completely fills the bore hole and completely coats the anchor.
2. The entire required anchor bond length to be pressure grouted using sufficient pressure to allow the required post tensioned loads to be placed on the anchors.
   a. Do not place required post tensioning loads on anchors until concrete grout has obtained sufficient strength to be capable of transferring the post tensioning loads from the anchor to the adjacent subgrade material.
3. The bore holes for soil anchors to be steel encased as required to prevent the intrusion of soil, water or any other material into the holes that would prevent the required bonding of the anchors to the subgrade.
   a. Withdraw steel casing slowly during grout placement in such a manner that grout completely fills the bore hole and completely coats the anchor.
4. Make three (3) 6 IN DIA x 12 IN high concrete grout test cylinders for each consecutive 10 production anchors installed.
   a. Make cylinders in accordance with ASTM C31.
   b. Test one (1) cylinder at seven (7) days and two (2) cylinders at 28 days.
      1) Perform tests in accordance with ASTM C39.
   c. Send test results indicating production anchors they represent to Owner.

F. Steel Anchor or Baseplates with Leveling Grout:
1. Provide anchor or baseplates of sufficient size and thickness to be capable of transferring the required post tensioning loads to the anchors without exceeding the specified allowable bearing stress on the leveling grout when such grout is required beneath the anchor or baseplate, and without exceeding the allowable bending stress for the steel plate as stated in the AISC 325.
2. When indicated on the Drawings or otherwise required, fully bed all anchor or baseplates on a minimum 1 IN thick layer of leveling grout.
   a. Leveling grout to be a fast setting cement grout.
3. Required post tensioning anchor loads to not impose a bearing stress on the leveling grout which exceeds 0.3 times the compressive strength of the grout at the time of post tensioning.
   a. Minimum compressive strength of leveling grout at time of post tensioning to be 3000 psi.

G. Application, Measurement, and Magnitude of Post Tensioning Forces Required for Production Anchors:

1. All production anchors indicated on Drawings or specified (except load test anchors) to be post tensioned to 150 percent of the required allowable working tension load carrying capacity indicated for each production anchor as stated in this Specification Section.
2. Maintain this 150 percent load on each production anchor for a minimum period of 5 minutes.
   a. Measure anchor movement by dial gage during the application of the 150 percent load and while maintaining this load for the minimum 5 minute period.
   b. If during the 5 minute period, the anchor movement is less than 0.03 IN, the 150 percent load can be lowered and locked at the required post tensioning load stated below.
   c. If the anchor movement is greater than 0.03 IN during the 5 minute period, then the 150 percent load to be maintained until the anchor movement decreases to an acceptable value as determined by the Soils Engineer.
3. When approval to do so is obtained from the Soils Engineer, reduce the 150 percent load at each production anchor to a post tension force which will remain permanently in each production anchor equal to 110 percent of the required allowable working tension load carrying capacity giving full consideration to all possible losses of the applied post tensioning force.
4. Allow the installation and post tensioning of all production anchors to be witnessed and approved by the Soils Engineer.
5. All anchors to be post tensioned by means of a hydraulic jack.
   a. Post tensioning forces to be determined by both of the following methods:
   b. Measurement of anchor elongation.
      1) Required elongation to be determined from average load elongation curves for type and size of anchors being installed.
   c. Observation of post tensioning force indicated on a calibrated gage attached to the hydraulic jack applying the post tensioning force.
      1) Discrepancies of more than 5 percent between elongation and gage reading to be investigated and remedied.
      2) Movement of the structural system during the application of the post tensioning forces to be taken into account.

3.6 SOIL ANCHORS

A. Place soil anchors in a 8 IN minimum diameter bore hole.
   1. Steel encase bore holes as necessary to prevent intrusion of water, soil or any other item that might prevent the bonding of the anchor to the subgrade soil.
   2. Allow Soils Engineer to witness the drilling of all bore holes.
B. Completely coat and bond all soil anchors to soil subgrade with concrete grout for entire anchor embedment length.
   1. Prior to placing anchor and grout in bore hole, remove all water, loose soil particles or any other item from bore hole that might weaken the bonding of the anchor to the soil subgrade.

3.7 ANCHOR REPORT

A. During the installation of the production anchors, provide an anchor report for each production anchor installed recording for each anchor the following information:
   1. Anchor type, manufacturer, diameter and length.
   2. Total anchor embedment length into soil.
   3. Anchor bore hole diameter.

4. Whether or not consolidation grouting or steel encasing was required for bore hole.
5. Anchor bond length.
6. Quantity of epoxy resin placed in bore hole.
7. Quantity of concrete grout placed in bore hole.
8. Hydraulic jacking force reading at 150 percent of required allowable working tension load carrying capacity with all accompanying anchor movement measurements.
9. Hydraulic jacking force reading at 110 percent of required allowable working tension load carrying capacity.

B. The anchor report to be signed by the Contractor with copies sent to Owner.

END OF SECTION

SECTION 02462

STEEL H- PILES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rolled steel section piles.

1.2 REFERENCES

A. ASTM A36/A36M	Standard Specification for Carbon Structural Steel.
B. ASTM A572	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
C. ASTM A588	Standard Specification for High-Strength Low-alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4-in. (100-mm) Thick.
D. ASTM A690/A690M	Standard Specification for High-Strength Low-Allow Nickel, Copper, Phosphorus Steel H-Piles and Sheet Piling with Atmospheric Corrosion Resistance for Use in Marine Environments.
E. ASTM A913/A913M	Standard Specification for High-Strength Low-Alloy Steel Shapes of Structural Quality, Produced by Quenching and Self-Tempering Process (QST).
F. ASTM A992/A992M	Standard Specification for Structural Steel Shapes.
G. AWS D1.1	Structural Welding Code – Steel.
H. AWS D1.5	Bridge Welding Code.
I. SSPC PA 1	Measurement of Dry Coating Thickness with Magnetic Gages.
J. SSPC SP 5	White Metal Blast Cleaning.

1.3 SUBMITTALS

A. Product Data:
   1. Submit details of collars, tips, splices, cushion blocks.
B. Shop Drawings:
   1. Indicate details and schedule of pile installation sequence. Identify recommended pile length and shapes to suit design loads as indicated.
C. Quality Assurance/Control Submittals:
   1. Manufacturer's Mill Certificate:
      a. Certify steel pile meets or exceeds specified requirements.
D. Closeout Submittals:
   1. Project Record Documents: Accurately record the following:
      a. Sizes, lengths, and locations of piles.
      b. Sequence of driving.
      c. Number of blows per foot for entire length of piles and measured set for last 10 blows.
      d. Identify piles requiring drilling, and hole diameters.
      e. Final base and top elevations.

f. Driving force of each hammer blow.

1.4 QUALITY ASSURANCE

A. Qualifications:
1. Perform Work in accordance with Owner standard and California Building Code, Section 1704.
2. Maintain one copy of each Quality Assurance Report prepared.
3. Installer: company specializing in performing work of this Section 02462 with minimum 5 years documented experience approved by manufacturer.
4. Contractor shall furnish and pay for services of Geotechnical Engineer, who shall be experienced in this Work and shall be a licensed Geotechnical Engineer in the State of California. Geotechnical Engineer shall monitor pile driving operations.
5. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.

B. Regulatory Requirements:
1. Provide hydroaccoustic monitoring during initial steel pile driving operations.
   a. Maximum noise level allowed: 180db
   b. Provide sound attenuation if necessary to reduce noise level

C. Pre-Installation Meetings:
1. Convene minimum one week prior to commencing Work of this Section 02462.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
1. Protect shop coated piles from damage to applied coating. Use nylon slings to handle coated piles.

1.6 SCHEDULING

A. Schedule test indicator piles.
B. Do not drive piles until excavation or filling of area surrounding piles is completed to design grades indicated on drawing.
C. Do not drive piles until mud-line is clear of debris or other material interfering with pile driving.
D. When concrete is less than seven days old, do not drive piles closer to concrete than distance computed by formula below.

D = 1/7 VE
Where:
E = Energy of pile hammer in foot-pounds
D = Distance in feet

PART 2 PRODUCTS

2.1 MATERIALS

A. Piles: Steel pipe piles ASTM A252 Grade 3. ASTM A992/A992M; structural steel, rolled wide flange sections, minimum 50 ksi yield strength; sizes and lengths indicated on drawings s required to achieve design loads.
B. Accessories: Points, driving cap; to suit pile shape.

1. Protective Coating: ON exposed face apply Coal Tar Epoxy: Two coats of two-component, catalyzed, chemically resistant, high build coal tar epoxy, suitable for immersion service; 5 mils dry film thickness each coat.

2.2 FINISHES

A. Shop Finishing:
   1. As specified in Section 02488 (Permanent Sheet Piling), Paragraph 2.4.A.

2.3 SOURCE QUALITY CONTROL

A. Test for continuity of coating with a holiday tester of 100 volts or less. Repair detected holidays and other coating imperfections.
B. Maintain record of coating tests and inspections. Submit test and inspection record.

PART 3 EXECUTION

3.1 PREPARATION

A. Obtain prior approval of hammer type to be used.
B. Use driving method which will not cause damage to nearby structures.
C. Protect structures including overhead and buried utilities near the Work, from damage.
D. Prepare to place piles from existing site elevations.
E. Field touch-Up Pile Coating:
   1. Provide touch-up system for repair of coating defects compatible with shop coating.
   2. Before driving, touch-up abraded surfaces in coating. Clean and touch-up field welds.
   3. Apply touch-up coating to match shop coating.

3.2 ERECTION TOLERANCES

A. Maximum Variation form Vertical for Plumb Piles: 1 in 48.
B. Maximum Variation from Required Angle for Batter Piles: 1 in 24.
C. Maximum Variation from Pile Cut-Off Elevation: 4 IN.
D. Maximum Variation in Centerline after Splicing: 3/8 IN in 40 FT for undriven portion.
E. Maximum Out-of-Position: 2 IN.

3.3 INSTALLATION

A. Drive piles only in presence of Owner, unless approved otherwise by Owner.
B. Use rigid frame, fixed lead type driving equipment capable of supporting pile firmly in vertical position or to required batter.
C. Align top of pile normal to driving force of pile, hammer and leads to minimize bowing of pile during impact of hammer ram.
D. Where groups of piles are required, drive center pile of group first and then drive remaining piles in group progressing outward from center.
E. Drive piles to minimum tip penetration indicated on Drawings. Take corrective action, when required, to prevent observable impact bowing of pile at final driving resistance.
F. When driving resistance prohibits advancing pile to required minimum tip penetration, spud, jet, jet and drive, or use other means as necessary to advance pile to required minimum tip penetration. Then drive pile to required resistance indicated on Drawings. After jetting pile, re-drive adjacent piles to required resistance.
G. Protect pile head during driving, using cap-block cushion consisting of alternate plates of phenolic laminate and aluminum designed to prevent damage to piles while transmitting

required hammer energy to pile top as indicated on drawings, with full bearing on pile butt for even distribution of hammer blow.

H. Deliver hammer blows to central axis of pile.
I. When driving is interrupted before refusal, drive an additional 12 IN before resuming recording of performance data.
J. Re-drive piles which have lifted due to driving adjacent piles, or by soil uplift.
K. Do not damage piles during driving operations.
L. Cut off tops of piles to elevations indicated.

3.4 FIELD QUALITY CONTROL

A. Perform Request inspection of foundations in accordance with applicable code.
B. Unacceptable Piles: Piles that are placed out of position, are below cut-off elevations, or are damaged.
C. Provide additional piles or replace piles to conform to specified requirements.

3.5 PILE HAMMER

A. Use pile hammer complying with requirements indicate don drawings.
B. Keep hammer in good mechanical condition.
C. Operate hammer at speed and pressure recommended by manufacturer.
D. During pile driving operations, Owner may make occasional measurements of velocity of hammer ram. Furnish Hammer Performance Analyzer (radar gun device, as manufactured by Pile Dynamics, Inc., Or Approved Equal, for Owner's use.
E. When energy per blow is less than 80 percent of rated energy per blow as specified by manufacturer of pile hammer, make necessary repairs to improve energy output to value of at least 80 percent of rated energy per blow, or replace pile hammer.

3.6 WELDING AND SPLICING

A. Perform welding in accordance with AWS D1.1 for shielded metal arc welding.
B. Only use welders qualified in accordance with AWS D1.1.
C. Reinforce pile tips, as indicated on drawings.
D. Splice pile sections with one of the following:
   1. Complete penetration butt weld of flanges and web.
   2. Splicer sleeve with flanges welded with full penetration groove welds.
E. Use jig or alignment device during welding to maintain required specified.
F. For splices made during pile installation, rigid frame pile leads may be used as jig.
G. Use only but weld splices with 20 FT from pile cut-off elevation or design grade, whichever is lower.
H. Comply with the following for number, type and location of splices:
   1. No more than three splices for piles over 100 FT long.
   2. No more than two splices for piles up to 100 FT Long.
   3. No splice closer than 25 FT from tip.

3.7 NONDESTRUCTIVE EXAMINATION

A. Tests:
   1. Butt joint and seam welds shall be visually examined to confirm code and engineering requirements for materials, components, dimensions, joint preparation, alignment, welding and assembly. Welds shall then be radiographically inspected for 100% of their circumference in accordance with API 1104.
   2. Perform dye penetrant test for all other applicable non-joint welds.

B. Test coupons: In accordance with ASTM E8.
   1. Welded seam shall develop full strength of adjacent steel sheet or plate.
   2. Take two test coupons upon commencement of pipe welding on a sample joint.
      a. Perform tensile test.
      b. Perform bend test.

END OF SECTION

SECTION 02488

PERMANENT SHEET PILING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel sheet piling for:
      a. Retaining walls.

B. Related Sections:
   1. Section 02315 (Driven Steel Piling).

1.2 REFERENCES

A. ASTM A36/A36M	Standard Specification for Carbon Structural Steel.
B. ASTM A123/A123M	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products. Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
C. ASTM A307	Standard Specification for Carbon Steel bolts and Studs, 60,000 PSI Tensile Strength.
D. ASTM A325	Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
E. ASTM A328/A328M	Standard Specification for Steel Sheet Piling
F. ASTM A385	Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip)
G. ASTM A490	Standard Specification for Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength.
H. ASTM A563	Standard Specification for Carbon and Alloy Steel Nuts.
I. ASTM A572/A572M	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
J. ASTM A588/A588M	Standard Specification for High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4-in. (100-mm) Thick.
K. ASMT A690/A690M	Standard Specification for High-Strength Low-Alloy Nickel, Copper, Phosphorus Steel H-Piles and Sheet Pilling with Atmospheric Corrosion Resistance for Use in Marine Environments.
L. ASMT A857/A857M	Standard Specification for Steel Sheet Piling, Cold formed, Light Gage.
M. ASTM A913/A913M	Standard specification for High-Strength Low-Alloy Steel Shapes of Structural Quality, Produced by Quenching and Self-Tempering Process (QST).
N. ASTM B695	Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.

O.	ASTM E376	Standard Practice for Measuring Coating Thickness by Magnetic-Field or Eddy-Current (Electromagnetic) Examination Methods.
P.	ASTM F436	Standard Specification for Hardened Steel Washers.
Q.	AWS D1.1	Structural Welding Code – Steel.
R.	AWS D1.5	Bridge Welding Code
S.	SSPC SP 5	White Metal Blast Cleaning.
T.	SSPC SP 10	Near-White Blast Cleaning
U.	MIL-PRF-24712A	Coatings, Powder (Metric).

1.3 DEFINITIONS

A. Hot Rolled (HR) – Sections are produced by traditional hot-mill procedure with rough shape reduced during series of stages to final form. Interlocks are formed by flow of metal.
B. Z-type – (Designation Z): Conforms to letter Z shape and is applicable for medium to deep walls.
C. Larssen and Other – (Designation U): Conforms to letter U shape and is applicable for medium to deep walls.
D. Shallow Arch Straight Web – (Designation SA or S): Flat sections with strong interlocks but little beam strength, usually for filled cell construction.

1.4 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Sheet piling section specified and shown on Drawings establishes design and functional requirements for sheet piling installation.
   2. Alternate Designs: Contractor may propose alternate sheet piling design for consideration by Owner.
      a. Design sheet piling to provide structural capacity equal to or greater than capacity of specified piling system.
      b. Design sheet piling configuration using standard published manufacturer's properties.
      c. Furnish required submittals signed and sealed by professional engineer.
      d. Design sheet piling as permanent structure to be left in place in completed construction.

1.5 SUBMITTALS

A. Product Data:
   1. Submit material certification, details of sheet piling, mill test reports, piling driving equipment certification and interlocking joint strength test procedure.
   2. Include data for joint sealants.
   3. Include manufacturer's data sheets on cranes and driving equipment.
B. Shop Drawings:
   1. Indicate location and extent of sheet piling, details of top protection, tip reinforcement, splices, cut off method, corrosion protection.
   2. Include complete dimensions and details of sheet piling sections.
   3. Include sequence of driving and detailed drawings of templates or other temporary guide structures.
   4. Submit proposed procedures for removing driven sheet piling.
   5. Submit list and size of proposed equipment including cranes, barges, driving equipment, extractors, protection caps, and other installation accessories.

6. Submit detailed procedures and features for protection of existing structures or other installations.
7. Include details of storage and handling procedures.

C. Quality Assurance/Control Submittals:
1. Design Data:
a. Signed and sealed by professional engineer registered in the State of California.
1) Submit calculations to support Contractor's sheet piling design.
2. Test Reports:
a. Indicate interlock tensile strength on hot and cold rolled steel sheet piling (Z, U, SA, S, A).

D. Closeout Submittals:
1. Project Record Documents:
a. Record actual locations of sheet piling and top and bottom elevations.
b. Provide driving records with hammer blows for final 12 inches of driving.

1.6 QUALITY ASSURANCE

A. Qualifications:
1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
2. Installer: Company specializing in performing work of this section with minimum five years documented experience approved by manufacturer.
3. Welders and Welding Procedures: AWS D1.1 qualified within previous 12 months.
4. Design alternate sheet piling systems under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of California.
5. Perform welding in accordance with AWS D1.1 and AWS D1.5.
6. Furnish each type sheet piling from a single source.
7. Perform Work in accordance with California Building Code, Section 1704.

B. Regulatory Requirements:
1. Provide hydroaccoustic monitoring during initial steel pile driving operations.
a. Maximum noise level allowed: 180db
b. Provide sound attenuation if necessary to reduce noise level

C. Pre-Installation Meetings:
1. Convene minimum 30 days prior to commencing work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
1. Deliver sheet piling with manufacturer's logo and mill identification mark on each sheet piling.
2. Handle using handling holes or lifting devices to prevent damage. Lift sheet piling to prevent permanent deformation.
3. Support on level racks spaced not more than 10 FT apart nor more than 2 FT from ends. Arrange supports for multiple lifts aligned vertically.
4. Protect sheet piling to prevent damage to coatings.
5. Protect sheet piling with factory installed joint sealant from exposure to water before installation.

1.8 COORDINATION

A. Coordinate sheet piling work with earthwork, foundation, utility, and demolition construction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Steel Sheet Piling – Z Shape, Hot Rolled, Joint BS (Ball & Socket):
   1. Gerdau, L.B. Foster Piling, Nucor-Yamato Steel Company, Skyline Steel, LLC., or Approved Equal.
   2. Sheet Piling: ASTM A328/A328M.
   3. Interlock strength: 16.
   4. Interlock swing allowable: As indicated on drawings.
B. Steel Sheet Piling – Flat Shapes, Hot Rolled, Joint TF (Thumb & Finger):
   1. Gerdau, L.B. Foster Piling, Nucor-Yamato Steel Company, Skyline Steel, LLC., or Approved Equal.
   2. Sheet Piling: ASTM A328/A328M.
   3. Interlock strength: 16 kips/inch.
   4. Interlock swing allowable: 5 degrees.
C. Steel Sheet Piling – All:
   1. Furnish materials in accordance with California Building Code, Section 1704.

2.2 COMPONENTS

A. Splices and Other Fabrication Appurtenances: Structural Steel ASTM A36/A36M.
B. Bolts, Nuts and Washers: ASTM A153/A153M; hot dipped galvanized.
   1. Bolts: ASMT A307; Grade A or B.
   2. High strength bolts: ASTM A325; Type 1 or ASTM A490; type 1.
   3. Nuts: ASTM A563 heavy hex type.
   4. Washers: ASTM F436 type 1.
C. Finish: Shop coated.
D. Welding Materials: AWS D1.1; type required for materials being welded.

2.3 FABRICATION

A. Fabricate sheet piling and special fabricated sections to full length and as indicated on drawings.
B. Fabricate tees, wyes, corners and cross pieces to match sheet piling sections, with ½ IN minimum web thickness.
C. Fabricated sheet piling with standard pulling holes.
D. Fabricate components indicated to receive galvanized coating in accordance with ASTM A385 to achieve high quality galvanized coating.
E. Clean interlock joint surfaces. Mix and install joint sealant in accordance with manufacturer's instruction in female side of interlock joint.

2.4 FINISHES

A. Shop Finishing:
   1. Preparation SSPC SP 10; abrasive blast cleaning.
   2. Apply coatings to sheet piling to extent indicated on drawings.
   3. Manufacturers: Coal Tar Epoxy: Two coats of two-component, catalyzed, chemically resistant, high build coal tar epoxy, suitable for immersion service; 5 mils dry film thickness each coat.
      a. Carbonline Company, Cloverdale Paint, Coranado Paint, Fox Industries, Rust-Oleum Corporation, or Approved Equal.

2.5 SOURCE QUALITY CONTROL

A. Interlock Tension Strength Test: conform to piling manufacturer's standard test. Include testing at least two 3 IN long coupons taken randomly from different as-produced pilings of each heat.
B. Verify required coating thicknesses:
   1. Provide test records for coating thickness as per ASTM E376 for coatings utilizing POSITECTOR 6000 Series Gage, with appropriate probes and matching calibration standards, with trained personnel and in accordance with the equipment manufacturer's instructions.
   2. Perform tests on not less than 3 percent of product supplied, but in no case on less than three individual sheet pile sections, from different portions of delivery.
C. Make completed sheet piling available for inspection at manufacturer's factory prior to packaging for shipment. Notify Owner at least seven days before inspection is allowed.
D. Allow witnessing of factory inspections and test at manufacturer's test facility. Notify Owner at least seven days before inspections and tests are scheduled.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify excavation is completed to working elevation as specified in Section 02315 (Driven Steel Piling).

3.2 PREPARATION

A. Use driving method that will not cause damage to nearby structures.
B. Notify adjacent and affected land owners and building occupants minimum 7 days before proceeding with the work.
C. Verify cranes will not impact aviation glide paths or clear zones or overhead utilities.
D. Protect structures including overhead and buried utilities near the Work, from damage.
E. Prepare to place sheet piling from existing site elevations.
F. Field Touch-Up Sheet Piling Coating:
   1. Provide touch-up system for repair of coating defects compatible with shop coating.
   2. Before driving, touch-up abraded surfaces in coating. Clean and touch-up field welds.
   3. Apply touch-up coating to match shop coating.
G. Leave permanent sheet piling in place as part of completed Work.
H. Remove temporary sheet piling when no longer required and remove from site.

3.3 ERECTION TOLERANCES

A. Maximum Variation from Vertical for Plumb Sheet Piling: 1:96.
B. Maximum Variation from sheet Piling Cut-Off Elevation: 1 IN.
C. Maximum Out-of-Position: 2 IN.

3.4 INSTALLATION

A. Drive sheet piling only in presence of Owner, unless approved otherwise by Owner.
   1. Use driving method not capable of causing damage to nearby structures.
B. Align top of sheet piling normal to driving force of piling, hammer, and leads to minimize bowing of piling during impact of hammer ram.
C. Maintain sheet piling vertical during driving:
   1. Drive Z piling with male interlock forward or leading.

2. Drive Z and U type piling in pairs.
3. Incrementally drive sheets or pairs of sheets so tip of any sheet or pair is not more than 4 FT below adjacent sheet or pair.
4. For circular of other closed cofferdams set all sheets in place before driving begins.

D. Jetting or pre-drilling of sheet piling is not permitted.
E. Drive sheet piling to minimum tip penetration and to driving resistance indicated on drawings.
   1. Take corrective action, when required, to prevent observable impact bowing of piling at final driving resistance.
F. When driving is interrupted before refusal, drive additional 12 IN before resuming recording of performance data.
G. Do not damage sheet piling during driving operations.
H. Cut off top of sheet piling to elevations indicated and prepare piling top to receive top finish construction indicated on drawings.

3.5 FIELD QUALITY CONTROL

A. Inspection:
   1. Inspect for imperfections in joint interlock capable of impeding installation.
   2. Inspect for damage to shop coatings before installation.
   3. Reject damaged sheet piling sections or repair as required prior to installing.

3.6 TEMPLATES

A. Provide template or driving frame suitable for aligning, supporting, and maintaining sheet piling in correct position during setting and driving:
   1. Structural frame sufficiently rigid to resist lateral driving forces.
   2. Provide at least two levels of support at 1/3 points not less than 20 FT apart.
   3. Provide wood blocking to bear against webs of alternate sheet piling.
   4. Provide outer restraints to prevent sheets from warping or wandering.
   5. Provide visible markings on templates to verify correct sheet piling location and direction.

3.7 PILING HAMMER

A. Use piling hammer complying with requirements indicated on drawings and approved submittals.
B. Keep hammer in good mechanical condition.
C. Operate hammer at speed and pressure recommended by manufacturer.
D. During piling driving operations, Owner may make occasional measurements of velocity of hammer ram.
E. Furnish Hammer Performance Analyzer (radar gun device), for Owner's use.
   1. Pile Dynamics, Inc., or Approved Equal.
F. When energy per blow is less than 80 percent of rated energy per blow as specified by manufacturer of piling hammer, make necessary repairs to improve energy output to value of at least 80 percent of rated energy per blow, or replace piling hammer.
G. Use protective cap during driving to prevent damage to top of sheet piling.

3.8 WELDING AND SPLICING

A. Perform welding in accordance with AWS D1.1 for shielded metal arc welding.
B. Splice sheet piling sections with one of the following:
   1. Complete penetration butt weld.

2. Splicer sleeve with flanges welded with full penetration groove welds.

C. Use jig or alignment device during welding to maintain required shape and alignment.

D. Use only butt weld splices within 20 FT from sheet piling cut-off elevation or design grade, whichever is lower.

E. Comply with the following for number, type and location of splices:
   1. No more than three splices for sheet piling over 100 FT long.
   2. No more than two splices for sheet piling up to 100 FT long.
   3. No splice closer than 25 FT from tip.

END OF SECTION

SECTION 02745

AGGREGATE BASE COURSE

PART 1 GENERAL

1.1 REFERENCES

A. ASTM C127	Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
B. ASTM C128	Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
C. ASTM C131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
D. ASTM D1557	Standard Test Methods for Laboratory Compaction characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
E. ASTM D2487	Soils for Engineering Purposes (Unified Soil Classification System)
F. ASTM E11	Wire Cloth and Sieves for Testing Purposes

1.2 DEFINITIONS

A. For the purposes of this specification, the following definitions apply.
B. Aggregate Base Course
   1. Aggregate base course (ABC) is well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction.
C. Degree of Compaction
   1. Degree of compaction required is expressed as a percentage of the maximum laboratory dry density obtained by the test procedure presented in ASTM D1557 abbreviated as percent of laboratory maximum dry density.

1.3 SUBMITTALS

A. Product Data:
   1. Plant, Equipment, and Tools
      a. List of proposed equipment to be used in performance of construction work, including descriptive data.
   2. Waybills and Delivery Tickets
      a. Copies of waybills and delivery tickets during the progress of the work.
B. Quality Assurance/Control Submittals:
   1. Test Reports:
      a. Source of Material Compliance Test Data
      b. Gradation, Atterberg limits tests, and moisture-density relationship from the material source.
      c. Laboratory Moisture-Density Relationship
      d. Moisture-Density Determinations
      e. Field Density Tests
      f. Certified copies of test results for review by owner.

g. Calibration curves and related test results prior to using the device or equipment being calibrated.

PART 2 PRODUCTS

2.1 MATERIALS

A. Aggregate:

1. The aggregate base course (ABC) shall consist of clean, sound, durable particles of crushed stone, crushed gravel, angular sand, or other approved material. ABC shall be free of lumps of clay, organic matter, and other objectionable materials or coatings. The portion retained on the No. 4 sieve shall be known as coarse aggregate; that portion passing the No. 4 sieve shall be known as fine aggregate.
2. Coarse Aggregates:
   a. Only one source of coarse aggregate shall be used on the project. Coarse aggregates shall be angular particles of uniform density. When the coarse aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements and shall be stockpiled separately.
      1) Crushed Gravel: Crushed gravel shall be manufactured by crushing gravels, and shall meet all the requirements specified below.
      2) Crushed Stone: Crushed stone shall consist of freshly mined quarry rock, and shall meet all the requirements specified below.
   b. Aggregate Base Course:
      1) ABC coarse aggregate shall not show more than 50 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C131. Gradation Requirements
3. The specified gradation requirements shall apply to the completed base course. The aggregates shall be continuously well graded within the limits specified in TABLE 1. Sieves shall conform to ASTM E11.

TABLE I. GRADATION OF AGGREGATES		
Percentage by Weight Passing Square-Mesh Sieve		
Sieve Designation	Operating Range	Contract Compliance
1 inch	100	100
¾ inch	90-100	87-100
No. 4	35-60	30-65
No. 30	10-30	5-35
No. 200	2-9	0-12

NOTE 1: The values are based on aggregates of uniform specific gravity. If materials from different sources are used for the coarse and fine aggregates, they shall be tested in accordance with ASTM C127 and ASTM C128 to determine their specific gravities. If the specific gravities vary by more than 10 percent, the percentages passing the various sieves shall be corrected as directed by the Owner.

NOTE 2: The Contract compliance range consists of the material gradation tested after placement and including any deviation resulting from crushed particle occurring as the result of compaction.

2.2 EQUIPMENT

A. All plant, equipment, and tools used in the performance of the work shall be subject to review before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

2.3 SOURCE QUALITY CONTROL

A. Approval of Material
   1. The source of the material shall be selected 30 days prior to the time the material will be required in the work. Tentative approval of material will be based on initial test results. Final approval of the materials will be based on sieve analysis, liquid limit, and plasticity index tests performed on samples taken from the completed and fully compacted course(s). The source of material compliance test data shall also be submitted.

PART 3 EXECUTION

3.1 PREPARATION

A. Prior to constructing the base course, the underlying course or subgrade shall be cleaned of all foreign substances. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. The underlying course shall conform to Section 02300 (Earthwork). Ruts or soft yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses containing sands or gravels, as defined in ASTM D2487, the surface shall be stabilized prior to placement of the base course(s). Stabilization shall be accomplished by mixing ABC into the underlying course and compacting by approved methods. The stabilized material shall be considered as part of the underlying course and shall meet all requirements of the underlying course. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the base course is placed.

3.2 INSTALLATION

A. Mixing the Materials:
   1. The coarse and fine aggregates shall be mixed in a stationary plant at source. The Contractor shall make adjustments in placement methods or in equipment as directed to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to insure a satisfactory base course meeting all requirements of this specification.
B. Placing:
   1. The mixed material shall be placed on the prepared subgrade in layers of uniform thickness with an approved spreader. No layer shall be thicker than 6 inches or thinner than 3 inches when compacted. The layers shall be so placed that when compacted they will be true to the grades or levels required with the least possible surface disturbance. Where the base course is placed in more than one layer, the previously constructed

layers shall be cleaned of loose and foreign matter. Such adjustments in placing procedures or equipment shall be made as may be directed to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to insure an acceptable base course.

C. Grade Control:
   1. The finished and completed base course shall conform to the lines, grades, and cross sections shown. Underlying material(s) shall be excavated and prepared at sufficient depth for the required base course thickness so that the finished base course and the subsequent surface course will meet the designated grades.

D. Compaction:
   1. Each layer of the base course shall be compacted as specified with approved compaction equipment. Water content shall be maintained during the compaction procedure to within plus or minus 2 percent of the optimum water content. Rolling shall begin at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. Speed of the roller shall be such that displacement of the aggregate does not occur. In all places not accessible to the rollers, the mixture shall be compacted with hand-operated power tampers. Compaction shall continue until each layer has a degree of compaction that is at least 95 percent of laboratory maximum density through the full depth of the layer. The Contractor shall make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory base course. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

E. Thickness:
   1. Compacted thickness of the base course shall be as indicated. No individual layer shall be thicker than 6 inches nor be thinner than 3 inches in compacted thickness. The total compacted thickness of the base course(s) shall be within 1/2 inch of the thickness indicated. Where the measured thickness is more than 1/2 inch deficient, such areas shall be corrected by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 1/2 inch thicker than indicated, the course shall be considered as conforming to the specified thickness requirements plus 1/2 inches. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 1/4 inch of the thickness indicated. The total thickness of the base course shall be measured at intervals in such a manner as to ensure one measurement for each 25 square yards of base course. Measurements shall be made in 3 inch diameter test holes penetrating the base course.

F. Finishing:
   1. The surface of the top layer of base course shall be finished after final compaction by cutting any overbuild to grade and rolling with a steel-wheeled roller. Thin layers of material shall not be added to the top layer of base course to meet grade. If the elevation of the top layer of base course is 1/2 inch or more below grade, then the top layer shall be scarified to a depth of at least 3 inches and new material shall be blended in and compacted to bring to grade. Adjustments to rolling and finishing procedures shall be made as directed to minimize segregation and degradation, obtain grades, maintain moisture content, and insure an acceptable base course. Should the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, the

unsatisfactory portion shall be scarified, reworked and recompacted or it shall be replaced as directed.

G. Smoothness:

1. The surface of the top layer shall show no deviations in excess of 3/8 inch when tested with a 12 foot straightedge. Measurements shall be taken in successive positions parallel to the centerline of the area to be paved. Measurements shall also be taken perpendicular to the centerline at 10 foot intervals. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

END OF SECTION

SECTION 02746

AGGREGATE SURFACE COURSE

PART 1 GENERAL

1.1 REFERENCES

A. ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
B. ASTM D 3740	Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
C. ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.2 SUBMITTALS

A. Product Data:
   1. List of proposed equipment to be used in performance of construction work including descriptive data.
      Source of aggregate base with test results showing conformance to these specifications.

B. Quality Assurance/Control Submittals:
   1. Test Reports:
      a. Calibration curves and related test results prior to using the device or equipment being calibrated.
      b. Copies of field test results within 24 hours after the tests are performed.
      c. Test results from samples, not less than 30 days before material is required for the work.
      d. Results of laboratory tests for quality control purposes, for review, prior to using the material.

PART 2 PRODUCTS

2.1 MATERIALS

A. Aggregates
   1. Class 2, 3/4 IN maximum.

PART 3 EXECUTION

3.1 INSTALLATION

A. Construct to line, grade and section as indicated
B. Install compacted layers of aggregate base course as indicated, in accordance with Caltrans 26.
C. Tolerance of Finished Grade: ±0.10 FT from required elevations unless otherwise indicated.
D. Tolerance of Finished Grade where new Work meets existing: 0.05 FT from existing elevations.
E. Do not place in wet weather or when rain is forecast.

F. Place drip pans or absorbent material under equipment when not in use.
G. The materials shall be mixed and placed to obtain uniformity of the material and a uniform water content for compaction. The Contractor shall make adjustments in mixing, placing procedures, or in equipment to obtain the true grades, to minimize segregation and degradation, to obtain the desired water content, and to ensure a satisfactory surface course.
H. Each layer of the aggregate surface course shall be compacted with approved compaction equipment. The water content during the compaction procedure shall be maintained at optimum or at the percentage specified by the Owner. In locations not accessible to the rollers, the mixture shall be compacted with mechanical tampers. Compaction shall continue until each layer through the full depth is compacted to at least 95 percent of laboratory maximum density in accordance with ASTM D1557. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked to produce a satisfactory material
I. Work shall comply with the Contractor's approved Storm Water Pollution Prevention Plan (SWPPP).

3.2 FIELD QUALITY CONTROL

A. Density Tests
   1. Density shall be measured in the field in accordance with ASTM D6938. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D6938. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in ASTM D6938, on each different type of material being tested at the beginning of a job and at intervals, as directed.

END OF SECTION

SECTION 02935

HYDROSEEDING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Erosion control seeding for disturbed soil surfaces and restored access and haul roads and staging areas as specified herein, as indicated, or as otherwise directed by Owner.

1.2 SUBMITTALS

A. Samples:
   1. Seed materials:
      a. Seed mix verification by way of certified mix labels from supplier in sealed seed mix bags. In addition, the Contractor shall submit a 5 pound bag sample of the seed mix.
      b. Before delivery of the straw and fertilizer material to the Site, the Contractor shall provide the material order and the name, address and telephone number of the material supplier.
      c. The Owner may at any time, request, test, and analyze seed materials including the seed mix, fertilizer, or mulch to ensure their conformance to these Specifications. The Contractor shall furnish, at no additional cost, the requested materials for the Owner's use. Seed materials not meeting the Owner's approval shall immediately be removed from the Site at the Contractor's expense. The Contractor shall incur any additional expenses required because of materials not meeting the requirements of these Specifications.

B. Shop Drawings:
   1. Layout drawings:
      a. Scaled site plan (scale 1 inch = 20 feet or equal to scale of Site plan drawing) to show areas to be hydroseeded.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Signed copies of vendor's statement for seed mixture required, stating botanical and common name, place of origin, strain, percentage of purity, percentage of germination, and amount of Pure Live Seed (PLS) per bag.
   3. Certification:
      a. Certify each container of seed delivered will be labeled in accordance with Federal and State Seed Laws and equals or exceeds Specification requirements.

C. Quality Assurance/Control submittals:
   1. Copies of invoices for fertilizer used on Project showing grade furnished, along with certification of quality and warranty. If Owner determines fertilizer requires sampling and testing to verify quality, testing will be done at Contractor's expense, in accordance with current methods of Association of Official Agricultural Chemists. Upon completion of project, a final check of total quantities of fertilizer used will be made against total area seeded. If minimum rates of application have not been met,

Contractor will be required to distribute additional quantities to make up minimum application specified.

2. Certificates:
   a. Certification that seed meets percent purity and germination requirement.
   b. Local regional source authentication for seed.
   c. Type of Hydro mulching equipment.

D. Submit an Installation Schedule as described in Paragraph 1.5 below.

E. The Contractor shall furnish evidence that clearance has been obtained from the County Agricultural Commissioner, as required by law, before straw obtained from outside Sonoma County is delivered to the Site.

1.3 QUALITY ASSURANCE

A. Seed materials, including the seed mix, fertilizer, and mulch, shall be delivered to the Site with durable, waterproof labels indicating the correct species, variety, percent live seed (PLS) and other certifications, and the supplier's name, in conformance to these Specifications. The Owner will observe the seed mix, fertilizer, and mulch material as it is being delivered to the Site for conformity to these Specifications. Such approvals shall not impair the right of additional observations during further progress of the Work.

B. The Contractor shall be responsible for storing and maintaining the seed mix and mulch as it is delivered throughout the Contract Time.

1.4 PROJECT CONDITIONS

A. Project Environmental Requirements:
   1. Weather conditions: Hydroseeding is not permitted when wind velocities exceed 15 miles per hour, when the ground is frozen, or within 24 hours after a rain.

1.5 SCHEDULING

A. Installation Schedule:
   1. Provide schedule showing when hydroseeding is anticipated.
   2. Indicate planting schedules in relation to schedule for finish grading and topsoiling.
   3. Indicate anticipated dates Owner will be required to review installation for Final Acceptance.

B. Pre-installation Meeting:
   1. Meet with Owner and other parties as necessary to discuss schedule and methods, unless otherwise indicated by Owner.

C. Install hydroseed in place within 10 Days after completion of finish grading.

PART 2 PRODUCTS

2.1 MATERIALS

A. Hydroseeding Materials:
   1. Fertilizer: Fertilizer used in hydroseed application shall have a guaranteed analysis of 16% nitrogen, 20% phosphoric acid, 15% sulphur and 0% soluble potash and shall be in a form that will readily disperse into the hydroseed slurry.
      a. Fertilizer application rate: 500 pounds/acre.
   2. Soil Amendment: Planter mix shall be a blend of nitrogen stabilized redwood and fir sawdust, screened loam, and compost chicken manure as produced by Soils Plus or Approved Equal.

3. Mulch: Mulch shall be wood cellulose fiber and shall be of such character that it will disperse uniformly into a slurry when mixed with water. No materials that inhibit growth or seed germination shall be present in the material.
   a. Mulch application rate: 4,000 pounds/acre.
4. Seed Mix: Seed used in hydroseed mix shall be as follows:

Name	Design Percent
California Brome	30
Blue Wild Grass	30
Meadow Barley	30
California Poppy	5
Lupine	5

   a. Seed Mix application rate: 200 pounds/acre.
5. Stabilizing Agent: Stabilizing agent shall be Exology Control "MBinder" or Albright and Towne Sentinel or Approved Equal. Stabilizing agent shall be plant derived (non-asphaltic).
   a. Stabilizing agent application rate: 75 - 100 pounds/acre.
6. Water: Water for hydro mulching shall be clean potable water added to the slurry mixture in sufficient amount to spread uniformly the required quantity of hydro mulch solids (approximately 3,000 gallons per acre).
7. Equipment: Hydro mulching equipment used for the application of the seed, fertilizer and slurry of prepared wood pulp shall be of the type normally used in such operations and shall be approved by Owner. This equipment shall have a built-in agitation system and operating capacity sufficient to agitate, suspend and homogeneously mix a slurry containing up to 40 pounds of fiber plus a combined total of 70 pounds of fertilizer solids and seeds for each 100 gallons of water. The slurry distribution lines shall be large enough to prevent stoppage. This discharge line shall be equipped with a set of hydraulic spray nozzles which will provide a continuous nonfluctuating discharge and delivery of the slurry in the prescribed quantities uniformly, without misses, waste, or erosion. The slurry tank shall have a minimum capacity of 1,000 gallons and shall be mounted on a traveling unit which may be either self propelled or drawn.

PART 3 EXECUTION

3.1 PREPARATION

A. General:
   1. Coordinate all site preparation and seeding operations with seasonal water levels. Hydroseed all disturbed ground surfaces.
B. Debris Removal:
   1. Prior to ground surface preparation operations, remove and dispose of all wire, rubbish, stones, and other material that might hinder proper seeding and subsequent maintenance. Remove all construction debris and weeds/grasses from areas to be hydroseeded.

C. Surface Preparation:
   1. Surfaces that are too hard and smooth, or compacted to accept the seeding, as determined by Owner, shall be broken up by methods approved by Owner until the condition of the soil is acceptable. When conditions are such, by reason of excessive moisture or other factors, that satisfactory results are not likely to be obtained, the Work shall be stopped and shall be resumed only when directed.

3.2 ESTABLISHMENT

A. Period:
   1. The Contractor shall be responsible for the proper care and maintenance of the seeded areas until May 1 of the year following the seeding, or until the desired stand of vegetation is established. The desired stand of vegetation is defined as a minimum of 85 percent coverage of the area seeded. The need for repairing and reseeding (as described herein) within the establishment period shall be determined by Owner.
B. Protection:
   1. Protect areas as necessary to establish vegetation until Final Acceptance.

3.3 REPAIR

A. General:
   1. When any portion of the ground surface becomes gullied or otherwise damaged following seeding within the period of Contractor's responsibility, repair the affected portion to re-establish the condition and grade of the soil and then reseed as specified for initial planting, all at no cost to the Owner.
B. Reseeding:
   1. When it becomes evident that the seeding has been unsuccessful, the Owner will require that these areas be reseeded with the same seed and quantity as specified for the initial seeding. Complete reseeding within fifteen (15) Days following notification. Prepare the area to be reseeded as directed by Owner. Reseeding due to damaged or deficient seed material or improper application shall be completed at no additional cost to the Owner.
C. Replacement of Straw Mulch:
   1. Slopes of 3 : 1 or steeper where erosion has occurred, or where straw mulch has blown or washed away within the period of Contractor's responsibility shall have straw reapplied at the rate and method described in paragraph 2.1 at no additional cost to the Owner.

3.4 FIELD QUALITY CONTROL

A. During the course of Work or upon completion of the Project, a check of the quantities of materials will be made against the areas treated, and if the minimum rates of application have not ben met, Owner will require the distribution of additional quantities of those materials to make up the minimum applications specified.

END OF SECTION

DIVISION 3

CONCRETE

SECTION 03108

FORMWORK

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Formwork requirements for concrete construction.
B. Related Sections:
   1. Section 03311 (Concrete Mixing, Placing, Jointing, and Curing).

1.2 REFERENCES

A. ACI 116R Cement and Concrete Terminology.
B. ACI 347 Guide to Formwork for Concrete.

1.3 DEFINITIONS

A. Words and terms used in these Specifications are defined in ACI 116R.
B. Reshoring: To reconfigure formwork support system prior to concrete reaching its 28 day strength.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Formwork design.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Manufacturer and type of proposed form materials.
      d. Manufacturer and type of proposed form ties.
      e. Manufacturer and type of proposed form coating material.
      f. Manufacturer and type of void forms including compressive strength.
   3. Certification displaying conformance to ACI 347R as follows:
      a. Specific forming system indicating of formwork capacity in PSF and where to be used.
      b. Correlation of specific forming system submitted to wet concrete pressure on the form.
      c. Correlation may be achieved by adjustment of pouring rates per ACI 347R. Provide schedule of rates correlated to specific pours when height of pour height is greater than 15 feet if pour rate adjustment is used.
   4. Structural calculations sealed by a Professional Engineer licensed in the State of California for the following:
      a. Designs.
      b. Design calculations to be submitted for information only.

1.5 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Concrete Institute (ACI):
      a. 116R, Cement and Concrete Terminology.

b. 347, Guide to Formwork for Concrete.
2. Building code:
a. International Code Council (ICC):
1) California Building Code, based on the International Building Code, associated standards, and all amendments, referred to herein as Building Code.

B. Qualifications:
1. Formwork, shoring and reshoring to be designed by a professional structural engineer currently registered in the State of California.

C. Miscellaneous:
1. Design and engineering of formwork, shoring and reshoring as well as its construction is the responsibility of the Contractor.
2. Design requirements:
a. Design formwork for loads, lateral pressures and allowable stresses outlined in ACI 347R and for design considerations, wind loads, allowable stresses and other applicable requirements of the controlling local Building Code.
1) Where conflicts occur between the above two (2) standards, the more stringent requirements shall govern.
b. Design formwork to limit maximum deflection of form facing materials reflected in concrete surfaces exposed to view to 1/240 of span between structural members.
3. For slabs and beams not cast on the ground, develop a procedure and schedule for removal of shores and installation of reshores where applicable and for calculating the loads transferred to the structure during this process.
a. Perform structural calculations as required to prove that all portions of the structure in combination with remaining forming and shoring system has sufficient strength to safely support its own weight plus the loads placed thereon.
b. When developing procedure, schedule and structural calculations, consider the following at each stage of construction:
1) The structural system that exists.
2) Effects of all loads during construction.
3) Strength of concrete.
4) The Modulus of Elasticity (Young's Modulus) of the concrete at the time of shoring and form removal.
5) The influence of deformations of the structure and shoring system on the distribution of dead loads and construction loads.
6) The strength and spacing of shores or shoring systems used, as well as the method of shoring, bracing, shore removal, and reshoring including the minimum time intervals between the various operations.
7) Any other loading or condition that affects the safety or serviceability of the structure during construction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Stay-in-place forms:
a. Alabama Metal Industries Corporation.
b. Or Approved Equal.

2. Form ties for process liquid containing walls:
   a. Dayton Superior.
   b. Or Approved Equal.

2.2 MATERIALS

A. Forms for Surfaces Exposed to View:
   1. Wood forms:
      a. New 5/8 or 3/4 IN 5-ply structural plywood of concrete form grade.
      b. Built-in-place or prefabricated type panel.
      c. 4 x 8 FT sheets for built-in-place type except where smaller pieces will cover entire area.
      d. When approved, plywood may be reused.
   2. Metal forms:
      a. Metal forms excluding aluminum may be used.
      b. Forms to be tight to prevent leakage, free of rust and straight without dents to provide members of uniform thickness.
B. Forms for Surfaces Not Exposed to View:
   1. Wood or metal sufficiently tight to prevent leakage.
   2. Do not use aluminum forms.

2.3 ACCESSORIES

A. Form Ties:
   1. Commercially fabricated for use in form construction.
      a. Do not use wire ties.
   2. Constructed so that ends or end fasteners can be removed without causing spalling at surfaces of the concrete.
   3. 3/4 IN minimum diameter cones on both ends.
   4. Embedded portion of ties to be not less than 1-1/2 IN from face of concrete after ends have been removed.
   5. Provide ties with built-in waterstops in all walls that will be in contact with process liquid during plant operation. She Bolt System by Dayton Superior or Approved Equal.
   6. Through-wall ties that are designed to be entirely removed are not allowed in walls that will be in contact with process liquid during plant operation.
B. Stay-In-Place Forms:
   1. Ribbed expanded metal leave-in-place concrete forms commercially fabricated to provide an intentionally rougher surface.
   2. Hot-dipped galvanized.
   3. Similar to “Stay-form” by Alabama Metal Industries Corporation.
C. Chamfer Strips:
   1. Clear white pine.
   2. Surface against concrete to be planed.

PART 3 EXECUTION

3.1 PREPARATION

A. Form Surface Treatment:
   1. Before placing of either reinforcing steel or concrete, cover surfaces of forms with an approved coating material that will effectively prevent absorption of moisture and

prevent bond with concrete, will not stain concrete or prevent bonding of future finishes.
    a. A field applied form release agent or sealer of approved type or a factory applied nonabsorptive liner may be used.
  2. Do not allow excess form coating material to stand in puddles in forms nor in contact with hardened concrete against which fresh concrete is to be placed.
B. Provide temporary openings at base of column and wall forms and at other points where necessary to facilitate cleaning and observation immediately before concrete is placed, and to limit height of free fall of concrete to prevent aggregate segregation.
  1. Temporary openings to limit height of free fall of concrete shall be spaced no more than 8 FT apart.
C. Clean surfaces of forms, reinforcing steel and other embedded materials of any accumulated mortar or grout from previous concreting and of all other foreign material before concrete is placed.

3.2 ERECTION

A. Install products in accordance with manufacturer's instructions.
B. Tolerances:
  1. Variation from plumb:
    a. In lines and surfaces of columns, piers, walls, and in risers.
      1) Maximum in any 10 FT of height: 1/4 IN.
      2) Maximum for entire height: 1/2 IN.
    b. For exposed corner columns, control-joint grooves, and other exposed to view lines:
      1) Maximum in any 20 FT length: 1/4 IN.
      2) Maximum for entire length: 1/2 IN.
  2. Variation from level or from grades specified:
    a. In slab soffits, ceilings, beam soffits and in arises, measured before removal of supporting shores.
      1) Maximum in any 10 FT of length: 1/4 IN.
      2) Maximum in any bay or in any 20 FT length: 3/8 IN.
      3) Maximum for entire length: 3/4 IN.
    b. In exposed lintels, sills, parapets, horizontal grooves, and other exposed to view lines:
      1) Maximum in any bay or in 20 FT length: 1/4 IN.
      2) Maximum for entire length: 1/2 IN.
  3. Variation of linear structure lines from established position in plan and related position of columns, walls, and partitions:
    a. Maximum in any bay: 1/2 IN.
    b. Maximum in any 20 FT of length: 1/2 IN.
    c. Maximum for entire length: 1 IN.
  4. Variation in sizes and location of sleeves, floor openings, and wall openings: Maximum of +1/2 IN.
  5. Variation in horizontal plan location of beam, column and wall centerlines from required location: Maximum of +1/2 IN.
  6. Variation in cross sectional dimensions of columns and beams and in thickness of slabs and walls: Maximum of -1/4 IN, +1/2 IN.
  7. Footings and foundations:
    a. Variations in concrete dimensions in plan: -1/2 IN, +2 IN.

b. Misplacement or eccentricity:
   1) 2 percent of footing width in direction of misplacement but not more than 2 IN.
c. Thickness:
   1) Decrease in specified thickness: 5 percent.
   2) Increase in specified thickness: No limit except that which may interfere with other construction.

8. Variation in steps:
   a. In a flight of stairs:
      1) Rise: +1/8 IN.
      2) Tread: +1/4 IN.
   b. In consecutive steps:
      1) Rise: +1/16 IN.
      2) Tread: +1/8 IN.
9. Establish and maintain in an undisturbed condition and until final completion and acceptance of Project, sufficient control points and bench marks to be used for reference purposes to check tolerances.
10. Regardless of tolerances listed allow no portion of structure to extend beyond legal boundary of Project.
11. To maintain specified tolerances, camber formwork to compensate for anticipated deflections in formwork prior to hardening of concrete.

C. Make forms sufficiently tight to prevent loss of mortar from concrete.
D. Place 3/4 IN chamfer strips in exposed to view corners of forms to produce 3/4 IN wide beveled edges.
E. At construction joints, overlap contact surface of form sheathing for flush surfaces exposed to view over hardened concrete in previous placement by at least 1 IN.
   1. Hold forms against hardened concrete to prevent offsets or loss of mortar at construction joint and to maintain a true surface.
   2. Where possible, locate juncture of built-in-place wood or metal forms at architectural lines, control joints or at construction joints.
F. Where circular walls are to be formed and forms made up of straight sections are proposed for use, provide straight lengths not exceeding 2 FT wide.
   1. Brace and tie formwork to maintain correct position and shape of members.
G. Construct wood forms for wall openings to facilitate loosening, if necessary, to counteract swelling.
H. Anchor formwork to shores or other supporting surfaces or members so that movement of any part of formwork system is prevented during concrete placement.
I. Provide runways for moving equipment with struts or legs, supported directly on formwork or structural member without resting on reinforcing steel.
J. Provide positive means of adjustment (wedges or jacks) of shores and struts and take up all settlement during concrete placing operation.
   1. Securely brace forms against lateral deflection.
   2. Fasten wedges used for final adjustment of forms prior to concrete placement in position after final check.
K. Stay-In-Place Forms:
   1. Support stay-in-place forms as required to maintain the formwork in proper position.
   2. Hold the edge of stay-in-place forms back a minimum of 2 IN from all smooth formed concrete surfaces.

3. Stay-in-place forms may be used at the Contractor's option at:
   a. Surfaces that will be backfilled with soil.
      1) Maintain a minimum of 3 IN of concrete cover over all reinforcing.
   b. Roughened construction joints.
   c. Other locations approved by Owner.

3.3 REMOVAL OF FORMS

A. No construction loads shall be supported on, nor any shoring removed from, any part of the structure under construction except when that portion of the structure in combination with remaining forming and shoring system has sufficient strength to safely support its weight and loads places thereon.
B. When required for concrete curing in hot weather, required for repair of surface defects or when finishing is required at an early age, remove forms as soon as concrete has hardened sufficiently to resist damage from removal operations or lack of support.
C. Remove top forms on sloping surfaces of concrete as soon as concrete has attained sufficient stiffness to prevent sagging.
   1. Perform any needed repairs or treatment required on such sloping surfaces at once, followed by curing specified in Section 03311 (Concrete Mixing, Placing, Jointing, and Curing).
D. Loosen wood forms for wall openings as soon as this can be accomplished without damage to concrete.
E. Formwork for columns, walls, sides of beams, and other parts not supporting weight of concrete may be removed as soon as concrete has hardened sufficiently to resist damage from removal.
F. Where no reshoring is planned, leave forms and shoring used to support weight of concrete in place until concrete has attained its specified 28 day compressive strength and the concrete Modulus of Elasticity has reached a value of (57000 times square root of f'c) unless otherwise approved in writing by the Owner.
   1. Where a reshoring procedure is planned, supporting formwork may be removed when concrete has reached the concrete strength required by the formwork designer's structural calculations.
G. When shores and other vertical supports are so arranged that non-load-carrying form facing material may be removed without loosening or disturbing shores and supports, facing material may be removed when concrete has sufficiently hardened to resist damage from removal.

3.4 RESHORING

A. No construction loads shall be supported on, nor any shoring removed from, any part of the structure under construction except when that portion of the structure in combination with remaining forming and shoring system has sufficient strength to safely support its weight and loads placed thereon.
B. While reshoring is underway, no superimposed dead or live loads shall be permitted on the new construction.
C. During reshoring do not subject concrete in structural members to combined dead and construction loads in excess of loads that structural members can adequately support.
D. Place reshores as soon as practicable after stripping operations are complete but in no case later than end of working day on which stripping occurs.
E. Tighten reshores to carry their required loads without overstressing.

F. Shoring, reshoring and supporting formwork may be removed when concrete has reached the concrete strength required by the formwork designer's structural calculations.
G. For floors supporting shores under newly placed concrete leave original supporting shores in place or reshore.
   1. Reshoring system shall have a capacity sufficient to resist anticipated loads.
   2. Locate reshores directly under a shore position above.
H. In multi-story buildings, extend reshoring over a sufficient number of stories to distribute weight of newly placed concrete, forms, and construction live loads in such a manner that design superimposed loads of floors supporting shores are not exceeded.

END OF SECTION

SECTION 03151

ANCHORAGE TO CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. All required bolts and anchors whether or not specified under other Section of the Contract Documents. This section takes precedence.
   2. The Supplier shall provide anchor bolts and adhesive anchors as shown and specified in the Contract Documents for equipment provided by the Supplier. Expansion anchors will not be allowed.
   3. The type of work using the bolts and anchors include, but are not limited to, the following:
      a. Membrane Filtration Equipment.
      b. Pumps.
      c. Compressors.
      d. Tanks including air receivers.
      e. Structural steel.

B. Related Sections:
   1. Section 03308 (Concrete, Materials and Proportioning).
   2. Section 05120 (Structural Steel).
   3. Section 05500 (Metal Fabrications).
   4. Section 09905 (Painting and Protective Coatings).
   5. Division 11 (Equipment).
   6. Section 15090 (Pipe Support Systems).

1.2 REFERENCES

A.	ACI 350	Code Requirements for Environmental Engineering Concrete Structures
B.	ASTM A36	Standard Specification for Carbon Structural Steel
C.	ASTM A108	Standard Specification for Steel Bar, Carbon and Alloy, cold-Finished
D.	ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
E.	ASTM A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
F.	ASTM A307	Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
G.	ASTM A496	Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement
H.	ASTM A563	Standard Specification for Carbons and Alloy Steel Nuts
I.	ASTM A780	Standard Practice for Repair of Damaged and Uncoated Areas of Hot Dip Galvanized Coatings.
J.	ASTM F436	Standard Specification for Hardened Steel Washers
K.	ASTM F593	Standard Specification for Stainless Steel Bolts, Hex Cap

Screws, and Studs

L. ASTM F1554 Standard Specification for Anchor bolts, steel 36, 55, and 105-ksi Yield Strength

M. Post-installed anchors and related materials shall be listed by the following agency, as applicable:
   1. ICC Evaluation Service (ICC-ES).

1.3 DEFINITIONS

A. Anchor Bolt: Any cast-in-place anchorage that is made of a headed (i.e. bolt) material.
B. Anchor Rod: Any cast-in-place or post-installed anchorage that is made from unheaded, threaded rod material.
C. Concrete Anchor: Generic term for either an anchor bolt or an anchor rod.
D. Galvanizing: Hot-dip galvanizing per ASTM A123 or ASTM A153 with minimum coating of 2.0 OZ of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by standard.
E. Hardware: As defined in ASTM A153.
F. Installer or Applicator:
G. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
H. Installer and applicator are synonymous.
I. Post-installed Anchor: Any adhesive or mechanical anchor installed into previously placed and adequately cured concrete.

1.4 SUBMITTALS

A. Product Data:
   1. Acknowledgement that products submitted meet requirements of referenced standards.
   2. Manufacturer's installation instructions.
B. Shop Drawings:
   1. Setting and template drawings and details:
      a. Submit drawings showing location and required installation instructions for anchorage devices.
      b. Identify materials of construction, shop coatings, and third party accessories.
C. Samples:
   1. Representative samples of concrete anchors
D. Quality Assurance/Control Submittals:
   1. Design Data:
      a. Contractor designed post-installed anchors:
         1) Certification that anchors meet all requirements indicated in this Specification.
         2) Shop drawings and engineering design calculations:
            (a) Indicate design load to each anchor.
         3) Type of post-installed anchor system used.
            (a) Provide manufacturer's standard allowable load tables for the following:
               (i) Expansion anchorage.
               (ii) Adhesive anchorage.
               (iii) Screw anchorage.
               (iv) Concrete inserts

4) Current ICC-ES report for each post-installed anchor system indicating the following:
   (a) Performance data showing that anchor is approved for use in cracked concrete.
   (b) Seismic design categories that the anchor system has been approved to be used in.
   (c) Required installation procedures.
   (d) Special inspection requirements for installation.
5) Diameter and embedment depth of each anchor.
6) Indicate compliance with ACI 350, Appendix D.
7) Stamped and signed by professional civil or structural engineer.

E. Miscellaneous Submittals:
   1. Certification of installer for post-installed anchors.
      a. Indicate manufacturer's certification of installer for each type of approved post-installed anchor to be used on the Project.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
   1. Package all anchor bolts in a single shipping container.
   2. Clearly identify in the shipment of anchor bolts the equipment that they are intended to be used for. Plastic bags, tape or wire ties may be used to group anchor bolts together.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following post-installed anchor manufacturers are acceptable:
   1. Headed studs and deformed bar anchors:
      a. Nelson Stud Welding Div., TRW Inc.
      b. Stud Welding Products, Inc.
      c. Or Approved Equal.
   2. Expansion anchor bolts:
      a. "Kwik Bolt KB TZ" by Hilti Inc.
      b. ITW Ramset/Red Head.
      c. "Power-Stud+" by Powers Fasteners.
      d. "Strong-Bolt" by Simpson Strong-Tie.
      e. Or Approved Equal.
   3. Epoxy adhesive anchor bolts:
      a. "RE 500-SD" by Hilti Inc.
      b. ITW Ramset/Red Head.
      c. "PE-1000+" by Powers Fasteners.
      d. "SET XP" by Simpson Strong-Tie.
      e. Or Approved Equal.
   4. Screw concrete anchors:
      a. "HUS-H" by Hilti.
      b. "Wedge-Bolt+" by Powers Fasteners.
      c. "Titen HD" by Simpson Strong-Tie.
      d. Or Approved Equal.

5. Threaded Concrete Inserts:
   a. “Snake +” by Powers Fasteners.
   b. “Vertigo +” by Powers Fasteners.
   c. “Titen HD Rod Hanger” by Simpson Strongtie.
   d. Or Approved Equal.

2.2 MATERIALS

A. Cast-in-place Concrete Anchors:
   1. Building, Nonbuilding Structures, and equipment:
      a. ASTM F1554, Grade 36 or Grade 55 with weldability supplement S1 for galvanized or non-galvanized threaded rods.
      b. ASTM A307, Grade A for galvanized headed bolts.
   2. All other cast-in-place concrete anchors: ASTM F593, Type 316 stainless steel with matching nut and washer.

B. Expansion, Epoxy, and Adhesive Concrete Anchors:
   1. ASTM F593 Type 316 stainless steel with matching nut and washer.
   2. Provide minimum edge distance, cover, and spacing as recommended by manufacturer, or as indicated on Drawings, whichever is larger.
      a. Minimum embedment as recommended by manufacturer or twelve (12) diameters of anchor, whichever is larger.
      b. Notify Owner if required depth of embedment cannot be achieved at a particular anchor location.
      c. Follow manufacturer’s recommendations for installation and torque.

C. Threaded Concrete Inserts:
   1. This specification shall govern and be required in lieu of all references to any other concrete insert anchors, drop-in anchors or other generic names for threaded concrete inserts in these project specifications.

D. Headed Studs: ASTM A108 with a minimum yield strength of 50,000 psi and a minimum tensile strength of 60,000 psi.

E. Deformed Bar Anchors: ASTM A496 with a minimum yield strength of 70,000 psi and a minimum tensile strength of 80,000 psi.

F. Washers:
   1. ASTM F436 or minimum 1/2 IN thick fabricated ASTM A36 square plates for all cast-in-place anchorage.
   2. If stainless steel anchorage is being used for cast-in-place anchorage, washers shall be the same material and alloy as in the accompanying anchorage.
   3. Follow manufacturer’s requirements for all post-installed anchorage.

G. Nuts:
   1. ASTM A563 for all cast-in-place anchorage.
   2. If stainless steel anchorage is being used for cast-in-place anchorage, nuts shall be the same material and alloy as in the accompanying anchorage.
   3. Follow manufacturer’s requirements if using post-installed anchorage.

H. Galvanizing Repair Paint:
   1. High zinc dust content paint for regalvanizing welds and abrasions.
   2. ASTM A780.
   3. Zinc content: Minimum 92 percent in dry film.
   4. ZRC "ZRC Cold Galvanizing" or Clearco "High Performance Zinc Spray" or Approved Equal.

5. Dissimilar Materials Protection: See Section 09905 (Painting and Protective Coatings).

2.3 DESIGN CRITERIA

A. When the size, length, or load carrying capacity of a concrete anchor is not shown on the Drawings, provide the following:
   1. For cast-in-place concrete anchors, provide the material, nominal diameter, embedment length, and design capacity to resist the calculated load based on the requirements given in the Building Code.
   2. For post-installed concrete anchors and concrete inserts, provide the manufacturer's system name/type, nominal diameter, embedment length, and design capacity required to resist the calculated load based on requirements given in the current ICC-ES report for the anchor to be used.
B. Determine design loads as follows:
   1. For equipment concrete anchors, use the dead and operating loads recommended by the equipment manufacturer and approved by the Owner.
   2. For concrete anchors supporting architectural components, use the dead and operating loads recommended by the vendor and/or the Owner.
   3. The Building Code shall be used to determine the design seismic loads for concrete anchorage of all nonstructural components including all Mechanical and Electrical equipment and all Architectural components.
   4. For pipe hangers and pipe support steel, see the requirements listed in Section 15090 (Pipe Support Systems).
   5. Post-installed concrete anchors shall develop strength level shear and pull-out loads of not less than the following values when installed in 4,000 psi concrete:

PART 3 EXECUTION

3.1 PREPARATION

A. Provide cast-in-place concrete anchorage and applicable setting templates in time to allow for their proper installation prior to placing concrete.
B. Prior to installation, inspect and verify areas and conditions under which concrete anchorage is to be installed and notify Owner, in writing, of conditions detrimental to proper and timely completion of Work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Owner.

3.2 INSTALLATION

A. Tie cast-in-place anchorage in position to embedded reinforcing steel using wire.
   1. Tack welding of anchorage is prohibited.
      a. Coat anchorage and nut threads with a heavy coat of clean grease.
   2. Anchorage location tolerance shall be in accordance with Section 7 of the AISC Code of Standard Practice for Steel Buildings and Bridges.
   3. Provide steel templates for all column and equipment anchorage.
B. Unless noted or specified otherwise:
   1. Connect aluminum and steel members to concrete and masonry using stainless steel cast-in-place anchorage unless shown otherwise.
      a. Provide dissimilar materials protection per Section 09905 (Painting and Protective Coatings).
   2. Provide washers for all anchorage.

3. Where exposed, anchorage shall extend a maximum of 3/4 IN and a minimum of 1/2 IN above the top of the nut.
    a. If anchorage is cut off to the required maximum height, threads must be dressed to allow nuts to be removed without damage to the nuts.

C. The following shall be done after nuts are snug-tightened down:
1. Upset threads of ASTM A307 unfinished anchorage to prevent nuts from backing off,
2. For all other cast-in-place anchorage material, tighten nuts down an additional 1/8 turn to prevent nuts from backing off,
3. If two nuts are used per concrete anchor above the base plate, tighten the top nut an additional 1/8 turn to "lock" the two nuts together,
4. If using post-installed anchorage, follow manufacturer's nut tightening procedures.

D. Assure that embedded items are protected from damage and are not filled in with concrete.

E. Anchor work such that it will not be distorted nor fasteners overstressed from expansion and contraction.

F. Set beam and column base plates accurately on non-shrink grout as indicated on Drawings.
1. See Section 03308 (Concrete, Materials and Proportioning) for non-shrink grout.
2. Set and anchor each base plate to proper line and elevation.
    a. Use metal wedges and/or shims for leveling and plumbing columns and equipment.
        1) Wedges and shims shall be of the same material as the base plate that they support.
    b. Use leveling or setting nuts under the base plates only if approved by Owner.
    c. Fill space between bearing surface and bottom of base plate with non-shrink grout.
        1) Fill space until voids are completely filled and base plates are fully bedded on wedges, shims, and grout.
        2) Use expansion joints in the grout in accordance with the grout manufacturer's requirements where large grout pours are required under equipment.
    d. Do not remove wedges or shims.
        1) Where they protrude, cut off flush with edge of base plate before installing the grout.
    e. Fill sleeves around anchorage solid with non-shrink grout.

G. Coat aluminum surfaces in contact with dissimilar materials in accordance with Section 09905 (Painting and Protective Coatings).

H. Repair damaged galvanized surfaces in accordance with ASTM A780.
1. Prepare damaged surfaces by abrasive blasting or power sanding.
2. Apply galvanizing repair paint to minimum 6 mils DFT in accordance with manufacturer's instructions.

I. For post-installed anchors, comply with the manufacturer's installation instructions on the hole diameter and depth required to fully develop the tensile strength of the anchor or reinforcing bar. Properly clean out the hole per the manufacturer's recommendations utilizing a non-metallic fiber bristle brush and compressed air to remove all loose material from the hole prior to installing the anchor.

J. Post-installed anchor manufacturer's representative shall observe and demonstrate the proper installation procedures for the anchors at no additional expense to the Owner.

3.3 FIELD QUALITY CONTROL

A. Periodic or continuous Special Inspection of post-installed anchors shall be provided as required by the Building Code, ICC-ES Evaluation Reports, and as specified by the Owner.

Special Inspection shall be performed by personnel independent of the Manufacturer or Contractor.

1. Contractor shall submit a statement of responsibility to the Owner acknowledging an awareness of the Special Inspection requirements for the Project. The statement shall specifically acknowledge that the Contractor has made provisions in the Project construction schedule to allow for completion of all Special Inspections.

B. Employ a testing laboratory to perform field quality testing of installed anchors. Owner is to determine the level of testing which is required for the various types of post-installed and cast-in-place anchorage. A minimum of ten percent of the post-installed anchors and reinforcing bars are to be tested to 50 percent of the ultimate tensile capacity of the post-installed anchor or reinforcing bar.

C. If failure of any of the post-installed anchors or reinforcing bars occurs, testing the remaining 90 percent will be required and the Contractor will be responsible to pay for the costs associated with the additional testing. The Contractor will also be responsible to correct improper workmanship, remove and replace, or correct, as directed by the Owner, all post-installed anchors or reinforcing bars found unacceptable or deficient at no additional cost to the Owner.

D. The independent testing and inspection agency shall complete a report on each area of the Project where concrete anchors are installed. The report shall summarize the observations made by the inspector and shall be submitted to the Owner.

E. Contractor shall provide access for the testing agency to places where concrete anchors are being installed so that required inspection and testing can be accomplished.

3.4 CLEANING

A. After concrete has been placed, remove protection and clean all anchorage and concrete inserts of all concrete, dirt, and other foreign mater.

B. Provide surface acceptable to receive field applied paint coatings specified in Section 09905 (Painting and Protective Coating).

3.5 GENERAL

A. Cast-in-place Anchorage:

1. Shall be used where a cast-in-place anchor rod or bolt is indicated on the Contract Drawings, unless another anchor type is approved by the Owner.
2. Provide concrete anchorage as shown on the Drawings or as required to secure structural steel to concrete.
3. Special Inspection is required in accordance with the Building Code for all concrete anchorage. Contractor shall notify the Special Inspector that an inspection is required prior to concrete placement (or during post-installed anchorage installation).

B. Epoxy and Adhesive Anchorage:

1. May only be used where specifically indicated on the Drawings or when approved for use by the Owner.
2. May be used where subjected to vibration or where buried or submerged.
3. Shall not be used in overhead applications.
4. Shall not be used for pipe hangers.

C. Expansion Anchorage:

1. May only be used where specifically indicated on the Drawings or when approved for use by the Owner.
2. Shall not be used where subjected to vibration.
3. May be used in overhead applications.

D. Concrete Inserts:
   1. May only be used where specifically indicated on the Drawings or when approved for use by the Owner.
   2. May be used for pipe hangers and supports for the pipe size and loading recommended by the insert manufacturer.
   3. See Section 15090 (Pipe Support Systems) for additional requirements.
E. Powder actuated fasteners and other types of bolts and fasteners not specified herein shall not be used unless approved by the Owner.

END OF SECTION

SECTION 03208

REINFORCEMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Reinforcing bar requirements for concrete construction.

1.2 REFERENCES

A.	ACI SP 66	ACI Detailing Manual
B.	ACI 318	Building Code Requirements for Structural Concrete
C.	ASTM A185	Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
D.	ASTM A497	Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete
E.	ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
F.	ASTM A706	Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
G.	ASTM A775	Standard Specification for Epoxy-Coated Steel Reinforcing Bars
H.	AWS D1.4	Structural Welding Code - Reinforcing Steel

1.3 SUBMITTALS

A. Shop Drawings:
   1. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Mill certificates for all reinforcing.
      d. Manufacturer and type of proprietary rebar mechanical splices.
      e. Manufacturer and type of rebar adhesive anchor including installation instructions.
   2. Qualifications of welding operators, welding processes/procedures and weld test reports.
   3. Rebar number, sizes, spacing, dimensions, configurations, locations, mark numbers, lap splice lengths and locations, concrete cover and rebar supports.
   4. Sufficient rebar details to permit installation of reinforcing.
   5. Rebar details in accordance with ACI SP 66.
   6. Locations where proprietary rebar mechanical splices are required or proposed for use.
   7. Shop Drawings shall be in sufficient detail to permit installation of reinforcing without reference to Contract Drawings.
      a. Shop Drawings shall not be prepared by reproducing the plans and details indicated on the Contract Drawings but shall consist of completely redrawn plans and details as necessary to indicate complete fabrication and installation of all reinforcing steel.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Welding operators, processes and procedures to be qualified in accordance with AWS D1.4.
   2. Welding operators to have been qualified during the previous 12 months prior to commencement of welding.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Support and store all reinforcing above ground.
B. Ship to Site with attached plastic or metal tags.
   1. With permanent mark numbers which match the Shop Drawing mark numbers.
   2. Mark numbers on tags to be so placed that the numbers cannot be removed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Rebar adhesive anchors:
      a. "RE 500-SD" by Hilti, Inc.
      b. "PE-1000+" by Powers Fasteners.
      c. "SET XP" by Simpson Strong-Tie.
      d. Or Approved Equal.
   2. Rebar mechanical splices:
      a. Lenton Rebar Splicing by Erico, Inc.
      b. Richmond dowel bar splicer system by Richmond Screw and Anchor Co., Inc.
      c. Bar-Grip Systems by Barsplice Products, Inc.
      d. Or Approved Equal.

2.2 MATERIALS

A. Reinforcing Bars: ASTM A615, grade 60, deformed.
B. Reinforcing Bars to be Welded: ASTM A706.
C. Welded Wire Reinforcement: ASTM A185, ASTM A497.
D. Smooth Dowel Bars: ASTM A615, grade 60 with metal end cap to allow longitudinal movement equal to joint width plus 1 IN.
E. Rebar Adhesive Anchors:
   1. Manufactured for the specific purpose of embedding and developing 125 percent of the yield strength of rebars in hardened concrete with ICC report verification.

2.3 ACCESSORIES

A. Metal Chairs, Runners, Bolsters, Spacers, Hangers, and Other Rebar Supports:
   1. Plastic-coated tips in contact with forms.
   2. Plastic coating meeting requirements of CRSI Manual of Standard Practice.
B. Protective plastic caps at mechanical splices.

2.4 FABRICATION

A. Tolerances:
   1. Sheared lengths: +1 IN.

2. Overall dimensions of stirrups, ties and spirals: +1/2 IN.
3. All other bends: +0 IN, -1/2 IN.

B. Minimum diameter of bends measured on the inside of the rebar to be as indicated in ACI 318 Paragraph 7.2.

PART 3 EXECUTION

3.1 INSTALLATION

A. Tolerances:
1. Rebar placement:
   a. Clear distance to formed surfaces: +1/4 IN.
   b. Minimum spacing between bars: -1/4 IN.
   c. Top bars in slabs and beams:
      1) Members 8 IN deep or less: +1/4 IN.
      2) Members between 8 IN and 2 FT deep: -1/4 IN, +1/2 IN.
      3) Members more than 2 FT deep: -1/4 IN, +1 IN.
   d. Crosswise of members: Spaced evenly within +1 IN.
   e. Lengthwise of members: +2 IN.
2. Minimum clear distances between rebars:
   a. Beams, walls and slabs: Distance equal to rebar diameter or 1 IN, whichever is greater.
   b. Columns: Distance equal to 1-1/2 times the rebar diameter or 1-1/2 IN, whichever is greater.
   c. Beam and slab rebars shall be threaded through the column vertical rebars without displacing the column vertical rebars and still maintaining the clear distances required for the beam and slab rebars.

B. Minimum concrete protective covering for reinforcement: As shown on Drawings.

C. Unless indicated otherwise on Drawings, provide splice lengths for reinforcing as follows:
1. For rebars: Class B splice meeting the requirements of ACI 318, Paragraph 12.15.
2. For welded wire reinforcement:
   a. Splice lap length measured between outermost cross wires of each fabric sheet shall not be less than one (1) spacing of cross wires plus 2 IN, nor less than 1.5 x development length nor less than 6 IN.
   b. Development length shall be as required for the yield strength of the welded wire reinforcement in accordance with ACI 318, Paragraph 12.8.
3. Provide splices of reinforcing not specifically indicated or specified subject to approval of Owner.
   a. Mechanical proprietary splice connectors may only be used when approved or indicated on the Contract Drawings.

D. Welding:
1. Obtain approval by the Owner prior to welding reinforcing. In general, welding of reinforcing will not be allowed unless needed for an unexpected condition arising in the field.
2. Perform welding of rebars in accordance with requirements of AWS D1.4.
3. Have each welder place an approved identifying mark near each completed weld.

E. Placing Rebars:
1. Assure that reinforcement at time concrete is placed is free of mud, oil or other materials that may affect or reduce bond.

2. Reinforcement with rust, mill scale or a combination of both will be accepted as being satisfactory without cleaning or brushing provided dimensions and weights including heights of deformations on a cleaned sample is not less than required by applicable ASTM specification that governs for the rebar supplied.
3. Rebar support:
   a. Uncoated rebar:
      1) Support rebars and fasten together to prevent displacement by construction loads or placing of concrete.
         (a) Locate and support reinforcement with bar supports to maintain minimum concrete cover.
         (b) Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
      2) On ground, provide supporting concrete blocks or metal bar supports with bottom plate.
         (a) Do not use concrete blocks to support slab-on-grade reinforcing.
      3) Over formwork, provide plastic-coated metal chairs, runners, bolsters, spacers, hangers and other rebar support.
         (a) Only tips in contact with the forms need to be plastic coated.
4. Where parallel horizontal reinforcement in beams is indicated to be placed in two or more layers, rebars in the upper layers shall be placed directly above rebars in the bottom layer with clear distance between layers to be 1 IN unless shown otherwise.
   a. Place spacer rebars at 3 FT maximum centers to maintain the required 1 IN clear distance between layers.
5. Extend reinforcement to within 2 IN of concrete perimeter edges.
   a. If perimeter edge is formed by earth or stay-in-place forms, extend reinforcement to within 3 IN of the edge.
6. To assure proper placement, furnish templates for all column vertical bars and dowels.
7. Do not bend reinforcement after embedding in hardened concrete unless approved by Owner.
   a. Do not bend reinforcing by means of heat.
8. Do not tack weld reinforcing.
9. Embed rebars into hardened concrete utilizing adhesive anchor system specifically manufactured for such installation:
   a. Drill hole in concrete with diameter and depth as required to develop 125 percent of the yield strength of the bar according to manufacturer's requirements and ICC report.
   b. Clean holes per manufacturer's recommendations.
   c. Place adhesive in drilled hole.
   d. Insert rebar into hole and adhesive in accordance with manufacturer's instructions.

3.2 FIELD QUALITY CONTROL

A. Reinforcement Congestion and Interferences:
   1. Notify Owner whenever the specified clearances between rebars cannot be met.
   2. Do not place any concrete until the Owner provides a solution to rebar congestion problem.
   3. Rebars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items.

4. If rebars are moved more than one bar diameter, obtain Owner's approval of resulting arrangement of rebars.
5. No cutting of rebars shall be done without written approval of Owner.

B. Employ a testing laboratory to perform and report following:
1. Review and approve Contractor proposed welding procedures and processes for conformance with AWS D1.4.
2. Qualify welders in accord with AWS D1.4.
3. Test three (3) samples of each bar size and each type of weld in accord with AWS D1.4.
   a. The tensile strength of each test shall be not less than 125 percent of the required yield strength of the rebar tested.
4. Conduct nondestructive field tests (radiographic or magnetic particle) on not less than one (1) random sample for each 10 welds.
   a. In addition if any welds are found defective, test five (5) previous welds performed by same welder.
5. Visually inspect each weld for presence of cracks, undercuts, inadequate size and other visible defects.

END OF SECTION

SECTION 03308

CONCRETE, MATERIALS, AND PROPORTIONING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete materials, strengths and proportioning for concrete Work.
   2. Grouting:
      a. Base plates for columns and equipment.
      b. Dowels and anchors into concrete.
      c. Patching cavities in concrete.

B. Related Sections:
   1. Section 03311 (Concrete Mixing, Placing, Jointing, and Curing).
   2. Section 03350 (Testing).
   3. Section 03431 (Precast and Prestressed Concrete).

1.2 REFERENCES

A.	ACI 116R	Cement and Concrete Terminology
B.	ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
C.	ACI 212.3R	Chemical Admixtures for Concrete
D.	ACI 350	Code Requirements for Environmental Engineering Concrete Structures
E.	ASTM C33	Standard Specification for Concrete Aggregates
F.	ASTM C39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
G.	ASTM C94	Standard Specification for Ready-Mixed Concrete
H.	ASTM C150	Standard Specification for Portland Cement
I.	ASTM C157	Standard Test Method for Length Change of Hardened Hydraulic-Cement, Mortar, and Concrete
J.	ASTM C192	Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
K.	ASTM C260	Standard Specification for Air-Entraining Admixtures for Concrete
L.	ASTM C494	Standard Specification for Chemical Admixtures for Concrete
M.	ASTM C618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
N.	COE CRD-C621	Standard Specification for Packaged, Dry, Hydraulic-Cement Grout (NonShrink)

1.3 DEFINITIONS

A. Words and terms used in these Specifications are defined in ACI 116R.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Product technical data including:

a. Acknowledgement that products submitted meet requirements of standards referenced.
b. Manufacturer's instructions.
c. Concrete mix designs as required by Section 03350 (Testing).
d. Manufacturer and type of proposed admixtures.
e. Manufacturer and type of proposed nonshrink grout and grout cure/seal compound.

B. Quality Assurance/Control Submittals:
1. Certifications:
a. Certification of standard deviation value in psi for ready mix plant supplying the concrete.
b. Certification that the fly ash meets the quality requirements stated in this Section if fly ash is used.
c. Fly ash supplier's certified test reports for each shipment of fly ash delivered to concrete supplier, if fly ash is used.
d. Certification that all fly ash supplied in concrete delivered to the site is from the same source, if fly ash is used.
e. Certification that the class of coarse aggregate meets the requirements of ASTM C33 for type and location of concrete construction and project requirements.
f. Certification of aggregate gradation.
g. Certification of percent of coarse aggregate not passing a 3/8 IN sieve that is crushed stone. A minimum of 50 percent of the coarse aggregate <u>not</u> passing a 3/8 IN sieve shall be crushed stone aggregate.
2. Test reports:
a. Cement mill reports for all cement to be supplied.
b. Compressive tests per Section 03350 (Testing).
c. Shrinkage tests per Section 03350 (Testing).
d. Percent of crushed coarse aggregate not passing a 3/8 IN sieve.
3. Certification that the aggregates to be supplied for the project are from the same location as the aggregates represented in the following concrete mix design submittal documents:
a. Compressive strength test reports.
b. Certification document for the class of coarse aggregate meeting the requirements of ASTM C33 and project requirements for type and location of concrete construction.
c. Shrinkage test reports.
d. Certification document for the aggregate gradation.
e. Certification document for the percent of crushed stone coarse aggregate <u>not</u> passing a 3/8 IN sieve.

1.5 DELIVERY, STORAGE AND HANDLING

A. Storage of Materials:
1. Store cement and pozzolan in weathertight buildings, bins, or silos which will exclude moisture and contaminants.
2. Arrange aggregate stockpiles and use in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of like aggregates.
3. Allow natural sand to drain until it has reached a relatively uniform moisture content before use.
4. Store admixtures in such a manner as to avoid contamination, evaporation, or damage.

a. For those used in form of suspensions or non-stable solutions, provide agitating equipment to assure thorough distribution of ingredients.
b. Protect liquid admixtures from freezing and temperature changes which would adversely affect their characteristics and performance.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Non-shrink Grout:
   a. BASF Admixtures, Inc.
   b. Euclid Chemical Corporation.
   c. U. S. Grout.
   d. Upco.
   e. Set Products, Inc.
   f. L & M Construction Chemicals, Inc.
   g. Sika Corporation.
   h. Or Approved Equal.
2. Epoxy Grout:
   a. Ceilcote.
   b. Exxon Chemical Company.
   c. Sika Corporation.
   d. U. S. Grout.
   e. Euclid chemical Corporation.
   f. Or Approved Equal.
3. Epoxy Adhesive:
   a. Sika Corporation.
   b. Euclid Chemical Corporation.
   c. Or Approved Equal.
4. Epoxy bonding Adhesive:
   a. Sika Corporation.
   b. Euclid Chemical Corporation.
   c. Or Approved Equal.
5. Cementitious Polymer Modified Patch:
   a. Sika Corporation.
   b. Euclid Chemical Corporation.
   c. Or Approved Equal.
6. Cementitious Polymer Modified Finishing Mortar:
   a. Sika Corporation.
   b. Euclid Chemical Corporation.
   c. Or Approved Equal.
7. Bonding Agent:
   a. Euclid Chemical Corporation.
   b. BASF Admixtures, Inc.
   c. L & M Construction Chemical, Inc.
   d. Thoro System Products.
   e. Or Approved Equal.

8. Anti-Corrosion bonding Agent:
   a. Sika Corporation.
   b. Euclid chemical Corporation.
   c. Or Approved Equal.

2.2 MATERIALS

A. Cement:
   1. ASTM C150, Type II.
   2. Cement type used shall correspond to that upon which selection of concrete proportions was based in the mix design.

B. Fly Ash:
   1. ASTM C618, Class F or Class C.
   2. Non-staining.
   3. Suited to provide hardened concrete of uniform light gray color.
   4. Maximum loss on ignition: 4 percent.
   5. Compatible with other concrete ingredients and having no deleterious effects on the hardened concrete.
   6. Produced by source approved by the State Highway Department in the state where the Project is located for use in concrete for bridges.
   7. Cement and fly ash type used shall correspond to that upon which selection of concrete proportions was based in the mix design.

C. Admixtures:
   1. Air entraining: ASTM C260.
   2. Water reducing, retarding, and accelerating: Conform to ASTM C494, Types A through E, and provisions of ACI 212.3R.
   3. High range water reducers (superplasticizers): Conform to ASTM C494, Types F or G.
   4. Admixtures to be chloride free.
      a. Do not use calcium chloride.
   5. Provide admixtures of same type, manufacturer and quantity as used in establishing required concrete proportions in the mix design.

D. Water:
   1. Potable.
   2. Clean and free from deleterious substances.
   3. Free of oils, acids and organic matter.

E. Aggregates for Normal Weight Concrete:
   1. ASTM C33.
   2. Fine and coarse aggregates to be regarded as separate ingredients.
   3. Fine aggregate:
      a. Clean natural sand.
      b. Manufactured or artificial sand.
   4. Gradation of coarse aggregate:
      a. All concrete: ASTM C33, size #57 or size #67.
      b. A minimum of 50 percent of the coarse aggregate <u>not</u> passing a 3/8 IN sieve shall be crushed stone aggregate.
   5. Provide aggregates approved for bridge construction by the California State Department of Transportation.
   6. Pozzolan or other additives shall not be used to compensate for alkali reactivity of aggregates.

F. Maximum total chloride ion content for concrete mix including all ingredients measured as a weight percent of cement:
   1. 0.06 for prestressed concrete.
   2. 0.10 for all other concrete.
G. Sand Cement Grout:
   1. Approximately three (3) parts sand, one (1) part Portland cement, 6 ±1 percent entrained air and water to produce a slump which allows grout to completely fill required areas and surround adjacent reinforcing.
      a. Provide sand in accordance with requirements for fine aggregate for concrete.
   2. Minimum 28 day compressive strength: 3000 psi.
H. Non-shrink Grout:
   1. Non-shrink, non-metallic, non-corrosive, and non-staining.
   2. Premixed with only water to be added in accordance with manufacturer's instructions at Site.
   3. Grout to produce a positive but controlled expansion.
      a. Mass expansion shall not be created by gas liberation or by other means.
   4. Minimum 28 day compressive strength: 6500 psi.
   5. Acceptable Products:
      a. BASF Admixtures, Inc. "Masterflow, 713 Plus".
      b. Euclid Chemical "NS Grout".
      c. Sauereisen Cements "F-100 Level Fill Grout".
      d. U. S. Grout "Five Star Grout".
      e. Set Products, Inc. "Set Non-Shrink Grout".
      f. The Upco Corp "Upcon".
      g. L & M "Crystex".
      h. Sika Corporation "Sika Grout 212".
      i. Or Approved Equal.
   6. In accordance with COE CRD-C621.
   7. Non-shrink grout under this paragraph shall not be used for machine base grout applications. Use epoxy grout.
I. Epoxy Grout:
   1. Three-component epoxy resin system:
      a. Two (2) liquid epoxy components.
      b. One (1) inert aggregate filler component.
   2. Adhesive:
      a. BASF “Masterflow 648 CP”.
      b. Exxon Chemical Company "Escoweld 2505".
      c. Sika "Sikadur 32 Hi-Mod", “Kikadur 32 Hi-Mod LPE”.
      d. U. S. Grout "Five Start Epoxy Grout".
      e. Euclid Chemical "E3-G".
      f. Or Approved Equal.
   3. Aggregate acceptable manufacturers:
      a. BASF “Masterflow 648 CP”.
      b. Exxon Chemical Company "Escoweld 2510".
      c. Sika aggregate.
      d. U. S. Grout aggregate.
      e. Euclid Chemical "Euclid aggregate".
      f. Or Approved Equal.

4. Aggregate manufacturer shall be the same as the adhesive manufacturer.
5. The aggregate shall be compatible with the adhesive.
6. Each component furnished in separate package for mixing at Site.
7. Epoxy grout shall be used for machine base grout applications and others where specified.

J. Epoxy Adhesive:
1. For use with retrofit waterstops, as seal on water-gearing form-tie holes, and as otherwise specified.
   a. Sikadur 32 Hi-Mod LPL by Sika Corporation.
   b. Or Approved equal.
2. Epoxy Bonding Adhesive:
   a. For use where bonding new concrete to existing concrete.
   b. Two component, moisture insensitive adhesive manufactured for the purpose of bonding fresh concrete to hardened concrete.
      1) Sikadur 32, Hi-Mod LPL by Sika Corporation.
      2) Euco No. 452 MV by Euclid Chemical Corporation.
      3) Or Approved Equal.

K. Epoxy Bonding Adhesive:
1. For use where bonding new concrete to existing concrete.
2. Two component, moisture insensitive adhesive manufactured for the purpose of bonding fresh concrete to hardened concrete.
   a. Sikadur 32, Hi-Mod LPL by Sika Corporation.
   b. Euco No. 452 MV by Euclid chemical Corporation.
   c. Or Approved Equal.

L. Cementitious Polymer Modified Patch:
1. Two component polymer-modified Portland cement non-sag mortar for patching vertical and overhead concrete surfaces.
   a. SikaTop 123 Plus by Sika Corporation.
   b. Verticoat by Euclid Chemical Corporation.
   c. Or Approved Equal.

M. Cementitious Polymer Modified Finishing Mortar:
1. SikaTop 121 Plus by Sika Corporation.
2. Tammscrete by Euclid Chemical Corporation.
3. Or Approved Equal.

N. Waterproofing Treatment:
1. Vandex super White by Euclid Chemical Corporation.
2. SikaTop 107 (white in color) by Sika Corporation.
3. Or Approved Equal.

O. Bonding Agent:
1. For use only on concrete surfaces not receiving liquid water repellent coating:
   a. High solids acrylic latex base liquid for interior or exterior application as a bonding agent to improve adhesion and mechanical properties of concrete patching mortars.
   b. Acceptable products:
      1) Euclid Chemical Co. “Flex-Con”.
      2) BASF Admixtures, Inc. “Acryl-Set”.
      3) L & M Construction chemicals, Inc. “Everbond”.
      4) Thoro System Products “Acryl 60”.
      5) Or Approved Equal.

2. For use only on concrete surface receiving liquid water repellent:
   a. Non-acrylic base liquid for interior or exterior application as a bonding agent to improve adhesion and mechanical properties of concrete patching mortars.

P. Anti-Corrosion bonding Agent:
1. Three component, moisture tolerant, cementitious bonding agent manufactured for the purpose of bonding fresh concrete to hardened concrete and providing an anti-corrosion coating to the embedded reinforcing.
   a. Sika Armatec 110 EpoCem by Sika Corporation.
   b. Duralprep A.C. by Euclid Chemical Corporation.
   c. Or Approved Equal.

2.3 MIXES

A. General:
1. Provide concrete capable of being placed without aggregate segregation and, when cured, of developing all properties specified.
2. Ready-mixed concrete shall conform to ASTM C94.
3. All concrete to be normal weight concrete, weighing approximately 145 to 150 LBS per cubic foot at 28 days after placement.

B. Minimum 28 Day Compressive Strengths:

Normal weight concrete fill, lean concrete, curbs, and concrete encasement	3000 psi
Normal weight precast concrete	5000 psi
Normal weight all other concrete	4500 psi

C. Air Entrainment:
1. Provide air entrainment in all concrete resulting in a total air content percent by volume as follows:
   a. 1 IN maximum aggregate size: 5 to 7 percent total air content.
   b. Interior slabs and mats with power trowel finish: Maximum 3 percent total air content.

D. Slump:
1. Concrete with high range water reducer (superplasticizer):
   a. Prior to introducing superplasticizer: 4 IN maximum
   b. After addition of superplasticizer: 7 IN maximum measured at the point of discharge into the concrete member.
   c. Slump shall be obtained by use of mid-range or high-range water reducer in accordance with ASTM C494.
2. All other concrete: 4 IN maximum, 3 IN minimum measured at point of discharge into the concrete construction member.
3. Concrete of lower than minimum slump may be used provided it can be properly placed and consolidated.
4. Provide additional water-reducing admixture at ready mix plant for concrete that is to be pumped to allow for slump loss due to pumping.
   a. Provide only enough additional water-reducing admixture so that slump of concrete at discharge end of pump hose does not exceed maximum slump specified and the maximum specified water-cement ratio is not exceeded.
5. Slump may be adjusted in the field through the use of water reducers.

a. Coordinate dosage and mixing requirements with concrete supplier.
b. Slump may not be adjusted on concrete that has exceeded the batching to placement time limit in Section 03311 (Concrete Mixing, Placing, Jointing, and Curing). Reject if not workable.

E. Proportioning:
1. General:
a. Proportion ingredients to produce a mixture which will work readily into corners and angles of forms and around reinforcement by methods of placement and consolidation employed without permitting materials to segregate or excessive free water to collect on surface.
b. Proportion ingredients to produce proper workability, durability, strength and other required properties.
2. Normal weight concrete minimum cement contents and maximum water cement ratios:

SPECIFIED STRENGTH (PSI)	MINIMUM CEMENT (LBS/CY)	MAXIMUM WATER CEMENT RATIO BY WEIGHT
3000	517*	0.45
4500	611*	0.42
4500 Super-P	611*	0.38
5000	611*	0.45

* If fly ash is proposed for use, the weight of fly ash plus weight of Portland cement shall equal these values.

3. Fly ash:
a. For cast-in-place concrete only, a maximum of 25 percent by weight of Portland cement content per cubic yard may be replaced with fly ash at a rate of 1 LB fly ash for 1 LB cement.
b. If fly ash is used, the water to fly ash plus cement ratio not to exceed the maximum water cement ratio specified in this Section 03308.
c. Concrete containing fly ash shall not be used in the construction of the precast concrete units specified in Section 03431 (Precast and Prestressed Concrete).
4. Water reducing, retarding, and accelerating admixtures:
a. Use in accordance with manufacturer's instructions.
b. Do not use unless required by these Specifications or approved for use by Owner.
5. High range water reducers (superplasticizers, Super-P):
a. Use in accordance with manufacturer's instructions.
b. Do not use unless required by these Specifications or approved for use by Owner.
c. Limit water/cement ratio to 0.38
6. Concrete mix proportioning methods for normal weight concrete:
a. Method 1:
1) Used when combination of materials proposed is to be evaluated and proportions selected to be on a basis of trial mixes.
2) Produce mixes having suitable proportions and consistencies based on ACI 211.1, using at least three (3) different water cement ratios or cement contents which will produce a range of compressive strengths encompassing the required average strength.

3) Design trial mixes to produce a slump within 0.75 IN of maximum specified, and for air entrained concrete, air content within 0.5 percent specified.
4) For each water cement ratio or cement content, make at least three (3) compression test cylinders for specified test age, and cure in accordance with ASTM C192.
   (a) Test for strength at 28 days in accordance with ASTM C39.
5) From results of these tests, plot a curve showing relationship between water cement ratio or cement content and compressive strength.
6) From this curve select water cement ratio or cement content to be used to produce required average strength.
7) Use cement content and mixture proportions such that maximum water cement ratio is not exceeded when slump is maximum specified.
8) Base field control on maintenance of proper cement content, slump, air content and water cement ratio.
9) See paragraph hereafter for definition of required average strength.

b. Method 2:
1) In lieu of trial mixes, field test records for concrete made with similar ingredients may be used.
2) Use of proposed concrete mix proportions based on field test records subject to approval by Owner based on information contained in field test records and demonstrated ability to provide the required average strength.
3) Field test records to represent materials, proportions and conditions similar to those specified.
   (a) Changes in the materials, proportions and conditions within the test records shall have not been more restricted than those for the proposed concrete mix.
   (b) Field test records shall meet the requirements of ACI 350 Paragraph 5.3.1.
4) Required concrete proportions may be established by interpolation between the strengths and proportions of two (2) or more test records each of which meets the requirements of this Section.

7. Required average strength to exceed the specified 28 day compressive strength by the amount determined or calculated in accordance with Section 5.3 of ACI 350 using the standard deviation of the proposed concrete production facility as described in Paragraphs 5.3.1 and 2 of ACI 350.

F. Allowable Shrinkage: 0.038 percent at 28 days per ASTM C157 and Section 03350 (Testing).

G. Pan stair fill:
1. Coarse aggregate: 100 percent passing a ½ IN sieve.
2. Proportions:
   a. 1 sack cement.
   b. 150 LBS coarse aggregate.
   c. 150 LBS fine aggregate.
3. Adjust mix to obtain satisfactory finishing.

2.4 SOURCE QUALITY CONTROL

A. To assure stockpiles are not contaminated or materials are segregated, perform any test for determining conformance to requirements for cleanness and grading on samples secured from aggregates at point of batching.

B. Do not use frozen or partially frozen aggregates.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

A. Perform concrete tests per Section 03350 (Testing).
B. Perform strength test on any concrete to which water has been added at the Site.

END OF SECTION

SECTION 03311

CONCRETE MIXING, PLACING, JOINTING, AND CURING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Mixing, placing, jointing, and curing of concrete construction.

B. Related Sections:
   1. Section 03108 (Formwork).
   2. Section 03208 (Reinforcement).
   3. Section 03308 (Concrete, Materials and Proportioning).
   4. Section 03348 (Concrete Finishing and Repair of Surface Defects).
   5. Section 03350 (Testing).
   6. Section 07900 (Joint Sealants).

1.2 REFERENCES

A. ACI 116R	Cement and Concrete Terminology
B. ACI 304R	Guide for Measuring, Mixing, Transporting and Placing Concrete
C. ACI 304.2R	Placing Concrete by Pumping Methods
D. ACI 305R	Hot Weather Concreting
E. ACI 306R	Cold Weather Concreting
F. ACI 309R	Guide for Consolidation of Concrete
G. ASTM C94	Standard Specification for Ready-Mixed Concrete
H. ASTM C156	Standard Test Method for Water Loss (from a Mortar Specimen) Through Liquid Membrane-Forming Curing Compounds for Concrete
I. ASTM C171	Standard Specification for Sheet Materials for Curing Concrete
J. ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
K. ASTM D1056	Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber
L. ASTM D1751	Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
M. COE CRD-C572	Specifications for Polyvinylchloride Waterstop

1.3 DEFINITIONS

A. Words and terms used in this Section 03311 are defined in ACI 116R.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Drawings showing all proposed construction slab joint layouts and any proposed wall joints not shown on the drawings.
   2. Product technical data including:

a. Acknowledgement that products submitted meet requirements of standards referenced.
b. Manufacturer's installation instructions.
1) Procedure for adding high-range water reducer at the Site.
c. Scaled (minimum 1/8 IN per foot) drawings showing proposed locations of construction joints and joint keyway dimensions.
d. Manufacturers and types:
1) Joint fillers.
2) Curing agents.
3) Construction joint bonding adhesive.
4) Waterstops.
(a) Provide, as applicable for this project, sample of Vertical Ell, Flat Ell, Flat Cross and Flat T prefabricated waterstop joints with 6 IN extensions beyond joint on all ends.

3. Certifications:
a. Ready mix concrete plant certification.
b. Waterstops: Products shipped meet or exceed the physical properties specified.

B. Work Plan:
1. Concrete Placement Plan, including, but not limited to:
a. Pour sequence, construction joints, and waterstops.
b. Formwork plan, including form material type, pour rate, and calculations.

C. Miscellaneous:
1. Copies of concrete delivery tickets.

1.5 QUALITY ASSURANCE

A. Qualifications:
1. Ready Mixed Concrete Batch Plant: Certified by NRMCA.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
1. Concrete:
a. Prepare a delivery ticket for each load of ready mixed concrete.
b. Truck operator shall hand ticket to Contractor at the time of delivery.
c. Ticket to show:
1) Mix identification.
2) Quantity delivered.
3) Amount of material in each batch.
4) Outdoor temperature in the shade.
5) Time at which cement was added
6) Time of delivery.
7) Time of discharge.
8) Amount of water that may be added at the site without exceeding the specified water-cement ratio.
9) Amount of water added at the site.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.

2.2 COMPONENTS

A. Evaporation Retardant:
   1. Acceptable Manufacturers:
      a. BASF.
      b. Euclid Chemical Corporation.
      c. Or Approved Equal.
B. Neoprene Expansion Joint Fillers:
   1. Acceptable manufacturers:
      a. Permaglaze.
      b. Rubatex.
      c. Williams Products.
      d. Or Approved Equal.
   2. Materials:
      a. Closed cell neoprene.
      b. ASTM D1056, Class SC.
      c. Compression deflection: As required to limit deflection to 50 percent of joint thickness under pressure from concrete pour height.
C. Asphalt Expansion Joint Fillers:
   1. Acceptable manufacturers:
      a. W. R. Meadows.
      b. J and P Petroleum Products.
      c. Or Approved Equal.
   2. Materials: ASTM D994.
D. Fiber Expansion Joint Fillers:
   1. Materials: ASTM D1751.
E. Waterstops, PVC Type:
   1. Acceptable manufacturers:
      a. Greenstreak Plastic Products.
      b. W. R. Meadows.
      c. Or Approved Equal.
   2. Materials:
      a. Virgin polyvinyl chloride compound not containing any scrap or reclaimed materials or pigment.
      b. Standard: COE CRD-C572.
   3. In expansion joints:
      a. 9 IN wide by 3/8 IN thick tear web type waterstop.
      b. 2 IN minimum horizontal movement without rupturing.
      c. Greenstreak Plastic Products Style #700 or Approved Equal.
   4. In control joints:
      a. 6 IN wide by 3/8 IN thick with ribs and center bulb.
      b. Similar to Greenstreak Plastic Products Style #705.
   5. In all other joints:
      a. 6 IN wide by 3/8 IN thick with ribs.

b. Similar to Greenstreak Plastic Products Style #679.
6. Provide hog rings or grommets at maximum 12 IN OC along the length of the waterstop.
7. Provide factory-made waterstop fabrications at all changes in direction, intersections and transitions, leaving only straight butt splices for the field.
8. Do not avert factory-made ells and T's in thicker walls.

F. Sand cement grout, non-shrink grout and epoxy grout: See Section 03308 (Concrete, Materials and Proportioning).

PART 3 EXECUTION

3.1 PREPARATION

A. General:
1. Complete formwork.
   a. See Section 03108 (Formwork).
2. Remove earth, snow, ice, water, and other foreign materials from areas that will receive concrete.
3. Secure reinforcement in place.
   a. See Section 03208 (Reinforcement).
4. Position expansion joint material, anchors and other embedded items.
5. Obtain approval of reinforcement erection and placement prior to placing concrete.
6. Do not place concrete during rain, sleet, or snow, unless adequate protection is provided and approval is obtained.
   a. Plan size of crews with due regard for effects of concrete temperature and atmospheric conditions on rate of hardening of concrete as required to obtain good surfaces and avoid unplanned cold joints.
   b. Do not allow rainwater to increase mixing water nor to damage surface finish.
7. Remove hardened concrete and foreign materials from inner surfaces of conveying equipment and formwork.
8. Provide slabs and beams of minimum indicated required depth when sloping structural foundation base slabs and elevated slabs to drains.
   a. For floor slabs on grade, slope top of subgrade to provide slab of required uniform thickness.

B. Preparation of Subgrade for Slabs On Ground:
1. Subgrade drained and of adequate and uniform load-bearing nature.
2. Obtain approval of subgrade compaction density prior to placing slabs on ground.
3. Maintain subgrade at a temperature above 32 DegF before concrete placing begins for a sufficient amount of time to remove frost.
4. Moisten subgrade to eliminate absorption.
   a. Keep subgrade moist at time of concreting.
   b. Allow no free-standing water on subgrade or soft or muddy spots when concrete is placed.

C. Edge Forms and Screeds:
1. Set accurately to produce designated elevations and contours of finished surface.
2. Sufficiently strong to support vibrating screeds or roller pipe screeds, if required.
3. Use strike off templates, or approved vibrating type screeds, to align concrete surfaces to contours of screed strips.

3.2 CONCRETE MIXING

A. General:
   1. Provide all concrete from a central plant conforming to Checklist for Certification of Ready Mixed Concrete Production Facilities of the NRMCA.
   2. Batch, mix, and transport in accordance with ASTM C94.

B. Control of Admixtures:
   1. Charge admixtures into mixer as solutions.
      a. Measure by means of an approved mechanical dispensing device.
      b. Liquid considered a part of mixing water.
      c. Admixtures that cannot be added in solution may be weighed or measured by volume if so recommended by manufacturer.
   2. Add separately, when two or more admixtures are used in concrete, to avoid possible interaction that might interfere with efficiency of either admixture, or adversely affect concrete.
   3. Complete addition of retarding admixtures within one minute after addition of water to cement has been completed, or prior to beginning of last three quarters of required mixing, whichever occurs first.

C. Tempering and Control of Mixing Water:
   1. Mix concrete only in quantities for immediate use.
   2. Discard concrete which has set.
   3. Discharge concrete from ready mix trucks within time limit and drum revolutions stated in ASTM C94.
   4. Addition of water at the Site:
      a. See Section 03308 (Concrete, Materials and Proportioning) for specified water cement ratio and slump.
      b. Do not exceed maximum specified water cement ratio or slump.
      c. Incorporate water by additional mixing equal to at least half of total mixing required.
      d. Perform strength test on any concrete to which water has been added at the Site.
         1) See Section 03350 (Testing).

3.3 PLACING OF CONCRETE

A. General:
   1. Comply with ACI 304R and ACI 304.2R.
   2. Deposit concrete:
      a. Continuously to avoid cold joints.
      b. In layers of 12 to 18 IN.
   3. Locate construction joints at locations approved by Owner.
      a. Plan size of crews with due regard for effects of concrete temperature and atmosphere conditions to avoid unplanned cold joints.
   4. Place slabs in checker board pattern and/or to allow a minimum of 7 days between pours on both sides of the same joint.
   5. Place concrete at such a rate that concrete, which is being integrated with fresh concrete, is still workable.
   6. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials.
   7. Spreaders:
      a. Temporary: Remove as soon as concrete placing renders their function unnecessary.
      b. Embedded:

1) Obtain approval of Owner.
2) Materials: Concrete or metal.
3) Ends of metal spreaders coated with plastic coating 2 IN from each end.

8. Do not begin placing of concrete in supported elements until concrete previously placed in supporting members is no longer plastic and has been in place at least a minimum of 2 HRS.
9. Deposit concrete as nearly as practicable in its final position to avoid segregation.
   a. Maximum free fall: 4 FT.
   b. Free fall exceeding 4 FT: Place concrete by means of hopper, elephant trunk or tremie pipe extending down to within 4 FT of surface placed upon.
10. Perform the following operations before bleeding water has an opportunity to collect on surface:
    a. Spread.
    b. Consolidate.
    c. Straightedge.
    d. Darby or bull float.
11. Use Evaporation Retardant to reduce surface moisture evaporation of slabs during concrete placement. Strict adherence to the manufacturer's instructions of use are essential for intended results.
    a. Confilm by BASF.
    b. Eucobar by Euclid chemical Corporation.
    c. Or Approved Equal.

B. Admixtures:
1. All admixtures to be introduced at the batch plant in accordance with manufacturer's recommendations.

C. Cold Weather Concrete Placement:
1. Comply with ACI 306R.
2. Do not place concrete on substrates that are below 32 DegF or contain frozen material.
3. Maintain all materials, forms, reinforcement, subgrade and any other items which concrete will come in contact with free of frost, ice or snow at time of concrete placement.
4. Temperature of concrete when discharged at site:

AIR TEMPERATURE DEGF	MINIMUM CONCRETE TEMPERATURE, DEGF FOR SECTIONS WITH LEAST DIMENSION LESS THAN 12 IN	MINIMUM CONCRETE TEMPERATURE, DEGF FOR SECTIONS WITH LEAST DIMENSION 12 IN OR GREATER
30 to 45	60	55
0 to 30	65	55
below 0	70	60

5. Heat subgrade, forms, and reinforcement so the temperature of the subgrade, forms, and reinforcement will be between 45 and 70 DegF, when temperature of surrounding air is 40 DegF or below at time concrete is placed.
   a. Remove all frost from subgrade, forms and reinforcement before concrete is placed.
6. Combine water with aggregate in mixer before cement is added, if water or aggregate is heated above 90 DegF.

7. Do not mix cement with water or with mixtures of water and aggregate having a temperature greater than 90 DegF.
8. Do not place slabs on ground if temperature is below 40 DegF or if temperature surrounding the slab will be below 40 DegF before structure is enclosed and heated.

D. Hot Weather Concrete Placement:
1. Comply with ACI 305R.
2. Cool ingredients before mixing, or add flake ice or well crushed ice of a size that will melt completely during mixing for all or part of mixing water if high temperature, low slump, flash set, cold joints, or shrinkage cracks are encountered.
3. Temperature of concrete when placed:
   a. Not to exceed 90 DegF.
   b. Not so high as to cause:
      1) Shrinkage cracks.
      2) Difficulty in placement due to loss of slump.
      3) Flash set.
4. Temperature of forms and reinforcing when placing concrete:
   a. Not to exceed 90 DegF.
   b. May be reduced by spraying with water to cool below 90 DegF.
      1) Leave no standing water to contact concrete being placed.

E. Consolidating:
1. Consolidate in accordance with ACI 309R except as modified herein.
2. Consolidate by vibration so that concrete is thoroughly worked around reinforcement, embedded items and into corners of forms. Pay particular attention to consolidation around waterstops.
   a. Eliminate:
      1) Air or stone pockets.
      2) Honeycombing or pitting.
      3) Planes of weakness.
3. Internal vibrators:
   a. Minimum frequency of 8000 vibrations per minute.
   b. Insert and withdraw at points approximately 18 IN apart.
      1) Allow sufficient duration at each insertion to consolidate concrete but not sufficient to cause segregation.
   c. Use in:
      1) Beams and girders of framed slabs.
      2) Columns and walls.
   d. Size of vibrators shall be in accordance with ACI 309R, Table 5.1.5.
4. Obtain consolidation of slabs with internal vibrators, vibrating screeds, roller pipe screeds, or other approved means.
5. Do not use vibrators to transport concrete within forms.
6. Provide spare vibrators on Site during all concrete placing operations.
7. Bring a full surface of mortar against form by vibration supplemented if necessary by spading to work coarse aggregate back from formed surface, where concrete is to have an as-cast finish.
8. Use suitable form vibrators located just below top surface of concrete, where internal vibrators cannot be used in areas of congested reinforcing.

9. Prevent construction equipment, construction operations, and personnel from introducing vibrations into freshly placed concrete after the concrete has been placed and consolidated.

F. Handle concrete from mixer to place of final deposit by methods which will prevent segregation or loss of ingredients and in a manner which will assure that required quality of concrete is maintained.
   1. Use truck mixers, agitators, and non-agitating units in accordance with ASTM C94.
   2. Horizontal belt conveyors:
      a. Mount at a slope which will not cause segregation or loss of ingredients.
      b. Protect concrete against undue drying or rise in temperature.
      c. Use an arrangement at discharge end to prevent segregation.
      d. Do not allow mortar to adhere to return length of belt.
      e. Discharge conveyor runs into equipment specially designed for spreading concrete.
   3. Metal or metal lined chutes:
      a. Slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal.
      b. Chutes more than 20 FT long and chutes not meeting slope requirements may be used provided they discharge into a hopper before distribution.
      c. Provide end of each chute with a device to prevent segregation.
   4. Pumping or pneumatic conveying equipment:
      a. Designed for concrete application and having adequate pumping capacity.
      b. Control pneumatic placement so segregation is avoided in discharged concrete.
      c. Loss of slump in pumping or pneumatic conveying equipment shall not exceed 1-1/2 IN.
      d. Do not convey concrete through pipe made of aluminum or aluminum alloy.
      e. Provide pumping equipment without Y sections.

G. Placing of Concrete on Metal Deck:
   1. Prior to concrete placement, the metal deck shall be free of soil, debris, standing water, loose mill scale, and all other foreign matter.
   2. Care shall be exercised when placing concrete so that the deck will not be subject to construction loads or impact that exceed the design capacity of the deck.
   3. Concrete shall be placed in a uniform manner and spread toward the center of the deck span.
   4. If buggies are used to place concrete, runways shall be planked, and the buggies shall only operate on planking.
      a. Planks shall be of adequate stiffness to transfer loads to the steel supports without damaging the deck.
   5. Deck damage caused by careless placement of concrete shall be repaired or replaced.

3.4 JOINTS AND EMBEDDED ITEMS

A. Construction Joints - General:
   1. Not all joint locations are shown on the design drawings for this project. Contractor shall provide shop drawings showing all proposed construction joint layouts for approval by the Owner prior to constructing.
      a. Construction joint spacing shall conform to the joint spacing criteria indicated in Paragraph B. below. Submit proposed construction joint locations in conformance with this Section 03311.
   2. Unplanned construction joints will not be allowed.

a. If concrete cannot be completely placed between planned construction joints, then it must be removed.

3. In general, locate joints near middle of spans of slabs, beams and girders unless a beam intersects a girder at this point, in which case, offset joint in girder a distance equal to twice the width of the beam.
4. Locate joints in walls and columns at underside of floors, slabs, beams, or girders, and at tops of foundations or floor slabs, unless shown otherwise.
   a. At Contractor's option, beam pockets may be formed into concrete walls.
   b. Size pockets to allow beam reinforcing to be placed as detailed on Drawings.
5. Place beams, girders, column capitals and drop panels at same time as slabs.
6. Place corbels monolithically with walls.
   a. Locate wall vertical construction joints midway between corbels.
   b. Where only a single corbel is located place it also monolithically with wall and locate wall vertical construction joint a minimum of 3 FT from face of corbel.
7. Make joints perpendicular to main reinforcement with all reinforcement continuous across joints.
8. Provide roughened construction joints at all construction joints unless indicated otherwise on drawings.
   a. Clean the previously hardened concrete interface and remove all laitance including curing compound where applicable.
   b. Intentionally roughen the interface to a full amplitude of 1/4 IN.
9. Provide continuous keyways only where indicated on drawings.
   a. Construction joint keyways shall have the following dimensions, unless shown otherwise on Drawings or directed otherwise by Owner.
   b. Construction joint keyways in walls:
      1) Keyway width, not less than 1/3 and not more than 1/2 the wall thickness measured perpendicular to the wall face.
      2) Keyway depth to be not less than 1-1/2 IN.
      3) Place keyway in center of wall thickness unless shown otherwise on Drawings.
   c. Construction joint keyways in footings, foundations, base slabs, and structural or elevated slabs:
      1) Keyway only allowed where shown on the drawings.
      2) Keyway height not less than 1/3 and not more than 1/2 the footing or slab thickness.
      3) Keyway depth not less than 1-1/2 IN.
      4) Keyway in center of slab or footing thickness unless shown otherwise on Drawings.
   d. Construction joint keyways in beams:
      1) Keyway height not less than 1/3 and not more than 1/2 the beam depth.
      2) Keyway depth not less than 1-1/2 IN.
      3) Keyway in center of beam section unless shown otherwise on Drawings.
10. Allow a minimum of 7 days before placement of adjoining concrete construction.

B. Construction Joints – Spacing unless shown otherwise on the Drawings or approved by the Owner:
   1. General - Structures <u>not</u> intended to contain liquid:
      a. Wall vertical construction joints:
         1) 30 FT maximum centers.
         2) At wall intersections, 15 FT maximum and 2 FT minimum from corner.

b. Wall horizontal construction joints: 20 to 25 FT centers.
c. Walls that are thicker than 18 IN may be poured up to 32 FT tall in one (1) pour provided requirements of the paragraph 3.4B.2c are satisfied.
d. Base slab, floor, and roof slab construction joints:
   1) Placements to be approximately square and not to exceed 1600 SF.
   2) Maximum side dimension of a slab pour to be less than:
      (a) Twice the length of the short side.
      (b) 40 FT.
   3) No re-entrant corners will be allowed in any concrete slab pour unless approved by the Owner. All pours shall be square or rectangular.

2. Structures intended to contain liquids unless shown otherwise on the Drawings or approved by the Owner:
   a. Wall vertical construction joints:
      1) 24 FT maximum centers.
      2) At wall intersections, 12 FT maximum and 2 FT minimum from corners.
   b. Wall horizontal construction joints: 12 to 18 FT centers.
      1) Walls that are thicker than 18 IN may be poured up to 32 FT tall in one (1) pour provided the following requirements are satisfied:
         (a) Full-height wall pours may be acceptable if included in an approved Concrete Placement Work Plan.
         (b) A test wall of similar size, height and thickness will be poured to demonstrate the quality of the concrete work.
         (c) The test wall will be located as a portion of a non-water bearing wall.
            (i) The test wall will include a waterstop at the bottom of the wall.
            (ii) Alternatively, a separate test wall with waterstop at bottom, not part of the final work, may be constructed.
         (d) The concrete placement and concrete quality of the test wall will be observed by the Owner.
            (i) Concrete will be judged on the following:
               - Ability to keep bottom of the pour clean and free from trash and debris.
               - Ability to protect the waterstop from folding over due to the force of falling concrete.
               - Ability to properly consolidate all concrete in the wall pour, including below formed openings.
      2) Owner will evaluate the Contractor's work and may recommend taller concrete wall pours if concrete quality is acceptable.
      3) Preparation for all subsequent wall pours over 18 FT tall must be the same as the preparation of the test wall.
      4) Should the quality of concrete work on subsequent wall pours be judged inadequate, the Contractor may be directed to limit wall pour heights to 18 FT as originally specified.
      5) Should the quality of concrete work on the test wall be judged inadequate, additional test walls will not be observed and judged to allow pour heights greater that 18 FT unless allowed by Owner.
   c. Base slab, floor, and roof slab construction joints:
      1) Placements to be approximately square and not to exceed 1200 SF.
      2) Maximum side dimension of a slab pour to be less than:

(a) One and one half times the length of the short side.
(b) 40 FT.

C. Construction Joints - Bonding:
1. Obtain bond between concrete pours at construction joints by thoroughly cleaning and removing all laitance, and curing compound where applicable, from construction joints.
   a. Before new concrete is placed, all construction joints shall be coated with an approved bonding adhesive applied in accordance with manufacturer's instruction.
2. Roughened construction joints:
   a. Roughen the surface of the concrete to expose the aggregate uniformly
   b. Remove laitance, loosened particles of aggregate or damaged concrete at the surface, or at the Contractor's option, use an approved chemical retarder which delays but does not prevent setting of the surface of the mortar in accordance with the manufacturer's recommendations.
      1) Retarded mortar shall be removed within 24 HRS after placing to produce a clean exposed aggregate bonding surface.
   c. Cover the hardened concrete of horizontal joints with a coat of cement grout of similar proportions to the concrete, except substitute fine aggregate for coarse aggregate.
   d. Place 1 IN layer of grout in bottoms of wall or column lifts immediately before placing concrete.
      1) Vibrate grout and first layer of concrete simultaneously.
   e. Place fresh concrete before the grout has attained its initial set.
3. Other keyed construction joints:
   a. Thoroughly clean construction joints and remove all laitance.
   b. Dampen the hardened concrete (but do not saturate) immediately prior to placing of fresh concrete.

D. Locate control joints in slabs on grade as indicated on Drawings.
1. Time cutting properly with set of concrete, if saw cut joints are required or permitted.
   a. Start cutting as soon as concrete has hardened sufficiently to prevent aggregates being dislodged by saw.
   b. Complete before shrinkage stresses become sufficient to produce cracking.

E. Expansion Joints:
1. Do not permit reinforcement or other embedded metal items bonded to concrete (except smooth dowels bonded on only one side of joint) to extend continuously through an expansion joint.
   a. If dowels are used, provide method to positively prevent movement during concrete placement.
   b. Grease for greased dowels to be waterproof wheel bearing grease in paste form. Spray-on grease not allowed. Dowels to be completely covered with grease by manual method.
2. Use neoprene expansion joint fillers, unless noted otherwise on Drawings.
3. Seal expansion joints as shown on Drawings.
   a. See Section 07900 (Joint Sealants) for requirements.

F. Waterstops:
1. PVC type:
   a. Position waterstop accurately in forms.
   b. Secure waterstops in correct position using hog rings or grommets spaced along the length of waterstop and tie wire to adjacent reinforcing.

c. Hold horizontal waterstops in place with continuous supports.
d. Install according to manufacturer's instructions.
   1) Do not displace reinforcement from required location.
e. Waterstops to be continuous.
f. Splice ends with perpendicular butt splice using electrical splicing iron in accordance with manufacturer's instructions.
g. Unless otherwise noted, use for all construction joints in new construction for all structures indicated on Drawings.

G. Other Embedded Items:
1. Place sleeves, inserts, anchors, and embedded items required for adjoining work or for its support, prior to initiating concreting.
2. Do not place electrical conduit, drains, or pipes in or thru concrete slabs, walls, columns, foundations, beams or other structural members unless approved by Owner.

H. Placing Embedded Items:
1. Position expansion joint material, waterstops, and other embedded items accurately.
2. Support against displacement.
3. Fill voids in sleeves, inserts and anchor slots temporarily with readily removable material to prevent entry of concrete into voids.
4. Provide adequate means for anchoring waterstop in concrete.
   a. Provide means to prevent waterstops in the forms from being folded over by the concrete as it is placed.
   b. Work concrete under the waterstops by hand, so as to avoid the formation of air and rock pockets, when placing roof and floor slab concrete around waterstops.

3.5 FINISHING

A. See Section 03348 (Concrete Finishing and Repair of Surface Defects).
B. Coordinate mixing and placing with finishing.

3.6 INSTALLATION OF GROUT

A. Grout Schedule of Use:
1. Sand cement grout:
   a. General use.
2. Non-shrink grout:
   a. Filling form tie holes.
   b. Under column and beam base plates.
   c. Other uses indicated on the Drawings.
3. Epoxy grout:
   a. Patching cavities in concrete.
   b. Grouting of equipment base plates where driving motor is 100 HP and above.
   c. Other uses indicated on the Drawings.

B. Grout Installation:
1. Sand cement grout:
   a. Fill keyways between precast concrete hollow core slabs with sand cement grout.
   b. Consolidate grout by rodding or by other means to assure complete filling of keyways.
   c. Cure grout by one of methods specified.
2. Non-shrink grout:
   a. Clean concrete surface to receive grout.
   b. Saturate concrete with water for 24 HRS prior to grouting.

c. Mix in a mechanical mixer.
d. Use no more water than necessary to produce flowable grout.
e. Place in accordance with manufacturer's instructions.
f. Provide under beam, column, and equipment base plates, in joints between precast concrete filter slabs, and in other locations indicated on the Drawings.
g. Completely fill all spaces and cavities below the top of base plates.
h. Provide forms where base plates and bed plates do not confine grout.
i. Where exposed to view, finish grout edges smooth.
j. Except where a slope is indicated on the drawings, finish edges flush at the base plate, bed plate, member or piece of equipment.
k. Coat exposed edges of grout with cure or seal compound recommended by the grout manufacturer.

3. Epoxy grout:
   a. Mix and place in accordance with manufacturer's instructions.
   b. Apply only to clean, dry, sound surface.
   c. Completely fill all cavities and spaces around dowels and anchors without voids.
   d. Grout base and bed plates as specified for non-shrinking, non-metallic grout.
   e. Obtain manufacturer's field technical assistance as required to assure proper placement.

3.7 CURING AND PROTECTION

A. Protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury immediately after placement, and maintain with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement, hardening, and compressive strength gain.
   1. Follow recommendations of ACI 308 except as modified herein.
   2. Use Evaporation retardant to reduce surface moisture evaporation of slabs during concrete placement. Strict adherence to the manufacturer’s instructions of use are essential for intended results.

B. General Curing Intent:
   1. Concrete shall be cured for a minimum of fourteen (14) days. At the Contractor’s option, the first seven (7) days of curing may follow the moist curing procedures listed in Paragraph 3.7C of this Section 03311.

C. Apply one of the following curing procedures immediately after completion of placement and finishing, for concrete surfaces not in contact with forms.
   1. Ponding or continuous sprinkling.
   2. Application of absorptive mats or fabric kept continuously wet.
   3. Application of sand kept continuously wet.
   4. Continuous application of steam (not exceeding 150 DegF) or mist spray.
   5. Ponding and Sprinkling in conjunction with application of waterproof sheet materials, conforming to ASTM C171 and only with a program as approved by the Owner that will keep the surface continuously wet.
   6. Ponding and Sprinkling in conjunction with application of other moisture retaining covering as approved and only with a program as approved by the Owner that will keep the surface continuously wet.

D. After seven (7) full days of moist curing, application of a curing compound conforming to ASTM C309 may be substituted for moist curing, at the Contractor’s option.

1. Apply curing compound in accordance with manufacturer's recommendations immediately after any water sheen which may develop during moist curing has disappeared from concrete surface.
2. Do not use on any surface against which additional concrete or other material is to be bonded unless it is proven that curing compound will not prevent bond.
3. Where a vertical surface is cured with a curing compound, the vertical surface shall be covered with a minimum of two (2) coats of the curing compound with a coverage rate of 400 SQ FT per gallon each coat.
   a. Apply the first coat of curing compound to a vertical surface immediately after form removal and before the surface displays water loss. Apply in one direction only, covering uniformly to a minimum coverage rate of 400 SQ FT per gallon.
   b. The vertical concrete surface at the time of receiving the first coat shall be damp with no free water on the surface.
   c. Allow the preceding coat to completely dry prior to applying the next coat.
   d. Apply second coat in direction perpendicular to the first coat application direction, covering uniformly to a minimum coverage rate of 400 SQ FT per gallon.
   e. A vertical surface: Any surface steeper than 1 vertical to 4 horizontal.

E. Curing Concrete In Contact with Forms:
1. Minimize moisture loss of concrete placed in forms wet and cool until they can be safely removed.
2. Moist cure the top surface of concrete placed in forms according to paragraph 3.7C above.
3. After form removal, cure concrete until end of time prescribed.
   a. Use one of methods listed above.
   b. When approved by the Owner, placement of the second pour at joints may occur prior to the end of the curing period.
4. Forms left in place shall not be used as a method of curing in hot weather.
5. The term "hot weather," where used in these specifications, is defined in ACI 305R.
6. In hot weather, remove forms from vertical surfaces as soon as concrete has gained sufficient strength so that the formwork is no longer required to support the concrete and commence moist curing according to paragraph 3.7C above.

F. Cold Weather:
1. Follow recommendations of ACI 306R.
2. Maintain temperature of concrete between 50 and 70 DegF for required curing period, when outdoor temperature is 40 DegF, or less.
3. Use heating, covering, insulating, or housing of the concrete work to maintain required temperature without injury due to concentration of heat.
4. Do not use combustion heaters unless precautions are taken to prevent exposure of concrete to exhaust gases which contain carbon dioxide.
5. Interior slabs in areas intended to be heated shall be adequately protected so that frost does not develop in the supporting subgrade.

G. Hot Weather:
1. Follow recommendations of ACI 305R.
2. Make provision for cooling forms, reinforcement and concrete, windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering with a light colored material.
3. Provide protective measures as quickly as concrete hardening and finishing operations will allow.

H. Rate of Temperature Change:

1. Keep changes in temperature of air immediately adjacent to concrete as uniform as possible, during and immediately following curing period.
2. Do not exceed a temperature change of 5 DegF in any 1 HR or 50 DegF in any 24 HR period.

I. Protection from Mechanical Injury:
1. Protect concrete from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration.
2. Protect finished concrete surfaces from damage by construction equipment, materials, or methods, and by rain or running water.
3. Do not load self supporting structures in such a way as to overstress concrete.

3.8 FIELD QUALITY CONTROL

A. Tests in accordance with Section 03350 (Testing).
1. Perform a strength test on all concrete to which water or superplasticizer, above the amount stated in the approved concrete mix design, has been added.
   a. Perform sampling after water or superplasticizer has been added and additional mixing has been performed.

B. Field samples of fabricated waterstop fittings (crosses, tees, etc.) will be selected at random by the Owner for testing by a laboratory at the Owner's expense.
1. When tested, they shall have a tensile strength across the joints equal to at least 600 psi.

END OF SECTION

SECTION 03348

CONCRETE FINISHING AND REPAIR OF SURFACE DEFECTS

PART 1 GENERAL

1.1 SUMMARY

A. Related Sections:
   1. Section 03108 (Formwork).
   2. Section 03308 (Concrete, Materials and Proportioning).
   3. Section 03311 (Concrete Mixing, Placing, Jointing and Curing).

1.2 REFERENCES

A.	ACI 116R	Cement and Concrete Terminology
B.	ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
C.	ASTM C1315	Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete
D.	ASTM D4258	Standard Practice for Surface Cleaning Concrete for Coating
E.	ASTM D4259	Standard Practice for Abrading Concrete
F.	SSPC/NACE SP 13/NACE No. 6	Surface Preparation of Concrete

1.3 DEFINITIONS

A. Vertical Surface Defects:
   1. Any void in the face of the concrete deeper than 1/8 IN, such as:
      a. Tie holes.
      b. Air pockets (bug holes).
      c. Honeycombs.
      d. Rock holes.
   2. Scabbing:
      a. Scabbing is defect in which parts of the form face, including release agent, adhere to concrete.
   3. Foreign material embedded in face of concrete.
   4. Fins 1/16 IN or more in height.
B. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Site.
   2. Installer and applicator are synonymous.
C. SSD: Saturated, surface dry.
D. Other words and terms used in this Section 03348 are defined in ACI 116R.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.

2. Certifications:
   a. Certification of aggregate gradation.
   b. Certification that products being used will not interfere with bonding of future floor or wall finishes.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Applicator of acrylics, epoxy products, and surfacer/fillers must be approved, in writing, by manufacturer.
   2. Installer/applicator of acrylics, epoxy products, and surfacer/fillers shall be licensed or approved in writing by manufacturer to install/apply this product.
   3. Applicator of concrete sealer shall be factory trained and approved, in writing, by the manufacturer to apply the product.
B. Mock ups:
   1. Provide a sample for float and smooth concrete finishes.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's recommendations and requirements for materials used.

1.7 WARRANTY

A. Provide warranty equal to specified manufacturer's standard warranty for all products used.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Chemical floor sealer (CS-1):
      a. L&M Construction Chemicals, Inc.
      b. Euclid Chemical Co.
      c. Dayton Superior
      d. Or Approved Equal
   2. Bonding agents:
      a. Euclid Chemical Co.
      b. BASF Admixtures, Inc.
      c. L&M Construction Chemicals, Inc.
      d. Sika Corporation
      e. Or Approved Equal

2.2 MATERIALS

A. Chemical Floor Sealer CS-1:
   1. Colorless low VOC water-based solution containing acrylic copolymers.
      a. ASTM C1315, Class B, minimum 30 percent solids.
      b. ASTM C309, Type 1.
      c. Non-yellowing UV resistant.
      d. Capable of being painted after cured.
   2. Similar to L&M Construction Chemicals, Inc., Dress and Seal WB 30.
B. Bonding Agent:

1. See Section 03308 (Concrete, Materials and Proportioning).
   a. All bonding agents and adhesives shall have a pot life that allows proper placement of new material against existing material as prescribed by manufacturer.
   b. Use Epoxy Modified Bonding Adhesive.

C. Aggregate:
   1. Sand: Maximum size #30 mesh sieve.
   2. For exposed aggregate finish surfaces: Same as surrounding wall.

D. Water: Potable.

E. Non-Shrink Grout: See Section 03308 (Concrete, Materials and Proportioning).

F. Cementitious Polymer Modified Patch: See Section 03308 (Concrete, Materials and Proportioning).

2.3 MIXES

A. Bonding Grout: One (1) part cement to one (1) part aggregate.

B. Patching Mortar:
   1. One (1) part cement to two and one-half (2-1/2) parts aggregate by damp loose volume.
      a. Substitute white Portland cement for a part of gray Portland cement to produce color matching surrounding concrete.

PART 3 EXECUTION

3.1 PREPARATION

A. For methods of curing, see Section 03311 (Concrete Mixing, Placing, Jointing, and Curing).

B. Preparation of Bonding Grout Mixture:
   1. Mix cement and aggregate.
   2. Mix bonding agent and water together in separate container in accordance with manufacturer's instructions.
   3. Add bonding agent/water mixture to cement/aggregate mixture.
   4. Mix to consistency of thick cream.
   5. Bonding agent itself may be used as bonding grout if approved by manufacturer and Owner.

C. Preparation of Patching Mortar Mixture:
   1. Mix cement and aggregate.
   2. Mix bonding agent and water together in separate container in accordance with manufacturer's instructions.
   3. Add only enough bonding agent/water mixture to cement/aggregate mixture to allow handling and placing.
   4. Let stand with frequent manipulation with a trowel, until mix has reached stiffest consistency to allow placement.

D. Clean surfaces in accordance with ASTM D4258 to remove dust, dirt, form oil, grease, or other contaminants prior to abrasive blasting, chipping, grinding or wire brushing.
   1. Abrasive blast surfaces in accordance with ASTM D4259 and SSPC SP 13/NACE No. 6 to completely open defects down to sound concrete and remove laitance.
      a. If additional chipping or wire brushing is necessary, make edges perpendicular to surface or slightly undercut.
      b. No featheredges will be permitted.
   2. Rinse surface with clean water and allow surface water to evaporate to SSD condition prior to repairing surface defects or bonding new concrete.

E. Repairing Surface Defects at Surfaces Not in Contact With Liquid:
   1. This method of repairing surface defects is to be used only on vertical concrete surfaces above finished grade, on exterior surfaces of structures containing liquid unless the surface is below finished grade, and on surfaces to receive liquid water repellent.
   2. At small voids and surface defects:
      a. Use Patching Mortar mix.
      b. Use Bonding Grout.
      c. Match color of surrounding wall.
      d. Do not use acrylic bonding agent in patching mortar for filling defects in surfaces to be treated with liquid water repellent.
   3. At voids larger than (4) four square inches at surface and deeper than 1/2 IN:
      a. Use non-shrink grout.
      b. Use Epoxy Bonding Adhesive.
      c. Cut perimeter of patch to 1/4 IN minimum depth at entire perimeter, with edge perpendicular to the surface to eliminate feathered edges.
      d. If applicable gouge void to eliminate thin patch areas less than 1/2 IN deep that are surrounded by deeper patch areas.
      e. Patch may gradually taper from maximum depth to a minimum of 1/4 IN depth at the perimeter.
      f. When reinforcing is exposed gouge void at exposed reinforcing to a depth of 1/2 IN beyond the reinforcing to allow patch material to lock around reinforcing.
      g. Where exposed to view and scheduled to receive concrete Finish #2 or #6, hold grout 1/4 IN below surface of concrete and fill with patching mortar to match surrounding concrete.
   4. At tie holes:
      a. Use non-shrink grout.
      b. Where exposed to view and scheduled to receive concrete Finish #2 or #6, hold grout 1/4 IN below surface of concrete and fill with patching mortar to match surrounding concrete.
   5. If required by bonding agent manufacturer, etch surfaces with a muriatic acid solution followed by a thorough rinse with clean water.
      a. Test concrete to determine pH level and continue flushing with clean water until surface pH is within acceptable limits.
   6. Dampen area to be patched and an area at least 6 IN wide surrounding it prior to application of bonding grout.
   7. Brush bonding grout into the surface after the surface water has evaporated.
   8. Allow bonding grout to set for period of time required by bonding agent manufacturer before applying premixed patching mortar.
   9. Consolidate grout or mortar into place and strike off so as to leave patch slightly higher than surrounding surface.
   10. Leave undisturbed for at least 60 minutes before finishing level with surrounding surface.
      a. Do not use metal tools in finishing a patch in a formed wall which will be exposed or coated with other materials.
   11. Keep areas damp in accordance with grout manufacturer or bonding agent manufacturer's directions.

F. Repairing Surface Defects at Surfaces in Contact With Liquid:

1. This method of repairing surface defects is to be used on vertical concrete surfaces below finished grade and on surfaces in direct contact with liquid.
2. At form tie holes and small voids:
   a. Use Cementitious Polymer Modified Patch
   b. Use Epoxy Bonding Adhesive.
   c. Apply a seal coat of Epoxy Adhesive over the tie hole patch, on the face in contact with the liquid within 72 hours of patching and after initial curing of the non-shrink grout. Extend the seal coat to one (1) IN beyond the tie hole patch on all sides.
3. At voids larger than (4) four square IN at surface and deeper than 1/2 IN when no reinforcing is exposed:
   a. Use Cementitious Polymer Modified Patch.
   b. Use Epoxy Bonding Adhesive.
   c. Cut perimeter of patch to ¼ IN minimum depth at entire perimeter, with edge perpendicular to the surface to eliminate feathered edges.
   d. If applicable gouge void to eliminate thin patch areas less than ½ IN deep that are surrounded by deeper patch areas.
   e. Patch may gradually taper from maximum depth to a minimum of ¼ IN depth at the perimeter.
   f. Apply a seal coat of Epoxy Adhesive over the tie hole patch, on the face in contact with the liquid within 72 hours of patching and after initial curing of the patch. Extend the seal coat to one (1) IN beyond the patch on all sides.
4. At voids larger than (4) four square inches at surface and deeper than ½ IN when reinforcing is exposed:
   a. Use Cementitious Polymer Modified Patch.
   b. Use Anti-Corrosion Bonding Agent.
   c. Cut perimeter of patch to ¼ IN minimum depth at entire perimeter, with edge perpendicular to the surface to eliminate feathered edges.
   d. If applicable gouge void to eliminate thin patch areas less than ½ IN deep that are surrounded by deeper patch areas.
   e. Patch may gradually taper from maximum depth to a minimum of ¼ IN depth at the perimeter.
   f. Gouge void at exposed reinforcing to a depth of ½ IN beyond the reinforcing to allow patch material to lock around reinforcing.
   g. Apply a seal coat of Epoxy Adhesive over the tie hole patch, on the face in contact with the liquid within 72 hours of patching and after initial curing of the patch. Extend the seal coat to one (1) IN beyond the patch on all sides.

3.2 INSTALLATION AND APPLICATION

A. Do not repair surface defects or apply wall or floor finishes when temperature is or is expected to be below 50 DegF.
   1. If necessary, enclose and heat area to between 50 and 70 DegF during repair of surface defects and curing of patching material.
      a. Use only clean fuel, indirect fired heating apparatus.
B. Chemical Floor Sealer CS-1 Application:
   1. Apply to floor areas indicated on the Drawings in accordance with manufacturer's recommendations.
   2. Apply at rate recommended by manufacturer.

3. After final coat of material is applied, remove surplus in accordance with manufacturer's recommendations.
4. Do not apply sealer to floors scheduled to receive epoxy floor finish.

C. Concrete Finishes for Vertical Wall Surfaces:
1. General: Give concrete surfaces finish as specified below after removal of formwork and repair of surface defects.
2. Finish #1 - As cast rough form finish:
   a. Selected forming materials are not required.
   b. Prepare surface in accordance with Article 3.1 and repair the following surface defects:
      1) Tie holes.
      2) Honeycombs deeper than 1/4 IN.
      3) Air pockets deeper than 1/4 IN.
      4) Rock holes deeper than 1/4 IN.
   c. Chip or rub off fins exceeding 1/4 IN in height.
   d. Use at unexposed surfaces such as foundations and backfilled surfaces of walls not to be waterproofed.
3. Finish #2 – As cast form finish:
   a. Form facing material shall produce a smooth, hard, uniform texture.
      1) Use forms specified for surfaces exposed to view in accordance with Section 03108 (Formwork).
   b. Prepare surface in accordance with Article 3.1 and repair the following surface defects:
      1) Tie holes.
      2) Honeycombs deeper than 1/4 IN or larger than 1/4 IN DIA.
      3) Air pockets deeper than 1/4 IN or larger than 1/4 IN DIA.
      4) Rock holes deeper than 1/4 IN or larger than 1/4 IN DIA.
      5) Scabbing.
   c. Chip or rub off fins exceeding 1/8 IN in height.
      1) Finish shall provide uniform color and texture.
   d. Provide this finish for all exposed interior surfaces.
4. Finish #6 – Cork floated finish:
   a. Form facing material shall produce a smooth, hard, uniform texture.
      1) Use forms specified for surfaces exposed to view in accordance with Section 03108 (Formwork).
   b. Prepare surface in accordance with Article 3.1 and repair all surface defects.
   c. Remove formwork as soon as possible, within 2 to 3 days of placement where possible.
   d. Mix one (1) part Portland cement and one (1) part fine sand with bonding agent/water mixture to produce a stiff mortar.
   e. Dampen wall surface.
   f. Apply mortar with rubber float or trowel, filling all surface voids.
   g. Compress mortar into voids using slow speed grinder or stone.
   h. If the mortar surface dries too rapidly to permit compaction and finishing, apply a small amount of water using a fog spray.
   i. Produce the final texture with a cork float using a swirling motion.
   j. Construct mock-up per Article 1.5.
   k. Provide this finish on all exterior exposed surfaces.

D. Related Unformed Surfaces (Except Slabs):
   1. Strike smooth and level tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces after concrete is placed.
   2. Float surface to a texture consistent with that of formed surfaces.
      a. If more than one (1) finish occurs immediately adjacent to unformed surface, provide surface with most stringent formed surface requirement.
   3. Continue treatment uniformly across unformed surfaces.
E. Concrete Finishes for Horizontal Slab Surfaces:
   1. General:
      a. Tamp concrete to force coarse aggregate down from surface.
      b. Screed with straightedge, eliminate high and low places, bring surface to required finish elevations; slope uniformly to drains.
      c. Dusting of surface with dry cement or sand during finishing processes not permitted.
   2. Unspecified slab finish:
      a. When type of finish is not indicated, use following finishes as applicable:
         1) Surfaces intended to receive bonded applied cementitious applications: Scratched finish.
         2) Surfaces intended to receive roofing except future floors, or waterproofing membranes: Floated finish.
         3) Floors and roof surfaces which are future floors intended as walking surfaces or for reception of floor coverings: Troweled finish.
         4) Garage floors and ramps: Broom or belt finish.
         5) Exterior slabs, sidewalks, platforms, steps and landings, and ramps, not covered by other finish materials: Broom or belt finish.
         6) All slabs to receive a floated finish before final finishing.
   3. Scratched slab finish: After concrete has been placed, consolidated, struck off, and leveled to a Class B tolerance, roughen surface with stiff brushes or rakes before final set.
   4. Floated finish:
      a. After concrete has been placed, consolidated, struck off, and leveled, do no further work until ready for floating.
      b. Begin floating when water sheen has disappeared and surface has stiffened sufficiently to permit operations.
         1) Use wood or cork float.
      c. During or after first floating, check planeness of entire surface with a 10 FT straightedge applied at not less than two (2) different angles.
      d. Cut down all high spots and fill all low spots to produce a surface with Class B tolerance throughout.
      e. Refloat slab immediately to a uniform texture.
   5. Troweled finish:
      a. Float finish surface to true, even plane.
      b. Power trowel, and finally hand trowel.
      c. First troweling after power troweling shall produce a smooth surface which is relatively free of defects, but which may still show some trowel marks.
      d. Perform additional trowelings by hand after surface has hardened sufficiently.
      e. Final trowel when a ringing sound is produced as trowel is moved over surface.
      f. Thoroughly consolidate surface by hand troweling.

g. Leave finished surface essentially free of trowel marks, uniform in texture and appearance and plane to a Class A tolerance.
h. On surfaces intended to support floor coverings, remove any defects that would show through floor covering by grinding.

6. Broom or belt finish: Immediately after concrete has received a float finish as specified, give it a transverse scored texture by drawing a broom or burlap belt across surface.
7. Underside of concrete slab finish:
   a. Match finish as specified for adjacent vertical surfaces.
   b. If more than one (1) finish occurs immediately adjacent to underside of slab surface, provide surface with most stringent formed surface requirement.

3.3 FIELD QUALITY CONTROL

A. Horizontal slab finishes will be accepted provided:
   1. Applicable specification requirements are satisfied.
   2. Water does not pond in areas sloped to drain.
   3. Gap between a 10 FT straightedge placed anywhere and the finished surface does not exceed:
      a. Class A tolerance: 1/8 IN.
      b. Class B tolerance: 1/4 IN.
      c. Class C tolerance: 1/2 IN.
   4. Accumulated deviation from intended true plane of finished surface does not exceed 1/2 IN.
   5. Accuracy of floor finish does not adversely affect installation and operation of movable equipment, floor supported items, or items fitted to floor (doors, tracks, etc.).

B. Unacceptable finishes shall be replaced or, if approved in writing by Owner, may be corrected provided strength and appearance are not adversely affected.
   1. High spots to be removed by grinding and/or low spots filled with a patching compound or other remedial measures to match adjacent surfaces.

3.4 PROTECTION

A. All horizontal slab surfaces receiving chemical floor sealer shall be kept free of traffic and loads for minimum of 72 HRS following installation of sealer.

END OF SECTION

SECTION 03350

TESTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Contractor requirements for testing of concrete and grout.
   2. Acceptance criteria for concrete.

B. Related Sections:
   1. Section 03208 (Reinforcement).
   2. Section 03308 (Concrete, Materials and Proportioning).

1.2 REFERENCES

A.	AASHTO T260	Standard Method of Test for Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials
B.	ACI 318	Building Code Requirements for Structural Concrete
C.	ASTM C31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
D.	ASTM C39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
E.	ASTM C42	Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
F.	ASTM C138	Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
G.	ASTM C143	Standard Test Method for Slump of Hydraulic-Cement Concrete
H.	ASTM C172	Standard Practice for Sampling Freshly Mixed Concrete
I.	ASTM C173	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
J.	ASTM C231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

1.3 SUBMITTALS

A. Shop Drawings:
   1. Product technical data including:
      a. Concrete materials and concrete mix designs proposed for use.
         1) Include results of all testing performed to qualify materials and to establish mix designs.
         2) Place no concrete until approval of mix designs has been received in writing.
         3) Submittal for each concrete mix design to include:
            (a) Sieve analysis and source of fine and coarse aggregates.
            (b) Test for aggregate organic impurities.
            (c) Proportioning of all materials.
            (d) Type of cement with mill certificate for the cement.
            (e) Brand, quantity and class of fly ash proposed for use along with other submittal data as required for fly ash by Section 03308 (Concrete, Materials and Proportioning).

(f) Slump.
(g) Brand, type and quantity of air entrainment and any other proposed admixtures.
(h) Shrinkage test results.
(i) Total chloride ion content per cubic yard of concrete determined in accordance with AASHTO T260.
(j) 28-day compression test results of at least 10 tests made no longer than 12 months prior to the date of submittal and any other data required by Section 03308 (Concrete, Materials and Proportioning) to establish concrete mix design.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 TESTING SERVICES TO BE PERFORMED BY OWNER

A. The following concrete testing will be performed by the Owner:
1. Concrete strength testing:
a. Secure concrete samples in accordance with ASTM C172.
1) Obtain each sample from a different batch of concrete on a random basis, avoiding selection of test batch other than by a number selected at random before commencement of concrete placement.
b. For each strength test mold and cure four (4) cylinders from each sample in accordance with ASTM C31.
1) Record any deviations from requirements on test report.
2) Cylinder size: Per ASTM C31.
c. Field cure one cylinder for the seven (7) day test.
1) Laboratory cure the remaining.
d. Test cylinders in accordance with ASTM C39.
1) Test two (2) cylinders at 28 days for strength test result and one (1) at seven (7) days for information.
2) Hold remaining cylinder in reserve.
e. Strength test result:
1) Average of strengths of two (2) cylinders from the same sample tested at 28 days.
2) If one (1) cylinder in a test manifests evidence of improper sampling, molding, handling, curing, or testing, discard and test reserve cylinder; average strength of remaining cylinders shall be considered strength test result.
3) Should all cylinders in a test show any of above defects, discard entire test.
f. Frequency of tests:
1) Concrete sand cement grout: One (1) strength test for each 4 HR period of grout placement or fraction thereof.
2) Precast concrete, concrete topping, concrete fill and lean concrete: One (1) strength test for each 10 CY of each type of concrete or fraction thereof placed.
3) All other concrete:
(a) One (1) strength test consisting to be taken not less than once a day, nor less than once for each 60 CY or fraction thereof placed in any one (1) day.
(b) If total volume of concrete on Project is such that frequency of testing required in above paragraph will provide less than five (5) strength tests for

each concrete mix, tests shall then be made from at least five (5) randomly selected batches or from each batch if fewer than five (5) batches are provided.

2. Slump testing:
   a. Determine slump of concrete sample for each strength test.
      1) Determine slump in accordance with ASTM C143.
   b. If consistency of concrete appears to vary, the Owner shall be authorized to require a slump test for each concrete truck.
      1) This practice shall continue until the Owner deems it no longer necessary.
3. Air content testing: Determine air content of concrete sample for each strength test in accordance with either ASTM C231, ASTM C173, or ASTM C138.
4. Temperature testing: Determine temperature of concrete sample for each strength test.
5. In-place concrete testing (if required).

3.2 ACCEPTANCE

A. Completed concrete work which meets applicable requirements will be accepted without qualification.
B. Completed concrete work which fails to meet one or more requirements but which has been repaired to bring it into compliance will be accepted without qualification.
C. Completed concrete work which fails to meet one or more requirements and which cannot be brought into compliance may be accepted or rejected as provided in these Contract Documents.
   1. In this event, modifications may be required to assure that concrete work complies with requirements.
   2. Modifications, as directed by Owner, to be made at no additional cost to Owner.
D. Dimensional Tolerances:
   1. Formed surfaces resulting in concrete outlines smaller than permitted by tolerances shall be considered potentially deficient in strength and subject to modifications required by Owner.
   2. Formed surfaces resulting in concrete outlines larger than permitted by tolerances may be rejected and excess material subject to removal.
      a. If removal of excess material is permitted, accomplish in such a manner as to maintain strength of section and to meet all other applicable requirements of function and appearance.
   3. Concrete members cast in wrong location may be rejected if strength, appearance or function of structure is adversely affected or misplaced items interfere with other construction.
   4. Inaccurately formed concrete surfaces exceeding limits of tolerances and which are exposed to view, may be rejected.
      a. Repair or remove and replace if required.
   5. Finished slabs exceeding tolerances may be required to be repaired provided that strength or appearance is not adversely affected.
      a. High spots may be removed with a grinder, low spots filled with a patching compound, or other remedial measures performed as permitted or required.
E. Appearance:
   1. Concrete surfaces exposed to view with defects which, in opinion of Owner, adversely affect appearance as required by specified finish shall be repaired by approved methods.

2. Concrete not exposed to view is not subject to rejection for defective appearance unless, in the opinion of the Owner, the defects impair the strength or function of the member.

F. High Water-Cement Ratio:
1. Concrete with water in excess of the specified maximum water-cement ratio will be considered potentially deficient in durability.
2. Remove and replace concrete with high water-cement ratio or make other corrections as directed by Owner.

G. Strength of Structure:
1. Strength of structure in place will be considered potentially deficient if it fails to comply with any requirements which control strength of structure, including but not necessarily limited to following:
   a. Low concrete strength:
      1) Test results for standard molded and cured test cylinders to be evaluated separately for each mix design.
         (a) Such evaluation shall be valid only if tests have been conducted in accordance with specified quality standards.
         (b) For evaluation of potential strength and uniformity, each mix design shall be represented by at least three (3) strength tests.
         (c) A strength test shall be the average of two (2) cylinders from the same sample tested at 28 days.
      2) Acceptance:
         (a) Strength level of each specified compressive strength shall be considered satisfactory if both of the following requirements are met:
            (i) Average of all sets of three (3) consecutive strength tests equal or exceed the required specified 28 day compressive strength.
            (ii) No individual strength test falls below the required specified 28 day compressive strength by more than 500 psi.
   b. Reinforcing steel size, configuration, quantity, strength, position, or arrangement at variance with requirements in Section 03208 (Reinforcement) or requirements of the Contract Drawings or approved Shop Drawings.
   c. Concrete which differs from required dimensions or location in such a manner as to reduce strength.
   d. Curing time and procedure not meeting requirements of this Section 03350.
   e. Inadequate protection of concrete from extremes of temperature during early stages of hardening and strength development.
   f. Mechanical injury, construction fires, accidents or premature removal of formwork likely to result in deficient strength.
   g. Concrete defects such as voids, honeycomb, cold joints, spalling, cracking, etc., likely to result in deficient strength or durability.
2. Structural analysis and/or additional testing may be required when strength of structure is considered potentially deficient.
3. In-place testing of concrete may be required when strength of concrete in place is considered potentially deficient.
   a. Testing by impact hammer, sonoscope, or other nondestructive device may be permitted by Owner to determine relative strengths at various locations in the structure or for selecting areas to be cored.
      1) Such tests shall not be used as a basis for acceptance or rejection.
   b. Core tests:

1) Where required, test cores will be obtained in accordance with ASTM C42.
   (a) If concrete in structure will be dry under service conditions, air dry cores (temperature 60 to 80 DegF, relative humidity less than 60 percent) for seven (7) days before test then test dry.
   (b) If concrete in structure will be wet or subjected to high moisture atmosphere under service conditions, test cores after immersion in water for at least 40 HRS and test wet.
   (c) Testing wet or dry to be determined by Owner.
2) Three (3) representative cores may be taken from each member or area of concrete in place that is considered potentially deficient.
   (a) Location of cores shall be determined by Owner so as least to impair strength of structure.
   (b) If, before testing, one (1) or more of cores shows evidence of having been damaged subsequent to or during removal from structure, damaged core shall be replaced.
3) Concrete in area represented by a core test will be considered adequate if average strength of three (3) cores is equal to at least 85 percent of specified strength and no single core is less than 75 percent of specified strength.
4) Fill core holes with nonshrink grout and finish to match surrounding surface when exposed in a finished area.

4. If core tests are inconclusive or impractical to obtain or if structural analysis does not confirm safety of structure, load tests may be required and their results evaluated in accordance with ACI 318, Chapter 20.
5. Correct or replace concrete work judged inadequate by structural analysis or by results of core tests or load tests with additional construction, as directed by Owner, at Contractor's expense.
6. Contractor to pay all costs incurred in providing additional testing and/or structural analysis required.

H. Shrinkage Tests:
1. Drying shrinkage tests shall be performed for the trial batches, the first placement of each class of concrete, and at 1/3 points of the concrete construction schedule during construction or when requested by the Owner (3 times during construction) for concrete or hydraulic structures to ensure continued compliance with these Specifications. Additional shrinkage tests reimbursed by the Contractor may be called for at the sole judgment of the Owner if cracking or other shrinkage related symptoms occur during construction.
2. 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 C 157.
3. The maximum concrete shrinkage for specimens cast in the laboratory from the trial batch, as measured at 21 day drying age or at 28 day drying age shall be 0.034 percent or 0.040 percent, respectively. Standard deviation will not be considered. The Contractor shall only use a mix design for construction that has first met the trial batch shrinkage requirements. Shrinkage limitations apply only to 4500 psi and 4500 psi Super P (superplasticized) structural concrete.
4. The maximum concrete shrinkage for specimens cast in the field and cured for the initial 14 days with the same curing methods used in the field shall not exceed the trial batch maximum shrinkage requirement by more than 20 percent on the initial placement of

each class of concrete. Subsequent shrinkage specimens taken during the construction period as specified shall use the initial placement of each class of concrete shrinkage results as a base line for acceptance. Subsequent shrinkage specimens shall not exceed the base line shrinkage by more than 0.001 percent shrinkage.

5. If the required shrinkage limitation is not met during construction, the Contractor shall take any or all of the following actions to reestablish compliance. These actions may include changing the source of aggregates or the amount of crushed stone rock in the aggregates; changing cement and/or admixtures; use of a shrinkage reducing admixture, reducing water/cement ratio; or other actions designed to minimize shrinkage.

END OF SECTION

SECTION 03371

SHOTCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pneumatically applied concrete.
B. Related Sections:
   1. Section 03208 (Reinforcement).

1.2 REFERENCES

A.	ACI 506.2	Specification for Shotcrete.
B.	ASTM A185/A185M-07	Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
C.	ASTM A497/A479M	Standard Specification for Steel Welded Wire Fabric, Deformed, for concrete Reinforcement.
D.	ASTM C33	Standard Specification for Concrete Aggregates.
E.	ASTM C150	Standard Specification for Portland Cement.
F.	ASTM C260	Standard Specification for Air-Entraining Admixtures for Concrete.
G.	ASTM C330	Standard Specifications for Lightweight Aggregates for Structural Concrete.
H.	ASMT C494/C494M	Standard Specification for Chemical Admixtures for Concrete.

1.3 SUBMITTALS

A. Product Data:
   1. Admixtures, chemical and pozzolanic mineral.
   2. Mix design and test reports.
B. Shop Drawings:
   1. Indicate formwork, dimensions and thickness, tolerances, and contours, reinforcement, and accessories.
C. Tests:
   1. Furnish and pay for independent testing agency to review mix proportions, gradation, and quality of aggregate.
   2. Independent testing agency will test mock-up panels as follows:
      a. Drill 3 IN diameter core samples from test panels.
      b. Test for strength, water absorption, drying and shrinkage, freeze and thaw resistance.
   3. Modify mix design as required based on results of testing and inspection.
   4. Repair core holes after testing, in accordance with ACI 506.2.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Applicator: Company specializing in performing the Work of this section with minimum 5 years documented experience approved by manufacturer.

B. Regulatory Requirements:
   1. Perform Work in accordance with ACI 506.2.
   2. Perform Work in accordance with Owner's standard.
   3. Maintain one copy of each document on site.
C. Mock-Ups:
   1. Construct mock-up of sufficient size to indicate special treatment or finish required.
      a. Test panels: Prior to starting Work construct mockup for evaluation of materials and workmanship.
      b. Construct three mockup test panels fabricated by placing shotcrete onto plywood for each mix design being considered, for each shooting position to be encountered, and for each 500 sq ft of placed shotcrete.
      c. Form panels to identical shotcrete thickness with reinforcement placement.
      d. Remove mockup when directed by Owner.
D. Pre-Installation Meetings:
   1. Convene minimum one week prior to commencing work of this section.

1.5 PROJECT CONDITIONS

A. Project Environmental Requirements:
   1. Maintain material and surrounding air temperature at minimum 50 DegF prior to and during installation, and maintain material at this minimum temperature for 7 days after completion of Work. Furnish equipment and cover to maintain minimum temperature.
   2. Suspend shotcrete operations during high winds, rainy weather, or near freezing temperatures when Work cannot be protected.

1.6 SCHEDULING

A. Coordinate the Work with associated items placed within shotcrete work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cement: ASTM C150, type II; gray color.
B. Aggregate: Normal weight, ASTM C33 3/8 IN maximum size.
C. Air Entraining Admixture: ASTM C260.
D. Chemical Admixture: ASTM C494/C494M.
E. Reinforcing Bars: type A706, size as shown on plan, as specified in Section 03208 (Reinforcement).
F. Water: Clean, potable, and not detrimental to shotcrete.
G. Curing Compound: Not detrimental to application of subsequent surface finish materials.
H. Bonding Agent: Compatible with substrate and subsequent materials.
I. Alignment Wire: Small gage, high strength steel wire.

2.2 SHOTCRETE MIX

A. Furnish wet or dry mix design that gives good compaction and low percentage of rebound, is stiff enough not to sag, and conforms to following requirements:
   1. Compressive strength (28 day minimum): 4,000 psi.
   2. Aggregate size (maximum: 3/8 IN.
   3. Air entrainment: 5.5 to 8 percent/cu yd.
   4. Chemical Admixture: As approved by Owner.
   5. Pozzolanic mineral admixture: As approved by Owner.

6. Slump: plus or minus ½ IN: 1 IN.

B. Maintain quality control records during production of shotcrete; make records available.

PART 3 EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions:
   1. Verify conditions are acceptable and are ready to receive work.
   2. Verify field measurements are as shown on drawings.
   3. Verify fabricated forms are:
      a. Set to line and dimension as indicated on drawings.
      b. Adequately braced against vibration during placement.
      c. Constructed to permit escape of air during gunning operations.
      d. Constructed to minimize rebound during gunning operations.
   4. Ensure correct placement of reinforcement and sufficient clearance exists around reinforcement to permit complete encasement.
   5. Ensure easy access to shotcrete surfaces for screeding and finishing, and to permit uninterrupted application.

3.2 PREPARATION

A. Remove existing unsound concrete from substrate surfaces.
B. Minimize abrupt changes in thickness of repair. Remove square external corners from substrate by radiusing edges.
C. Clean surfaces to receive shotcrete.
D. Determine operating procedures for placement in close quarters, extended distances, or around unusual obstructions where placement velocities and mix consistency may be adjusted during application.
E. Clean and wet cementitious or absorptive substrate surfaces prior to receiving shotcrete. Keep porous surfaces damp for several hours prior to placement of shotcrete. Apply bonding agent.
F. Protect adjacent surfaces not receiving shotcrete.

3.3 FIELD QUALITY CONTROL

A. Construct additional test panels, as specified for mock-up, during course of the work as requested by Owner.

3.4 PROTECTION OF INSTALLED WORK

A. Do not permit applied work to damage adjacent surfaces.

3.5 ALIGNMENT CONTROL

A. Provide alignment wire to establish thickness and plane of required surfaces.
B. Install alignment wire at corners and offsets not established by forms.
C. Tighten alignment wire to establish lines indicated on drawings. Position adjustment devices to permit additional tightening.

3.6 APPLICATION

A. Place reinforcement in accordance with ACI 506.2.
B. Use mixing and delivery equipment capable of thoroughly mixing aggregate, cement, and water in sufficient quantity to maintain continuous and uniform placement.

C. Do not apply shotcrete more than 45 minutes after adding Portland cement to mix.
D. Do not place shotcrete on surfaces that are frozen, spongy, or where there is free water.
E. Achieve maximum compaction with minimum rebound.
F. Build-up to required thickness in multiple passes to achieve layering. Encase reinforcement with first pass.
G. Allow each layer to take initial set before applying succeeding layers.
H. Do not permit applied shotcrete to sag, slough, or displace.
I. After initial set of final layer, remove excess material outside of forms and alignment lines.
J. Sandblast to remove laitance. Clean with broom.
K. Finish surface of final layer with steel trowel finish.
L. Remove rebound material which does not fall clear of work. Discard salvaged rebound.
M. Maintain shotcrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of shotcrete.
N. Immediately after placement, protect shotcrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
O. Maintain surfaces wet for minimum of 7 days.
P. Sound test applied material with hammer for voids. Remove void areas and replace with new shotcrete ensuring full bond with adjacent work.

END OF SECTION

SECTION 03431

PRECAST AND PRESTRESSED CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Segmented block retaining wall
B. Related Sections
   1. Section 03208 (Reinforcement).
   2. Section 03308 (Concrete, Materials and Proportioning).
   3. Section 03350 (Testing).
   4. Section 09905 (Painting and Protective Coatings).

1.2 REFERENCES

A.	ACI 318	Building Code Requirements for Structural Concrete
B.	ASTM A36	Standard Specification for Carbon Structural Steel
C.	ASTM A108	Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
D.	ASTM A496	Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement
E.	ASTM C33	Standard Specification for Concrete Aggregates
F.	ASTM C150	Standard Specification for Portland Cement
G.	ASTM E329	Standard Specification for Agencies Engaged in Construction Inspection and/or Testing
H.	AWS A5.1	Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
I.	AWS A5.5	Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding
J.	AWS D1.1	Structural Welding Code - Steel
K.	AWS D1.4	Structural Welding Code - Reinforcing Steel
L.	PCI MNL 116	Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products
M.	PCI Handbook	Design Handbook - Precast and Prestressed Concrete

1.3 SUBMITTALS

A. Shop Drawings:
   1. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Hardware to be utilized to support suspended appurtenances.
   2. Shop Drawings and erection plans for precast units, their connections and supports showing:
      a. Member size and location.
      b. Size, configuration, location and quantity of reinforcing bars.
      c. Size and location of openings verified by Contractor.
      d. Size, number, and locations of embedded metal items and connections.

e. Required concrete strengths.
f. Identification of each unit using same standard marking numbers as used to mark actual units.

3. Calculations for members and connections designed by fabricator.
   a. Calculations to be sealed by a professional Structural Engineer registered in the State of California.
4. Submit test results, when so required on Drawings, showing that embedded connection items will adequately support the indicated loads.
   a. Connection items to have an ultimate load capacity of at least two (2) times the required indicated load.
5. Concrete mix design(s) including submittal information defined in Section 03350 (Testing).
6. Copies of source quality control tests.
7. Certification of manufacturer's testing facility qualifications.
8. Certification of welding operators and processes.
9. Welding operators and processes to be qualified in accordance with:
   a. AWS D1.1 for welding steel shapes and plates.
   b. AWS D1.4 for welding reinforcing bars.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Provide precast concrete units produced by an active member of PCI.
   2. Assure manufacturer's testing facilities meet requirements of ASTM E329.
   3. Welding operators to have passed qualification tests for type of welding required during the previous 12 months prior to commencement of welding.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Headed studs and deformed bar anchors:
      a. Nelson Stud Welding Div., TRW, Inc.
      b. KSM Division, Omark Industries.
      c. Or Approved Equal.

2.2 MATERIALS

A. Embedded Steel Plates and Shapes: ASTM A36.
B. Cement:
   1. Comply with ASTM C150, Type I, II, or III.
C. Aggregates for Normal Weight Concrete:
   1. ASTM C33 with coarse aggregate meeting the gradation for Size #67 or size #7 as stated in ASTM C33.
   2. All fine aggregate to be natural not manufactured.
D. Water:
   1. Potable, clean.
   2. Free of oils, acids, and organic matter.

E. Maximum total chloride ion content contributed from all ingredients of concrete including water, aggregates, cement and admixtures measured as a weight percent of cement to not exceed 0.06 for prestressed concrete and 0.10 for all other precast concrete.
F. Reinforcing Steel and Welded Wire Reinforcement: See Section 03208 (Reinforcement).
G. Headed Studs:
   1. ASTM A108.
   2. Minimum yield strength: 50,000 psi.
   3. Minimum tensile strength: 60,000 psi.
H. Deformed Bar Anchors:
   1. ASTM A496.
   2. Minimum tensile strength: 80,000 psi.
   3. Minimum yield strength: 70,000 psi.
I. Electrodes:
   1. E70 series conforming to AWS A5.1 or AWS A5.5 for welding steel shapes and plates.
   2. E90 series conforming to AWS A5.5 for welding rebar.

2.3 MIXES

A. See Section 03308 (Concrete, Materials and Proportioning).
B. Do not begin fabrication of units until concrete mix design(s) have been approved by Owner.

2.4 DESIGN

A. General Design Requirements:
   1. Design units and connections in strict accordance with ACI 318 and the PCI Design Handbook - Precast and Prestressed Concrete.
   2. Design units taking into account reduced cross section at openings and penetrations.
   3. Provide all reinforcing in units as indicated.
      a. Where not indicated, design and provide all reinforcing subject to approval of Owner.

2.5 FABRICATION

A. Do not fabricate units until Shop Drawings have been approved by Owner and returned to Contractor.
B. Manufacture, quality, dimensional and erection tolerances of all units to be in accordance with both PCI MNL 116 and PCI Design Handbook - Precast and Prestressed Concrete.
C. Cast all members in smooth rigid forms which will provide straight, true members of uniform thickness and uniform color and finish.
D. Use sand cement grout mixture to fill all air pockets and voids, and to repair chipped edges.
E. Finish all repairs smooth and to match adjacent surface texture and color.
F. Incorporate any required embedded plates, angles, and miscellaneous embedded items into members at time of manufacture.
   1. Cast lifting handles into units at or near support points.
      a. Remove lifting handles after units are erected.
G. Cast openings larger than 6 IN SQ or 6 IN DIA in units at time of manufacture.
   1. Make smaller openings by neat cutting or neat drilling by trades requiring them.
   2. Coordinate sizes and locations of all openings before fabrication of units.
H. Automatically weld headed studs and deformed bar anchors to members to provide full penetration weld between studs, bar anchors and members they are attached to.

I. Weld steel shapes and plates per AWS D1.1 and reinforcing steel per AWS D1.4.
J. Mark each unit as indicated on the erection plans.
   1. Place mark on non-exposed-to-view surface.
K. Fabricate the following types of precast and prestressed units (all units to be made with normal weight concrete unless noted otherwise on Drawings):
   1. Precast junction boxes and precast vaults as shown on Electrical Drawings or as noted in Specification.
   2. Precast utility vaults, precast manholes, and other miscellaneous precast items as shown on Civil Drawings or as noted in Specification.

2.6 SOURCE QUALITY CONTROL

A. During production of precast concrete units, conduct strength tests of concrete placed in units as required in Section 03350 (Testing) for concrete placed during fabrication.
   1. Results of strength tests to be sent immediately to Owner, Contractor and Owner.
   2. Test reports to indicate units they represent.
B. When approved by Owner, strength tests may be made by precast manufacturer after submitting certification that precast manufacturer's testing facilities meet the requirements of ASTM E329.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify acceptability and location of supports to receive units.
   1. Check bearing surfaces to determine that they are level and uniform.
B. Verify compressive strengths of concrete and masonry supports.
   1. Do not start erection of units until supports have reached their 28 day required compressive strengths.

3.2 INSTALLATION

A. Sequence installation to provide a balance of loads across precast elements.
B. Use only erection equipment adequate for placing units at lines and elevations indicated on Drawings.
   1. Do not damage units or existing construction during erection.
   2. Erect units using lifting handles cast into the units.
C. Weld steel shapes and plates per AWS D1.1 and reinforcing steel per AWS D1.4.
D. After all precast units are erected and all precast unit connections have been made, coat all exposed surfaces of the connections with the same prime and finish paint as required on the adjacent precast concrete units.
   1. See Section 09905 (Painting and Protective Coatings).

3.3 FIELD QUALITY CONTROL

A. Causes for rejection of units include, but are not necessarily limited to the following:
   1. Cracked units.
   2. Chipped, broken, or spalled edges.
   3. Units not within allowable casting tolerances.
   4. Voids or air pockets which, in opinion of Owner, are too numerous or too large.
   5. Non-uniform finish or appearance.

6. Low concrete strength.
7. Improperly placed embedded items and/or openings.
8. Exposed wire mesh, reinforcing or prestressing strands.

END OF SECTION

DIVISION 5

METALS

SECTION 05120

STRUCTURAL STEEL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Structural steel, including the fabrication and erection of framing and bracing members, including connections.

B. Related Sections include but are not necessarily limited to:
   1. Section 03151 (Anchorage to Concrete).
   2. Section 03308 (Concrete, Materials and Proportioning)
   3. Section 09905 (Painting and Protective Coatings).

1.2 REFERENCES

A.	AISC 303	Code of Standard Practice for Steel Buildings and Bridges
B.	AISC 360	Specifications for Structural Steel Buildings
C.	AISC Technical Bulletin #3	Shape Material
D.	ASME B18.22.1	Plain Washers
E.	ASTM A2	Standard Specification for Carbon Steel Girder Rails of Plain, Grooved, and Guard Types
F.	ASTM A6	Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
G.	ASTM A36	Standard Specification for Carbon Structural Steel
H.	ASTM A53	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
I.	ASTM A108	Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
J.	ASTM A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
K.	ASTM A307	Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
L.	ASTM A325	Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
M.	ASTM A490	Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
N.	ASTM A496	Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement
O.	ASTM A500	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
P.	ASTM A563	Standard Specification for Carbon and Alloy Steel Nuts
Q.	ASTM A572	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
R.	ASTM A992	Standard Specification for Steel for Structural Shapes
S.	ASTM F436	Standard Specification for Hardened Steel Washers

T. ASTM F959	Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners
U. AWS A5.1	Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
V. AWS A5.5	Specification for Low-Alloy Steel Electrodes for Shielded Metal Arc Welding
W. AWS A5.17	Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding
X. AWS A5.18	Specification for Carbon Steel Electrodes and Rods for Gas Shielded Arc Welding
Y. AWS A5.20	Specification for Carbon Steel Electrodes for Flux Cored Arc Welding
Z. AWS A5.23	Specification for Low-Alloy Steel Electrodes and Fluxes for Submerged Arc Welding
AA.AWS A5.28	Specification for Low-Alloy Steel Electrodes and Rods for Gas Shielded Arc Welding
BB. AWS A5.29	Specification for Low-Alloy Steel Electrodes for Flux Cored Arc Welding
CC.AWS D1.1	Structural Welding Code - Steel (referred herein as AWS Code)
DD.RCSC Specification for Structural Joints	Specification for Structural Joints Using ASTM A325 or A490 Bolts

1.3 DEFINITION

A. Code: IBC 2009, AWS, AISC 325, AISC 360, AISC 303, Code of Standard Practice for Steel Buildings and Bridges.

B. Galvanizing: Hot-dipped galvanizing per ASTM A153 with minimum coating of 2.0 OZ of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by standard.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Fabrication and/or layout drawings:
      a. Prepare Shop Drawings under National Institute of Steel Detailing Quality Procedures Program certification.
      b. Complete Shop Drawings for all of the Work showing clearly all pieces, sizes, dimensions, details, connections materials and shop coatings.
         1) Show all cuts, copes, and holes.
         2) Indicate all shop and field bolts.
         3) Indicate all shop and field welds using AWS symbols.
         4) Design sealed by a professional engineer registered in the State of California.
      c. Prepare complete erection drawings showing the location and marks of all pieces.
         1) Copies of up-to-date erection drawings shall accompany the Shop Drawings.
            (a) Use match marks on the erection drawings to indicate the sheet number on which each particular member is detailed.
      d. Correct any incorrect or unacceptable material or fabrication due to incorrect detailing, shop work, or erection, without additional charge.

2. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
   c. Detailed supplemental specification relating to load indicator washers or high-strength bolts - alternate design (submitted at Contractor's option if desired by Contractor for use).
   d. Source and certification of quality for high-strength bolts, nuts and washers.
3. Certifications:
   a. Certificates of compliance with standards specified for all major components and fasteners incorporated into Work.
   b. Copies of current welding certificates for each welder assigned to perform welding indicating compliance with testing specified by AWS.
   c. Welder qualification data and prequalified procedures.
   d. Steel erector certification for erected structural steel.
4. Test reports:
   a. Certified copies of mill tests.
   b. Manufacturer's load test and temperature sensitivity data for expansion anchor bolts and adhesive anchor bolts.
   c. Welding inspection and test reports.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Steel erector:
      a. With an active and enforced quality assurance program in place, as described in the Building Code.
B. Minimize the amount of field welding.
   1. Shop assemble components into largest size possible commensurate with transportation and handling limitations.
   2. Shop connections: Bolted with high-strength bolts or welded.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle and store steel members above ground on skids or other supports.
   1. Keep free of dirt and other foreign material and protect against corrosion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. High-strength bolts:
      a. Bethlehem Steel Corporation.
      b. Lewis Bolt & Nut Company.
      c. Nucor Fasteners.
      d. St. Louis Screw and Bolt Company.
      e. Or Approved Equal.

2. Load indicator washers for high-strength bolts:
   a. Bethlehem Steel Corporation.
   b. Mid-South Bolt and Screw Co., Inc.
   c. J and M Turner, Inc.
   d. Or Approved Equal.
3. Alternate design high-strength bolts:
   a. T. C. Bolt Corporation.
   b. Construction Fastener Systems Division of Bristol Machine Company.
   c. LeJuene Bolt Co.
   d. Or Approved Equal.
4. Headed studs and deformed bar anchors:
   a. Nelson Stud Welding Division, TRW, Inc.
   b. Stud Welding Products, Inc.
   c. Or Approved Equal.
5. Expansion anchor bolts: See Section 03151 (Anchorage to Concrete).
6. Adhesive anchors bolts: See Section 03151 (Anchorage to Concrete).
7. Anchor bolt sleeves:
   a. Sinco/Wilson.
   b. Or Approved Equal.

2.2 MATERIALS

A. Steel, Structural Shapes and Plate (unless noted otherwise on Drawings):
   1. All W-shapes and WT-shapes: ASTM A992, Grade 50.
      a. Provide ASTM A992, Grade 50.
      b. ASTM A572, Grade 50 with special requirements per AISC Technical Bulletin #3, may be used in lieu of ASTM A992, Grade 50.
   2. All other plates and rolled shapes: ASTM A36.
B. Plate and Bar: ASTM A36.
C. Pipe: ASTM A53, Grade B (Type E or S) (Fy=35).
D. Hollow Structural Sections (HSS):
   1. Round: ASTM A500, Grade B (Fy=42).
   2. Square or rectangular: ASTM A500, Grade B (Fy=46).
E. High-Strength Bolts, Nuts and Washers, ASTM A325 with ASTM A563 nuts galvanized:
   1. High-strength bolts:
      a. Provide two (2) ASTM F436 washers for all bolts.
      b. Provide beveled washers at connections of sloped/tapered sections.
   2. High-strength bolts with load indicating devices, ASTM F959, Type 325.
      a. Provide at Contractor's option and subject to approval of Owner.
   3. Alternate high-strength design:
      a. Provide at Contractor's option and subject to approval of Owner.
F. Bolts and Nuts, Unfinished: ASTM A307, Grade A.
G. Washers, Plain (Unfinished Bolts): ASME B18.22.1, Type B.
H. Welding Electrodes (AWS):
   1. Shielded metal arc: AWS A5.1 or AWS A5.5, E70XX or E801X-X.
   2. Submerged arc: AWS A5.17 or AWS A5.23, F7XX-EXXX or F8XX-EXXX-XX.
   3. Gas metal arc: AWS A5.18, E70S-X or E70U-1 or AWS A5.28, ER805-XX, E80C-XXX.
   4. Flux cored arc: AWS A5.20, E7XT-X (except 2, 3, 10, GS), AWS A5.29, E7XT-X or E8XTX-X, E8XTX-XM.

I. Anchor Rods and Bolts:
   1. See Section 03151 (Anchorage to Concrete).
J. Headed Studs and Deformed Bar Anchors:
   1. Studs: ASTM A108, complying with AWS Code Section 7, Type B; minimum yield strength 50,000 psi, minimum tensile strength 60,000 psi.
      a. Uniform diameter.
      b. Heads: Concentric and normal to shaft.
      c. Weld end: Chamfered and solid flux.
   2. Deformed anchor bars:
      a. ASTM A496, complying with AWS Code Section 7 Type C.
      b. Minimum yield strength: 70,000 psi.
      c. Minimum tensile strength: 80,000 psi.
      d. Straight, unless indicated otherwise.
      e. Solid flux.
   3. After welding, remove ceramic ferrules and maintain free from any substance which would interfere with function, or prevent bonding to concrete.
K. Nonshrink Grout: See Section 03308 (Concrete, Materials and Proportioning).
L. Crane Rails:
   1. Controlled-cooled, open-hearth carbon steel ASCE rails per ASTM A2, Class A, #1 rails, unless noted otherwise, of size and weight indicated.
   2. Furnish rails with milled tight end joints suitable for crane service, with standard drilling, removable end stops and all related accessories required, including:
      a. Joint bars: Match rail section and properties, drilled to match rail drilling.
      b. Joint bar bolts and nuts: High strength.
      c. Hardened washer: ASTM F436 for bar bolts.
      d. Except as indicated otherwise, two-bolt type fixed or floating rail clamps to suit the conditions, of forged or pressed steel, complete with ASTM A325 bolts, reversible fillers, and self-locking nut or nut and lock washer.
M. Expansion Anchor Bolts and Adhesive Anchor Bolts for Fastening to Concrete:
   1. See Section 03151 (Anchorage to Concrete).

2.3 FABRICATION

A. Comply with requirements of applicable Building Codes and AISC 360 with modifications and additional requirements specified herein.
   1. Identify high-strength steel material in fabricated members in accordance with ASTM A6.
B. Connection Details:
   1. Connections not fully detailed on Drawings shall be designed by a Professional Engineer registered in the State of California.
C. Provide as a minimum, two (2) 3/4 IN DIA, high-strength bolts for all bolted connections.
D. Provide bearing type connections for all bolted connections, unless specified otherwise or required to be slip-critical by the RCSC Specification for Structural Joints.
E. One-sided or other types of eccentric connections not indicated will not be permitted without prior approval.
F. Field Connections: Provide bolts for all field connections except where shown otherwise on the Drawings.
   1. Use high-strength bolts unless shown or specified otherwise.
   2. Use of high-strength bolts: Conform to RCSC Specification for Structural Joints.

3. Stainless steel bolts must be used for attaching stair treads to stringers.
4. If structural steel details (field welds versus shop welds, etc.) shown on design Drawings are not compatible with selected erection procedures, submit proposed modifications for review.
5. Connections to structural steel provided by others: Provide all connectors and coordinate location of bolt holes to match connection holes in steel provided by others.

G. Accurately mill column end bearing surfaces to true plane.
H. Fabricate and erect beams with non-specified camber in accordance with AISC Specification Chapter L1.
I. Cut, drill, or punch holes at right angles to surface of metal.
   1. Do not make or enlarge holes by burning.
   2. Make holes clean cut, without torn or ragged edges.
   3. Remove outside burrs resulting from drilling or reaming operations with tool making 1/16 IN bevel.
   4. Provide holes in members to permit connection of Work of other trades or contractors.
J. Make allowance for draw in all cross bracing to provide small amount of initial tension in members.
K. Make splices only where indicated or where approved.
L. Cope at 45 degrees, corners of stiffener plates at junction of member flanges with webs.
M. Flame cut bevels for welds, provided such cutting is done automatically.
   1. Leave free of burrs and slag by grinding or planing the cut edges.
N. Grind smooth all rough welds and sharp steel edges shall be ground to approximately 1/8 IN radius.
O. Tolerances (unless noted otherwise on Drawings):
   1. ASTM A6: When material received from the mill does not satisfy ASTM A6 tolerances for camber, profile, flatness or sweep, the Contractor is permitted to perform corrective Work by the use of controlled heating, and mechanical straightening, subject to the limitations of the AISC Specification.
   2. Fabrication tolerance:
      a. Member length:
         1) Both ends finished for contact bearing: 1/32 IN.
         2) Framed members 30 FT or less: 1/16 IN. Over 30 FT: 1/8 IN.
      b. Member straightness:
         1) Compression members: 1/1000 of axial length between points laterally supported.
         2) Non-compression members: ASTM A6 tolerance for wide flange shapes.
      c. Specified member camber (except compression members):
         1) 50 FT or less: +1/2 IN.
         2) Over 50 FT: +1/2 IN (plus 1/8 IN per 10 FT over 50 FT).
         3) Members received from mill with 75 percent of specified camber require no further cambering.
         4) Beams/trusses without specified camber shall be fabricated so after erection, camber is upward.
         5) Camber shall be measured in fabrication shop in unstressed condition.
      d. At bolted splices, depth deviation shall be taken up by filler plates.
         1) At welded joints, adjust weld profile to conform to variation in depth.
         2) Slope weld surface per AWS requirements.
      e. Finished members shall be free from twists, bends and open joints.

1) Sharp kinks, bends and deviation from the above tolerances are cause for rejection of material.

2.4 WELDING

A. Comply with AWS Code, and other requirements indicated herein, for all welding, techniques of welding employed, appearance and quality of welds, and methods used to correct defective Work.
   1. Qualify joint welding procedures or test in accordance with AWS qualification procedures.
B. Quality welding procedures and welding operators in accordance with AWS.
C. Before Starting Welding:
   1. Carefully plumb and align members in compliance with specified requirements.
   2. Fully tighten bolts.
   3. Comply with Section 5 of AWS Code for assembly and surface preparation.
   4. Preheat base metal to temperature stated in AWS Code.
      a. When no preheat temperature is given in AWS Code and base metal is below 50 DegF, preheat base metal to at least 70 DegF.
      b. Maintain temperature during welding.
      c. Preheat surface of all base metal within distance from point of welding equal to thickness of thicker part being welded or 3 IN, whichever is greater, to specified preheat temperature.
      d. Maintain this temperature during welding.
   5. Each welder shall use identifying mark at welds.
D. Make flange welds before making web welds.
E. Where groove welds have back-up plates, make first three (3) passes with 1/8 IN round electrodes.
   1. Use backup plates in accordance with AWS Code, extending minimum of 1 IN either side of joint.
F. Flame cut edges of stiffener plates at shop or field butt weld.
   1. Do not shear.
G. Grind flush web fillets at webs notched to receive backup plates for flange groove welds.
H. Low Hydrogen Electrodes: Dry and store electrodes in compliance with AWS Code.
I. Do not perform welding when ambient temperature is lower than 0 DegF or where surfaces are wet or exposed to rain, snow, or high wind, or when welders are exposed to inclement conditions.
J. Headed Studs and Deformed Bar Anchors:
   1. Automatically end welded in accordance with the AWS Code and manufacturer's recommendations.
   2. Fillet welding of headed studs and deformed bar anchors is not allowed unless approved by Owner.
K. Test in-place studs in accordance with requirements of AWS Code to ensure satisfactory welding of studs to members.
   1. Replace studs failing this test.
L. When headed stud-type shear connectors are to be applied, clean top surface of members to receive studs in shop to remove oil, scale, rust, dirt, and other materials injurious to satisfactory welding.
   1. Do not shop paint or galvanize metal surfaces to receive field applied studs.

2.5 SHOP COATING

A. Refer to Section 09905 (Painting and Protective Coatings) and coordinate shop primer, surface preparation and coating with field applied primers and coatings where specified.
B. Provide suitable methods of handling and transporting painted steel to avoid damage to coating.
C. Do not coat following surfaces:
   1. Machined surfaces, surfaces adjacent to field welds, and surfaces fully embedded in concrete.
   2. All other members for which no coating is specified.
   3. Contact surfaces at bolted slip-critical connections, unless surface condition conforms to the RCSC Specification for Structural Joints, Part 3b.
D. Clean thoroughly all surfaces not coated before shipping.
   1. Remove loose mill scale, rust, dirt, oil and grease.
   2. Protect machined surfaces.

2.6 SOURCE QUALITY CONTROL

A. Responsibilities of Contractor's Testing Agency. Contractor is responsible for inspection and testing requirements specified below:
   1. Inspect shop and field welding in accordance with AWS Code Section 6 including the following non-destructive testing:
      a. Visually inspect all welds.
      b. In addition to visual inspection, test 50 percent of full penetration welds and 20 percent of fillet welds with liquid dye penetrant.
      c. Test 20 percent of liquid dye penetrant tested full penetration welds with ultrasonic or radiographic testing.
   2. Inspect high-strength bolting in accordance with the RCSC Specification for Structural Joints, Section 9.
      a. Verify proper pretension for slip-critical bolted connection.
      b. Verify direct tension indicator gaps.
   3. Inspect structural steel which has been erected.
   4. Inspect stud welding in accordance with AWS Code Section 7.8.
   5. Contractor's Testing Agency shall prepare and submit inspection and test reports to Contractor and Owner.
      a. Contractor must assist Owner to determine corrective measures necessary for Defective Work.

PART 3 EXECUTION

3.1 GENERAL

A. Contractor is solely responsible for safety.
   1. Construction means and methods and sequencing of Work is the prerogative of the Contractor.
      a. Take into consideration that full structural capacity of many structural members is not realized until structural assembly is complete; e.g., until slabs, decks, bracing or rigid connections are installed.
   2. Partially complete structural members shall not be loaded without an investigation by the Contractor.

3. Until all elements of the permanent structure and lateral bracing system are complete, provide temporary bracing designed, furnished, and installed by the Contractor for the partially complete structure.

B. Adequate temporary bracing to provide safety, stability and to resist all loads to which the partially complete structure may be subjected, including wind, construction activities, and operation of equipment is the responsibility of the Contractor.
   1. Use temporary guys, braces, shoring, connections, etc., necessary to maintain the structural framing plumb and in proper alignment until permanent connections are made, the succeeding Work is in place, and temporary Work is no longer necessary.
   2. Use temporary guys, bracing, shoring, and other Work to prevent injury or damage to adjacent Work or construction from stresses due to erection procedures and operation of erection equipment, construction loads, and wind.
   3. Contractor shall be responsible for the design of the temporary bracing system and must consider the sequence and schedule of placement of such elements and effects of loads imposed on the structural steel members by partially or completely installed Work, including Work of all other trades.
      a. If not obvious from experience or from the Drawings, the Contractor shall confer with the Owner to identify those structural steel element that must be complete before the temporary bracing system is removed.
   4. Remove and dispose of all temporary Work and facilities off-Site.

C. Examine Work-in-place on which specified Work is in any way dependent to ensure that conditions are satisfactory for the installation of the Work.
   1. Report defects in Work-in-place which may influence satisfactory completion of the Work.
   2. Absence of such notification will be construed as acceptance of Work-in-place.

D. Field Measurement:
   1. Take field measurements as necessary to verify or supplement dimensions indicated on the Drawings.
   2. Contractor responsible for the accurate fit of the Work.

E. Check the elevations of all finished footings or foundations and the location and alignment of all anchor bolts before starting erection.
   1. Notify Owner of any errors or deviations found by such checking.

3.2 ERECTION

A. Framing member location tolerances after erection shall not exceed the frame tolerances listed in Article 3.3 of this Section 05120.

B. Erect plumb and level; introduce temporary bracing required to support erection loads.

C. Use light drifting necessary to draw holes together.
   1. Drifting to match unfair holes is not allowed.

D. Welding:
   1. Conform to AWS D1.1 and requirements of this Section 05120.
   2. When joining two (2) sections of steel of different ASTM designations, welding techniques shall be in accordance with a qualified AWS D1.1 procedure.

E. Shore existing members when unbolting of common connections is required.
   1. Use new bolts for rebolting connections.

F. Clean stored material of all foreign matter accumulated during erection period.

G. Clean bearing and contact surfaces before assembly.

H. Set beam and column base and bearing plates accurately, as indicated, on non-shrink grout.

1. Set and anchor each base plate to proper line and elevation.
2. Use metal wedges, shims or setting nuts as required and tighten anchor bolts.
   a. Use same metal as base plate.
   b. Cut off protrusions of wedges and shims flush with edge of base plate.
3. Fill sleeves around anchor bolts with nonshrink grout.
4. Pack grout solidly between bottom of plate and bearing surface.
5. Refer to Section 03308 (Concrete, Materials and Proportioning) for non-shrink grout requirements.

I. Anchor Bolts:
   1. See Section 03151 (Anchorage to Concrete).

J. Install high strength bolts with hardened washers.
   1. Install and tighten in accordance with the RCSC Specification for Structural Joints, Section 8.
   2. Coordinate installation with inspection.
      a. Do not start installation until coordination with Testing Agency is complete.
   3. Bearing-type connections: High-strength bolts shall be tightened to snug-tight condition.
   4. Slip-critical connections: Perform calibration testing for all methods of installation of high-strength bolts in accordance with the RCSC Specification for Structural Joints, Section 8(b).
      a. Turn-of-nut tightening: Torque wrenches shall be used only by laboratory personnel.
      b. Calibrated wrench tightening: Calibrate on a daily basis.
      c. Direct tension indicator tightening: If previously approved by Owner.
      d. Installation of alternate design bolts: If previously approved by Owner.
   5. In the event any bolt in a connection is found to be defective, check and retighten all bolts in the connection.

K. Do not use gas cutting to correct fabrication errors.
   1. In case members do not fit or holes do not match, ream out the holes and insert the next larger size bolt.
      a. If the connections require new holes, then drill new holes.
      b. Make no such corrections without prior approval of the Owner.
   2. Burning of holes: Not permitted.

L. Prior to making field connections to existing structural steel, remove completely all paint from existing steel which will be in contact with new steel and new welds.

M. Tighten and leave in place erection bolts used in welded construction.

N. Provide beveled washers to give full bearing to bolt head or nut where bolts are to be used on surfaces having slopes greater than 1 in 20 with a plane normal to bolt axis.

O. After bolts are tightened, upset threads of ASTM A307 unfinished bolts and anchor bolts to prevent nuts from backing off.

P. After erection, grind smooth all sharp surface irregularities resulting from field cutting or welding; power tool clean welds, bolts, washers and abrasions to shop coat removing all rust and foreign matter.

Q. Expansion anchor bolts and adhesive anchor bolts:
   1. See Section 03151 (Anchorage to Concrete).

3.3 FIELD QUALITY CONTROL

A. Testing Agency responsibilities are described in Article 2.6 of this Section 05120.

B. Erected Frame Tolerance (Unless noted otherwise on the Drawings):
   1. Overall finished dimensions shall not exceed cumulative effect of rolling, fabrication and erection tolerance.
   2. Erection tolerances are defined relative to member working points and working lines as follows:
      a. Actual centerline of top flange or surface at each end for horizontal members.
      b. Actual center of member at each end for all other members.
      c. Other points may be used, providing they are based on these definitions.
      d. Working line is straight line connecting member working points.
   3. Tolerances on position and alignment are as specified in the Code of Standard Practice for Steel Buildings and Bridges, unless otherwise modified. "Adjustable items" such as lintels, wall supports, curb angles, window mullions and similar members shall be provided with adjustable connections to supporting structural frame.
   4. Steel erector shall certify the location of erected structural steel is acceptable for plumbness, level and aligned within tolerances specified.
      a. Such certification can be provided upon completion of any part of Work and shall be done prior to start of Work by other trades that may be supported, attached or applied to structural steel Work.

3.4 CLEANING AND REPAIR OF SHOP PRIMER PAINT

A. After erection, clean all steel of mud or other foreign materials, and repair any damage.
   1. Touchup coatings to comply with Section 09905 (Painting and Protective Coatings).

END OF SECTION

SECTION 05131

STRUCTURAL ALUMINUM

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Structural aluminum including the fabrication and erection of stairs, framing and bracing members, including connection design as required.

B. Related Sections:
   1. Section 03151 (Anchorage to Concrete).
   2. Section 09905 (Painting and Protective Coatings).

1.2 REFERENCES

A.	AA ADM 1	The Aluminum Design Manual
B.	AA DAF 45	Designation System for Aluminum Finishes
C.	AISC 325	Manual of Steel Construction
D.	ASTM B209	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
E.	ASTM B210	Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes
F.	ASTM B221	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
G.	ASTM B247	Standard Specification for Aluminum and aluminum-Alloy die forgings, Hand Forgings, and Rolled Ring Forgings
H.	ASTM B308	Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
I.	ASTM B429	Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
J.	ASTM F467	Standard Specification for Nonferrous Nuts for General Use
K.	ASTM F468	Standard Specification for Nonferrous bolts, Hex Cap Screws, and Studs for General Use
L.	ASTM F593	Standard Specification for Stainless Steel bolts, Hex Cap Screws, and Studs.
M.	ASTM F594	Standard Specification for Stainless Steel Nuts
N.	AWS D1.2	Structural Welding Code – Aluminum

1.3 SUBMITTALS

A. Product Data:
   1. Acknowledgement that products submitted meet requirements of standards referenced.
   2. Manufacturer's installation instructions.

B. Shop Drawings:
   1. Fabrication and/or layout drawings:
      a. Erection plans and details of each piece including connection details:
         1) Show all cuts, copes and holes.
         2) Indicate all shop and field welds using AWS symbols.
         3) Indicate all shop and field bolts.

4) Reviewed and sealed by Professional Engineer registered in the State of California.
b. Complete shop drawings for all of the Work showing clearly all pieces, details, connections, materials and shop-applied coatings.
c. Prepare complete erection drawings showing the location and marks of all pieces.

C. Quality Assurance/Control Submittals:
1. Test Reports:
a. Certified copies of mill tests.
b. Manufacturer's load test and temperature sensitivity data for expansion anchor bolt and adhesive anchor bolts.
2. Certificates:
a. Certificates of compliance with standards specified for all major components and fasteners incorporated into work.
b. Copies of current welding certificates for each welder assigned to perform welding indicating compliance with testing specified by AWS.

1.4 QUALITY ASSURANCE

A. Qualifications:
1. For welding aluminum:
a. Qualify welding procedures and welding operators in accordance with AWS D1.2.
b. Welding operators to have been qualified during the 12-month period prior to commencement of welding.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Expansion anchor bolts: See Section 03151 (Anchorage to Concrete).
2. Adhesive anchor bolts: See Section 03151 (Anchorage to Concrete).

2.2 MATERIALS

A. Alloy 6061-T6, 32,000 psi tensile yield strength minimum.
1. ASTM B209 for sheets and plates.
2. ASTM B210 for tubes.
3. ASTM B221 and ASTM B308 for shapes: Beams, channels, and angles.
4. ASTM B247 for forgings.

B. Alloy 6063-T5 or T6, 15,000 psi tensile yield strength minimum.
1. ASTM B221 and ASTM B429 for bars, rods, wires, pipes, and tubes.

C. Nonferrous Bolts and Nuts: ASTM F467 and ASTM F468 of alloy 2024-T4 (60,000 psi tensile strength minimum).

D. Stainless Steel Bolts and Nuts : ASTM F593 and ASTM F594, Type 316 with a minimum yield strength of 30,000 psi and a minimum tensile strength of 75,000 psi.

E. Washers: Same material and alloy as found in bolts and nuts with which the washers are to be used.

F. Electrodes for Welding Aluminum: AWS D1.2 filler alloy 5356.

G. Expansion and Adhesive Anchor Bolts for Fastening to Concrete:
1. Where approved by Owner.

2. Stainless steel, Type 316.
3. See Section 03151 (Anchorage to Concrete).

2.3 FABRICATION

A. Fabrication of bolted and welded connections of aluminum work shall be in accordance with AA ADM 1.
B. Contractor to be solely responsible for correctness of all shop and field fabrication and fit. Verify field conditions and dimensions prior to fabrication.
C. Fabricate aluminum work and assemble in shop to greatest extent possible.
   1. Make splices only where indicated or approved by Owner.
D. Provide connections as indicated.
   1. Where not indicated, design and provide connections in accordance with requirements of this Section.
   2. One-sided or other types of eccentric connections are not acceptable unless indicated on Contract Drawings or approved on Shop Drawings.
E. Drill or punch holes at right angles to surface of metal.
   1. Do not make or enlarge holes by burning.
   2. Provide holes clean and free of torn or ragged edges.
   3. Use tools which will make a 1/16 IN bevel to remove outside burrs resulting from drilling or punching operations.
   4. Punch or drill for field connections and for attachment of work by other trades.
F. Cope at 45 degrees corners of stiffener plates at junction of member flanges with webs.
G. Welding:
   1. Weld connections to members in shop and bolt connections in field.
   2. Perform welding using electrodes of filler alloy 5356.
   3. Perform welding in accordance with AWS D1.2.
H. All full penetration welds shall be non-destructively tested by liquid penetrant or ultrasonic methods per AWS standards.
I. Form to shapes indicated with straight lines, true angles and smooth curves.
   1. Grind smooth all rough welds and sharp edges.
   2. Round all corners to approximately 1/8 IN radius.
J. Finish: Mill finish as fabricated.
   1. Architectural Class 1 coating per AA DAF 45:
      a. Clear anodized AA-M12C22A413.

2.4 DESIGN

A. All design shall consider effect of welds on material properties.
   1. Minimize or eliminate the use of field welding.
   2. Observe locations of any specified shop splice welds.
B. Where final design of connections for any portion of structure is not indicated, perform final design of such connections in accordance with the Building Code.
C. Final designs of connections shall conform to AA ADM 1 and to details and requirements stated in the Contract Documents.
   1. Design loads for connections to be designed by the Contractor shall be as shown on the Drawings.
   2. Where design loads are not specified, connections shall be detailed to develop the full capacity of the member.

PART 3 EXECUTION

3.1 ERECTION

A. Contractor is solely responsible for safety.
   1. Construction means and methods and sequencing of work is prerogative of the Contractor.
   2. Take into consideration that full structural capacity of many structural members is not realized until structural assembly is complete; e.g., until decks and diagonal bracing or rigid moment-type connections are installed.
   3. Partially complete structural members shall not be loaded without an investigation by the Contractor.
   4. Until all elements of the permanent structure and lateral bracing system are complete, provide temporary bracing designed, furnished and installed by the Contractor.

B. Bolting:
   1. Protect bolt threads from damage.
   2. Rest bolt heads and nuts squarely against surfaces.
   3. Where bolt heads or nuts rest on beveled surfaces having slope greater that 1 in 20 with plane normal to bolt axis, use beveled washers to provide full bearing to head and nut.
   4. Correct poor matching of holes by drilling to next larger size and use larger diameter bolt
   5. Unless otherwise specified, connect aluminum members to:
      a. Aluminum members using 3/4 IN DIA nonferrous bolts of alloy 2024-T4 or stainless steel bolts (ASTM F593 and ASTM F594).
      b. Carbon and low alloy steel using 3/4 IN DIA stainless steel bolts (ASTM F593 and ASTM F594).
      c. Concrete or masonry using stainless steel expansion anchor bolts or adhesive anchor bolts unless shown otherwise.
         1) Provide dissimilar materials protection.

C. Welding: Field welding of aluminum is not allowed unless indicated on Drawings.

D. Correct fabrication errors and damaged members in shop.
   1. Do not use cutting torch in shop or in field to cut any members, to correct fabrication errors, or to cut openings.

E. Provide templates for anchors, bolts, and other items to be installed in other work.

F. Field Assembly:
   1. Tolerances shall comply with AISC 325.
      a. Before members are assembled, thoroughly clean all bearing surfaces and surfaces that will be in permanent contact.
      b. After assembly, carefully align all members of each frame or assembly and accurately adjust until final, correct and true location is achieved.
         1) As work progresses, securely fasten in place.
   2. Provide full length members without splices.
   3. Securely tighten and leave in place all erection bolts used in welded construction, unless removal is required.

G. Set beam and column baseplates accurately, as indicated, on non-shrink grout, in accordance with Section 03311 (Concrete Mixing, Placing, Jointing, and Curing).
   1. If not indicated, provide minimum of 1 IN grout thickness under base plates.
   2. Set and anchor each base plate to proper line and elevation.

a. Use aluminum wedges, shims, or setting nuts for leveling and plumbing columns and beams.
   1) Tighten anchor bolts.
b. Fill space between bearing surface and bottom of base plate with non-shrink grout.
   1) Fill space until voids are completely filled and base plates are fully bedded on wedges, shims, and grout.
c. Do not remove wedges or shims and where they protrude, cut off flush with edge of base plate.

H. Temporary Protection:
   1. Suitably protect aluminum surfaces against lime mortar stains, discoloration, surface abrasion and other construction abuses.

I. Contact with Dissimilar Materials: Where aluminum surfaces will be embedded in concrete, built into masonry, or in contact with steel, concrete, grout, masonry, or other dissimilar materials, coat the aluminum surfaces as described in Section 09905 (Painting and Protective Coatings).

END OF SECTION

SECTION 05500

METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Custom fabricated metal items and certain manufactured units not otherwise indicated to be supplied under work of other Specification Sections.
   2. Design of all temporary bracing not indicated on Drawings.

B. Related Sections:
   1. Division 03 (Concrete).
   2. Section 03151 (Anchorage to Concrete).
   3. Section 03308 (Concrete, Materials and Proportioning).
   4. Section 05120 (Structural Steel).
   5. Section 05522 (Aluminum Railing).
   6. Section 05525 (Steel Railing).
   7. Section 09905 (Painting and Protective Coatings).

1.2 REFERENCES

A. AISC 360	Specifications for Structural Steel Buildings
B. ANSI A14.3	Ladders - Fixed - Safety Requirements
C. ASTM A6	Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
D. ASTM A36	Standard Specification for Carbon Structural Steel
E. ASTM A47	Standard Specification for Ferritic Malleable Iron Castings
F. ASTM A48	Standard Specification for Gray Iron Castings
G. ASTM A53	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
H. ASTM A108	Standard Specification for Steel Bars, Carbon and Alloy, Cold Finished
I. ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
J. ASTM A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
K. ASTM A197	Standard Specification for Cupola Malleable Iron
L. ASTM A269	Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
M. ASTM A276	Standard Specification for Stainless Steel Bars and Shapes
N. ASTM A307	Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
O. ASTM A312	Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
P. ASTM A325	Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
Q. ASTM A496	Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement

R. ASTM A500	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
S. ASTM A501	Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
T. ASTM A536	Standard Specification for Ductile Iron Castings
U. ASTM A554	Standard Specification for Welded Stainless Steel Mechanical Tubing
V. ASTM A666	Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
W. ASTM A668	Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use
X. ASTM A780	Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
Y. ASTM A992	Standard Specification for Steel for Structural Shapes
Z. ASTM B26	Standard Specification for Aluminum-Alloy Sand Castings
AA.ASTM B221	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
BB. ASTM B308	Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
CC.ASTM B429	Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
DD.ASTM B632	Standard Specification for Aluminum-Alloy Rolled Tread Plate
EE. ASTM C478	Standard Specification for Precast Reinforced Concrete Manhole Sections
FF. ASTM F467	Standard Specification for Nonferrous Nuts for General Use
GG.ASTM F468	Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use
HH.ASTM F593	Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
II. AWS A5.1	Standard Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding
JJ. AWS D1.1	Structural Welding Code Steel
KK.AWS D1.2	Structural Welding Code Aluminum
LL. NAAMM AMP 510	Metal Stairs Manual
MM.NAAMM MBG 531	Metal Bar Grating Manual

1.3 DEFINITIONS

A. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Site.
   2. Installer and applicator are synonymous.

B. Hardware: As defined in ASTM A153.

C. Galvanizing: Hot-dip galvanizing per ASTM A123 or ASTM A153 with minimum coating of 2.0 OZ of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by standard.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Fabrication and/or layout drawings and details:
      a. Submit drawings for all fabrications and assemblies.
         1) Include erection drawings, plans, sections, details and connection details.
      b. Identify materials of construction, shop coatings and third party accessories.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Provide manufacturer's standard allowable load tables for the following:
         1) Grating and checkered plate.
         2) Expansion anchor bolts.
         3) Adhesive anchor bolts.
         4) Castings, trench covers and accessories.
   3. Contractor designed systems and components, including but not limited to, stairs, landings, ladders, gratings and checkered plates:
      a. Certification that manufactured units meet all design loads specified.
      b. Shop Drawings:
         1) Sealed by a Professional Engineer registered in the State of California.
      c. Structural design calculations:
         1) Indicate all required design loads.
         2) Sealed by a Professional Engineer registered in the State of California.
            (a) Calculations to be for information only.
   4. Certification of welders and welding processes.
      a. Indicate compliance with AWS.
   5. Samples:
      a. Provide a sample of abrasive stair nosing.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Qualify welding procedures and welding operators in accordance with AWS.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and handle fabrications to avoid damage.
B. Store above ground on skids or other supports to keep items free of dirt and other foreign debris and to protect against corrosion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Abrasive stair nosings (embedded in concrete stairs):
      a. American Safety Tread.
      b. Balco.
      c. Or Approved Equal.

2. Headed studs and deformed bar anchors:
   a. Nelson Stud Welding Div., TRW Inc.
   b. Stud Welding Products, Inc.
   c. Or Approved Equal.
3. Expansion anchor bolts:
   a. See Section 03151 (Anchorage to Concrete).
4. Adhesive anchor bolts:
   a. See Section 03151 (Anchorage to Concrete).
5. Castings, trench covers and accessories:
   a. Neenah Foundry Co.
   b. Deeter Foundry Co.
   c. Barry Craft Construction Casting Co.
   d. McKinley Iron Works.
   e. Or Approved Equal.
6. Manhole steps:
   a. Neenah Foundry.
   b. Or Approved Equal.
7. Galvanizing repair paint:
   a. ZRC Products.
   b. Or Approved Equal.
8. Ladder safety extension post:
   a. Bilco.
   b. Or Approved Equal.

2.2 MATERIALS

A. Steel:
   1. Structural:
      a. W-shapes and WT-shapes: ASTM A992, Grade 50.
      b. All other plates and rolled sections: ASTM A36.
   2. Pipe: ASTM A53, Types E or S, Grade B or ASTM A501.
   3. Structural tubing:
      a. ASTM A500, Grade B (46 ksi minimum yield).
   4. Bolts, nuts and washers, high strength:
      a. ASTM A325.
      b. Provide two (2) washers with all bolts.
   5. Bolts and nuts:
      a. ASTM A307, Grade A.
   6. Welding electrodes: AWS D1.1, E70 Series.
   7. Steel forgings: ASTM A668.
B. Iron:
   1. Ductile iron: ASTM A536.
   2. Gray cast iron: ASTM A48 (minimum 30,000 psi tensile strength).
   3. Malleable iron: ASTM A47, ASTM A197.
C. Stainless Steel:
   1. Minimum yield strength of 30,000 psi and minimum tensile strength of 75,000 psi.
      a. Bars, shapes: ASTM A276, Type 316.
      b. Tubing and pipe: ASTM A269, ASTM A312 or ASTM A554, Type 304 or 316.
      c. Strip, plate and flat bars: ASTM A666, Type 304 or 316, Grade A.

d. Bolts and nuts: ASTM F593, Type 316.
2. Minimum yield strength of 25,000 psi and minimum tensile strength of 70,000 psi.
a. Strip, plate and flat bar for welded connections, ASTM A666, Type 316L.
3. Welding electrodes: In accordance with AWS for metal alloy being welded.

D. Aluminum:
1. Alloy 6061-T6, 32,000 psi tensile yield strength minimum.
a. ASTM B221 and ASTM B308 for shapes including beams, channels, angles, tees and zees.
2. Alloy 6063-T5 or T6, 15,000 psi tensile yield strength minimum.
a. ASTM B221 and ASTM B429 for bars, rods, wires, pipes and tubes.
3. ASTM B26 for castings.
4. ASTM F468, alloy 2024 T4 for bolts.
5. ASTM F467, alloy 2024 T4 for nuts.
6. Electrodes for welding aluminum: AWS D1.2, filler alloy 4043 or 5356.

E. Washers: Same material and alloy as found in accompanying bolts and nuts.

F. Embedded Anchor Bolts:
1. See Section 03151 (Anchorage to Concrete).

G. Expansion Anchor Bolts and Adhesive Anchor Bolts:
1. See Section 03151 (Anchorage to Concrete).

H. Headed Studs: ASTM A108 with a minimum yield strength of 50,000 psi and a minimum tensile strength of 60,000 psi.

I. Deformed Bar Anchors: ASTM A496 with a minimum yield strength of 70,000 psi and a minimum tensile strength of 80,000 psi.

J. Iron and Steel Hardware: Galvanized in accordance with ASTM A153 when required to be galvanized.

K. Galvanizing Repair Paint:
1. High zinc dust content paint for regalvanizing welds and abrasions.
2. Dried film shall contain not less than 93 percent zinc dust by weight.
3. Similar to ZRC by ZRC Products.
4. VOC: 0 LBS per GAL.

L. Dissimilar Materials Protection: See Section 09905 (Painting and Protective Coating).

2.3 MANUFACTURED UNITS

A. Ladders:
1. Material:
a. Aluminum.
2. Rails:
a. Maximum 3 x 2 IN heavy-duty rectangular tubing or channel, with minimum thickness of 0.125 IN or 1-1/2 IN nominal diameter schedule 80 pipe.
b. Spacing: Nominal 18 IN from centerline of rails except at top.
1) Minimum clear distance between rails to be 16 IN.
c. Brackets for wall supported units: Provide 3/8 x 2-1/2 IN x length required angle brackets welded to side rails with punched holes for ¾ IN bolts.
1) Maximum spacing: 4 FT OC.
d. For floor supported units provide 3/8 x 2-1/2 x 4 IN rectangular bracket or 3/8 x 6 x 6 IN square plate welded to rails with punched holes for ¾ IN bolts.
1) Provide wall brackets on floor supported units if vertical run is over 4 FT.
3. Rungs:

    a. Minimum 1 IN DIA or 1 IN square extruded, with integral serrated non-slip finish on all sides.
    b. Shop or field-applied grit tape and cap type non-slip finish is not acceptable.
4. Minimum distance from centerline of rung to wall or any obstruction: 7 IN.
5. Rung spacing:
    a. Uniform, 12 IN.
    b. Top rung shall be level with landing or platform.
    c. Spacing of bottom rung from grade or platform may vary but shall not exceed 14 IN.
6. As a minimum, design ladder in accordance with OSHA Standards, ANSI A14.3 and applicable Building Codes.
    a. Ladders shall be designed to support a minimum concentrated live load of 200 LBS.
    b. Maximum allowable stresses per AISC 360 and AA Specification.
    c. Maximum lateral deflection: Side rail span/240 when lateral load of 100 LBS is applied at any location.
7. Construction:
    a. Fully welded type.
    b. All welds to be full penetration welds, where applicable.
    c. All ladders of a particular material shall have consistent construction and material shapes and sizes unless detailed otherwise on the Drawings.
    d. Provide cap at top and bottom of side rails.
    e. Rungs shall not extend beyond the outside face of the side rail.
    f. The side rails of through ladder extension shall extend 42 IN above the top rung or landing and shall flare out on each side to provide a clearance of 24 IN centerline to centerline of rails.
8. Finish:
    a. Aluminum: Anodized.
        1) Color: AA-M10C22A41 clear.
9. Ladder safety extension post:
    a. Telescoping tubular aluminum section that automatically locks into place when fully extended.
    b. Non-ferrous corrosion-resistant spring and hardware.
    c. Factory assembled with all hardware necessary for mounting ladder.
    d. Bilco "LadderUp" safety post or Approved Equal.

B. Manhole steps:
1. ASTM C478.
2. Minimum clear step width: 16 IN.
3. Minimum cross section: 1 IN.
4. Extruded aluminum:
    a. Slip resistant design.
5. Neenah Foundry Model R-1982-W or Approved Equal.

C. Bollards:
1. 8 IN DIA extra strength steel pipe, ASTM A53.
    a. Galvanized.
2. Minimum 48 IN projection above ground.
3. Minimum 48 IN embedment in concrete.

D. Abrasive Stair Nosings:
1. Two (2) component consisting of an embedded subchannel, installed with the concrete pour, and an abrasive tread plate to be installed later.

2. 6063-T5 extruded aluminum, mill finished and heat treated.
3. Complete with concrete anchors and tread plate securing screws.
4. Units: 4 IN less in length than stair width unless noted otherwise and unless required different to avoid guardrails base plates (see below).
5. Tread plate: Extruded aluminum with solid epoxy abrasive filler.
6. Similar to Balco "DXH-330".
7. Color: to be selected by Owner.

E. Metal Stairs:
1. Fabricated as indicated.
2. Treads: Galvanized steel grating as specified.
   a. Provide integral corrugated non-slip nosing.
3. Risers:
   a. Grating treads: Solid plate attached to trailing edge of tread.
4. Landings:
   a. Galvanized steel grating as specified.
   b. Provide integral corrugated non-slip nosing at edge acting as stair tread/nosing.
5. Fabricate and design stair, platforms and landings, and all connections to support a 100 psf uniform live load or a concentrated load of 1000 LBS, whichever requires the stronger component.
6. Design, fabricate, and install in compliance with NAAMM AMP 510 and applicable codes.
7. Handrails and guardrails: Refer to Section 05525 (Steel Railing).
8. Material:
   a. Grating at landings and guardrails - Steel: ASTM A36, galvanized after fabrication.
   b. Stair and stair treads – Steel: ASTM A36, galvanized after fabrication.

F. Metal Stairs:
1. Fabricated as indicated.
2. Treads: Aluminum grating as specified.
   a. Provide integral corrugated non-slip nosing.
3. Risers:
   a. Grating treads: Solid plate attached to trailing edge of tread.
4. Landings:
   a. Aluminum grating as specified.
   b. Provide integral corrugated non-slip nosing at edge acting as stair tread/nosing.
5. Fabricate and design stair, platforms and landings, and all connections to support a 100 psf uniform live load or a concentrated load of 1000 LBS, whichever requires the stronger component.
6. Design, fabricate, and install in compliance with NAAMM AMP 510 and applicable codes.
7. Handrails and guardrails: Refer to Section 05522 (Aluminum Railing).
8. Material:
   a. Grating at landings and guardrails - Aluminum.
   b. Stair and stair treads – Aluminum.

G. Stairs, Concrete Filled Steel Pan:
1. Fabricated as indicated.
   a. ASTM A36 steel.
2. Treads: Minimum 14 GA pans with self furring metal lath in pan.
3. Risers: Minimum 14 GA.

4. Landings: As shown on Drawings.
5. Fabricate and design stair, platforms and landings, and all connections to support a 100 PSF uniform live load or a concentrated load of 300 LBS, whichever requires the stronger component.
6. Design, fabricate, and install in compliance with NAAMM AMP 510 and applicable codes.
7. Form surface of nosings with slip resistant materials or provide separate slip-resistant nosings.
8. Handrails and guardrails: Refer to Specification Section 05525 (Steel Railing).
9. Galvanize entire assembly after fabrication.

H. Aluminum Checkered Plate:
1. Conform to ASTM B632.
   a. Diamond pattern: Use one (1) pattern throughout Project.
   b. Material: Type 6061-T6.
2. Design Live Load:
   a. 100 PSF, uniform load.
   b. 300 LBS, concentrated load on 4 IN square area.
   c. All components to be adequate for the uniform load or the concentrated load, whichever requires the stronger component.
   d. Maximum deflection: 1/300 of span under superimposed live load of 50 PSF.
3. Reinforce as necessary with aluminum angles.
   a. See Drawings for additional reinforcing angle requirements if reinforcing is required to achieve required design loading.
4. Plate sections:
   a. Maximum 3 FT wide.
   b. Minimum 1/4 IN thick.
   c. Maximum 100 LBS per section if required to be removable.
5. Provide joints at center of all openings unless shown otherwise.
   a. Reinforce joints and openings with additional angles to provide required load carrying capacity.
6. Provide watertight continuous neoprene gaskets at supports configured to provide a watertight installation and where indicated on Drawings.
   a. Embedded support frames to be shop fabricated and pre-fitted to assure water tightness in shop and delivered to site as a unit.
7. Unless shown otherwise, frame for openings with aluminum checkered plate cover:
   a. Aluminum support angles:
      1) 3 IN by 2 IN by 1/4 IN minimum size with long leg vertical.
      2) 5/8 IN DIA adhesive anchor bolts spaced at maximum of 24 IN OC along each side with not less than two (2) anchor bolts per side.
   b. Aluminum concrete insert seats:
      1) 2 IN by 2 IN by 1/4 IN minimum size.
      2) Auto-welded studs or strap anchors at 18 IN OC with not less than two (2) studs or strap anchors per side.
   c. Drill and tap frame to receive 3/8 IN DIA fasteners at not more than 24 IN OC with not less than two (2) fasteners per side.
      1) Fasteners: Stainless steel flat countersunk cap screws: ASTM F879.

I. Steel Grating:
1. NAAMM MBG 531.

2. Bearing bars:
   a. Rectangular 1-1/2 x 1/4 IN unless shown otherwise on Drawings.
   b. Maximum 1-3/16 IN OC spacing.
3. Design Live Load:
   a. 100 PSF, uniform load.
   b. 300 LBS, concentrated load on 4 IN square area.
   c. All components to be adequate for the uniform load or the concentrated load, whichever requires the stronger component.
   d. Maximum deflection: 1/300 of span under a superimposed live load of 50 PSF.
4. Cross bars:
   a. Welded, swagged or pressure locked to bearing bars.
   b. Maximum 4 IN OC spacing.
5. Top edges of bars: Serrated or grooved.
6. Removable grating sections: Not wider than 3 FT and not more than 100 LBS.
7. Finish:
   a. Galvanized.
   b. Clips and bolts: Galvanized.
   c. Seat angles: Galvanized steel.
8. Ends and perimeter edges: Banded.
9. Openings through grating: Reinforced to provide required load carrying capacity and banded with 4 IN high toe plate. (None intended)
10. Provide joints at openings between individual grating sections.

J. Aluminum Grating:
1. NAAMM MBG 531.
2. Minimum depth: 1 1/2 IN.
3. Minimum rectangular bearing bar size:
   a. 3/16 IN thick.
   b. Maximum 1-3/16 IN OC spacing.
4. Minimum I-Bar flange width: 1/4 IN.
5. Design Live Load:
   a. 100 PSF, uniform load.
   b. 300 LBS, concentrated load on 4 IN square area.
   c. All components to be adequate for the uniform load or the concentrated load, whichever requires the stronger component.
   d. Maximum deflection: 1/300 of span under a superimposed live load of 50 PSF.
6. Cross bars:
   a. Welded, swaged or pressure locked to bearing bars.
   b. Maximum 4 IN OC spacing.
7. Top edges of bars: Serrated or grooved.
8. Removable grating sections: Not wider than 3 FT and not more than 100 LBS.
9. Standard mill finish.
10. Ends and perimeter edges: Banded.
11. Openings through grating: Reinforced to provide required load carrying capacity and banded with 4 IN high toe plate.
12. Provide joints at openings between individual grating sections.
13. Clips and bolts: Stainless steel.
14. Seat angles: Aluminum.

K. Heavy-Duty Castings, Trench Covers, and Accessories:
   1. Prefabricated, cast aluminum ASTM B26.
   2. Design load: AASHTO HS-20 wheel loading for indicated span.
   3. Machine horizontal mating surfaces.
L. Access Cover:
   1. Tank type manhole frame and solid lid: ASTM A48 or ASTM A536, cast iron.
   2. Unless shown otherwise, design of cover shall be such that top of frame extends several inches above slab to prevent surface water from entering tank.
   3. Equip lid with four (4) stainless steel screws to secure lid to frame.

2.4 FABRICATION

A. Verify field conditions and dimensions prior to fabrication.
B. Form materials to shapes indicated with straight lines, true angles, and smooth curves.
   1. Grind smooth all rough welds and sharp edges.
      a. Round all corners to approximately 1/32 - 1/16 IN nominal radius.
C. Provide drilled or punched holes with smooth edges.
   1. Punch or drill for field connections and for attachment of work by other trades.
D. Weld Permanent Shop Connections:
   1. Welds to be continuous fillet type unless indicated otherwise.
   2. Full penetration butt weld at bends in stair stringers and ladder side rails.
   3. Weld structural steel in accordance with AWS D1.1 using Series E70 electrodes conforming to AWS A5.1/A5.1M.
   4. Weld aluminum in accordance with AWS D1.2.
   5. All headed studs to be welded using automatically timed stud welding equipment.
   6. Grind smooth welds that will be exposed.
E. Conceal fastenings where practicable.
F. Fabricate work in shop in as large assemblies as is practicable.
G. Tolerances:
   1. Rolling:
      a. ASTM A6.
      b. When material received from the mill does not satisfy ASTM A6 tolerances for camber, profile, flatness, or sweep, the Contractor is permitted to perform corrective work by the use of controlled heating and mechanical straightening, subject to the limitations of the AISC 360.
   2. Fabrication tolerance:
      a. Member length:
         1) Both ends finished for contact bearing: 1/32 IN.
         2) Framed members:
            (a) 30 FT or less: 1/16 IN.
            (b) Over 30 FT: 1/8 IN.
      b. Member straightness:
         1) Compression members: 1/1000 of axial length between points laterally supported.
         2) Non-compression members: ASTM A6 tolerance for wide flange shapes.
      c. Specified member camber (except compression members):
         1) 50 FT or less: Minus 0/plus 1/2 IN.
         2) Over 50 FT: Minus 0/plus 1/2 IN (plus 1/8 IN per 10 FT over 50 FT).

3) Members received from mill with 75 percent of specified camber require no further cambering.
4) Beams/trusses without specified camber shall be fabricated so after erection, camber is upward.
5) Camber shall be measured in fabrication shop in unstressed condition.

d. At bolted splices, depth deviation shall be taken up by filler plates.
1) At welded joints, adjust weld profile to conform to variation in depth.
2) Slope weld surface per AWS requirements.

e. Finished members shall be free from twists, bends and open joints.
1) Sharp kinks, bends and deviation from above tolerances are cause for rejection of material.

H. Fabricate checkered plate, ladders and accessories using aluminum unless shown otherwise on Drawings. Fabricate grating, stairs, stair landing gratings and stair treads using steel, galvanized after fabrication.
1. Finish:
a. Aluminum: Mill finished unless scheduled or otherwise specified or, if approved by Owner, finished in manufacturer's standard.
b. Coat or otherwise separate surfaces in contact with dissimilar materials.
1) See 09905 (Painting and Protective Coating).
2. See Section 09905 (Painting and Protective Coating) for preparation and painting of ferrous metals and other surfaces.

I. Maximum tolerance for difference in depth between checkered plate or grating depth and seat or support angle depth: 1/8 IN.

J. Distance between edge of grating or checkered plate and face of embedded seat angle or face of wall or other structural member shall be 1/4 IN.
1. Tolerance per NAAMM MBG 531.

2.5 SOURCE QUALITY CONTROL

A. Surface Preparation:
1. Refer to Section 09905 (Painting and Protective Coatings) for surface preparation requirements.

B. Shop Applied Paint Coating Application:
1. Refer to Section 09905 (Painting and Protective Coatings) for painting requirements.

C. Meet structural requirements of Section 05120 (Structural Steel) for inspection and testing items of structural nature.

PART 3 EXECUTION

3.1 PREPARATION

A. Provide items to be built into other construction in time to allow their installation.
1. If such items are not provided in time for installation, cut in and install.

B. Prior to installation, inspect and verify condition of substrate.

C. Correct surface defects or conditions which may interfere with or prevent a satisfactory installation.
1. Field welding aluminum is not permitted unless approved in writing by Owner.

3.2 INSTALLATION

A. Set metal work level, true to line, plumb.

1. Shim and grout as necessary.

B. Bolt Field Connections: Where practicable, conceal fastenings.

C. Grind welds smooth where field welding is required.

D. Field cutting grating or checkered plate to correct fabrication errors is not acceptable.
   1. Replace entire section.

E. Remove all burrs and radius all sharp edges and corners of miscellaneous plates, angles, framing system elements, etc.

F. Unless noted or specified otherwise:
   1. Connect steel members to steel members with 3/4 IN DIA ASTM A325 high strength bolts.
   2. Connect aluminum to aluminum with 3/4 IN DIA aluminum bolts.
   3. Connect aluminum to structural steel using 3/4 IN DIA stainless steel bolts.
      a. Provide dissimilar metals protection.
   4. Connect aluminum and steel members to concrete and masonry using stainless steel expansion anchor bolts or adhesive anchor bolts unless shown otherwise.
      a. Provide dissimilar materials protection.
   5. Provide washers for all bolted connections.
   6. Where exposed, bolts shall extend a maximum of 3/4 IN and a minimum of 1/2 IN above the top nut.
      a. If bolts are cut off to required maximum height, threads must be dressed to allow nuts to be removed without damage to the bolt or the nuts.

G. Install and tighten ASTM A325 high-strength bolts in accordance with the AISC Manual of Steel Construction - Allowable Stress Design (ASD).
   1. Provide hardened washers for all ASTM A325 bolts.
      a. Provide the hardened washer under the element (nut or bolt head) turned in tightening.

H. After bolts are tightened, upset threads of ASTM A307 unfinished bolts or anchor bolts to prevent nuts from backing off.

I. Secure metal to wood with lag screws of adequate size with appropriate washers.

J. Do not field splice fabricated items unless said items exceed standard shipping length or change of direction requires splicing.
   1. Provide full penetration welded splices where continuity is required.

K. Provide each fabricated item complete with attachment devices as indicated or required to install.

L. Anchor such that Work will not be distorted nor fasteners overstressed from expansion and contraction.

M. Set beam and column base plates accurately on non-shrink grout as indicated on Drawings.
   1. See Division 3 Specification Sections for non-shrink grout.
   2. Set and anchor each base plate to proper line and elevation.
      a. Use metal wedges, shims, or setting nuts for leveling and plumbing columns and beams.
         1) Wedges, shims and setting nuts to be of same metal as base plate they support.
         2) Tighten nuts on anchor bolts.
      b. Fill space between bearing surface and bottom of base plate with non-shrink grout.
         1) Fill space until voids are completely filled and base plates are fully bedded on wedges, shims, and grout.
      c. Do not remove wedges or shims.
         1) Where they protrude, cut off flush with edge of base plate.

d. Fill sleeves around anchor bolts solid with non-shrink grout.

N. Tie anchor bolts in position to embedded reinforcing steel or embedded standees using templates and wire.
1. Tack welding prohibited.
a. Coat bolt threads and nuts with heavy coat of clean grease.
2. Anchor bolt location tolerance:
a. 1/16 IN.
b. Provide sturdy templates for all anchor bolts.

O. Install bollards in concrete as detailed.
1. Fill pipe with concrete and round off at top.

P. Provide abrasive stair nosings in each tread and landing of all concrete stairs and at each concrete stair landing having metal stair structure attaching to the concrete landing.
1. Center stair nosings in stair width.
2. Coordinate nosings with railing vertical posts.
a. Maintain 2 IN clear between end of nosing and edge of railing base plate.

Q. Accurately locate and place frames for openings before casting into floor slab so top of plate is flush with surface of finished floor.
1. Keep screw holes clean and ready to receive screws.

R. Attach grating to end and intermediate supports with grating saddle clips and bolts.
1. Maximum spacing: 2 FT OC with minimum of two (2) per side.
2. Attach individual units of aluminum grating together with clips at 2 FT OC maximum with a minimum of two (2) clips per side.

S. Coat aluminum surfaces in contact with dissimilar materials in accordance with Section 09905 (Painting and Protective Coating).

T. Repair damaged galvanized surfaces in accordance with ASTM A780.
1. Prepare damaged surfaces by abrasive blasting or power sanding.
2. Apply galvanizing repair paint to minimum 6 mils DFT in accordance with manufacturer's instructions.

U. Anchor ladder to concrete or masonry structure with minimum 3/4 IN stainless steel adhesive anchor bolts with minimum 6 IN embedment.
1. When anchoring into masonry, fill masonry cores with grout at anchor locations and each masonry core within 8 IN of anchor.

V. Install manhole steps in cast-in-place concrete where indicated on the Drawings.
1. Provide in compliance with ASTM C478, OSHA, and Or-OSHA requirements for fixed ladders.
2. Tie steps to reinforcing or formwork.
a. Provide equal spacing from surface to first rung and equal spacing on remaining rungs.
1) Maximum spacing: 12 IN.
b. Minimum clear distance from face of wall to center of step: 7 IN.
c. Minimum embedment: 6 IN.
3. Provide dissimilar materials protection.
a. See Section 09905 (Painting and Protective Coating).
4. At the Contractor's option, manhole steps may be installed in drilled holes and grouted in place.
a. Grout: See Section 03308 (Concrete, Materials and Proportioning).

W. Install ladder safety extension post in accordance with manufacturer's instructions.
1. Mount device opposite the climbing side.

2. Provide ladder safety extension device for all ladders where indicated on Drawings.

X. Anchor ladder to metal stud walls using minimum 1/2 IN stainless steel bolts, nuts and washers.

1. Verify that stud wall has been provided with adequate backing to accept ladder anchors.

3.3 CLEANING

A. After erection, installation or application, clean all miscellaneous metal fabrication surfaces of all dirt, weld slag and other foreign matter.

B. Provide surface acceptable to receive field applied paint coatings specified in Section 09905 (Painting and Protecting Coatings).

END OF SECTION

SECTION 05522

ALUMINUM RAILINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aluminum handrail, stair rail and guardrail.
B. Related Sections:
   1. Section 03151 (Anchorage to Concrete).
   2. Section 05500 (Metal Fabrications).
   3. Section 09905 (Painting and Protective Coatings).

1.2 REFERENCES

A.	ASME Section IX	Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators
B.	ASTM B108	Standard Specification for Aluminum-Alloy Permanent Mold Castings
C.	ASTM B209	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
D.	ASTM B221	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
E.	ASTM B247	Standard Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings
F.	ASTM B308	Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
G.	ASTM B429	Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
H.	AWS C5.5	Recommended Practices for Gas Tungsten Arc Welding
I.	AWS D1.2	Structural Welding code – Aluminum
J.	NAAMM AMP 521	Pipe Railing Systems Manual
K.	OSHA	California Title 8, General Industry & electrical Safety Orders
L.	ICC	California Building Code, 2010 edition, based on the International building code, associated standards, and all amendments, referred to herein as Building Code

1.3 DEFINITIONS

A. Guardrail: A system of building components located near the open sides of elevated walking surfaces for the purpose of minimizing the possibility of an accidental fall from the walking surface to the lower level.
B. Handrail: A railing provided for grasping with the hand for support.
C. Railing: A generic term referring to guardrail, handrail and/or stair rails.
D. Stair Rail: A guardrail, installed at the open side of stairways with either a handrail mounted to the inside face of the guardrail, or where allowed by applicable codes, with the top rail mounted at handrail height and serving the function of a handrail.

1.4 SUBMITTALS

A. Product Data:
   1. Acknowledgement that products submitted meet requirements of standards referenced.
   2. Manufacturer's installation details.
B. Shop Drawings:
   1. Fabrication and/or layout drawings:
      a. Drawings showing profile, location, sections and fabrication details including all welding information of each railing.
      b. Type and details of anchorage.
      c. Location and type of expansion joints.
      d. Materials of construction, shop coatings and all third-party accessories.
C. Calculations:
   1. Calculations for all proposed deviations from the Specification.
      a. Calculations shall be performed, sealed, signed and dated by a registered professional engineer licensed in the State of California.
      b. Calculations shall be specific to this Project and shall include all assumptions, references and design interpretations used.
      c. Reduction in load criteria is not acceptable as reason for deviation from sizes indicated in the Specification.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Qualify welding procedures and welding operators in accordance with AWS and ASME Section IX.
B. Certifications:
   1. Certification of welders and welding procedures indicating compliance with AWS requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and handle railings to preclude damage.
B. Store railings on skids, keep free of dirt and other foreign matter which will damage railings or finish and protect against corrosion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Newark Wire Works, Inc.
B. Or Approved Equal.

2.2 MATERIALS

A. Alloy 6061-T6, 32,000 psi tensile yield strength minimum.
   1. ASTM B209 for sheets and plates.
   2. ASTM B221 and ASTM B308 for shapes - beams, channels, angles, tees, and zees.
   3. ASTM B247 for forgings.
B. Alloy 6063-T5 or T6, 15,000 psi tensile yield strength minimum.
   1. ASTM B221 and ASTM B429 for bars, rods, wires, pipes and tubes.
C. Cast Fittings: Aluminum, ASTM B108.
D. Shims: Aluminum of same alloy as component being shimmed.

E. Fasteners: See Section 05500 (Metal Fabrications).
F. Expansion and Adhesive Anchors: See Section 03151 (Anchorage to Concrete).
G. Electrodes for Welding:
   1. Aluminum: AWS D1.2.
   2. Filler alloy 5356 or 4043.

2.3 FABRICATION

A. General:
   1. Verify field conditions and dimensions prior to fabrication.
   2. For fabrication of items which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.
      a. Remove blemishes by grinding and buffing or by welding and grinding, prior to cleaning, treating and application of surface finishes.
   3. Form exposed work with smooth, short radius bends, accurate angles and straight edges.
      a. Ease exposed edges to a radius of approximately 1/32 IN.
      b. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
      c. Drill or punch holes with smooth edges.
   4. Form exposed connections with flush, smooth, hairline joints, using stainless steel or aluminum splice locks to splice sections together or by welding.
      a. Ease the edges of top rail splices and expansion joints and remove all burrs left from cutting.
   5. Provide for anchorage of type indicated on Drawings or as required by field conditions.
      a. Drill or punch holes with smooth edges.
   6. Design railings and anchorage system in accordance with NAAMM AMP 521 to resist loading as required by Building Code.
      a. Maximum allowable stresses per AA ADM 1.
   7. Design railings in accordance with accessibility requirements per the Building Code.
   8. Custom fabricate railings to dimensions and profiles indicated.
      a. Fabricate handrail mounted to wall or to guardrail vertical posts using minimum 1-1/4 IN nominal diameter Schedule 40 pipe.
      b. Fabricate all guardrail top rails using minimum 2 IN nominal diameter Schedule 40 pipe.
      c. Fabricate all guardrail vertical posts using minimum 2 IN nominal diameter Schedule 40 pipe.
         1) Guardrail vertical posts that are to be side-bracket mounted to a vertical concrete surface or metal structure shall use Alloy 6063-T6.
      d. All intermediate rails shall be fabricated using minimum 1-1/2 IN nominal diameter Schedule 40 pipe.
         1) Where details are not indicated, set horizontal rails and vertical pickets to requirements of the Building Code, OSHA Standards, whichever requires the more restrictive design.
      e. Space vertical posts as required by loading requirements but not more than 4 FT on center.
      f. Space handrail brackets as required by loading requirements but not more than 4 FT on center.

g. Base plate for vertical guardrail posts mounted to top of concrete surface:
   1) 3/8 x 6 x 6 IN square plate.
   2) Predrilled to accept four (4) anchors.
   3) Provide a 2 IN DIA x 8 IN long solid aluminum rod welded to the base plate.
   4) Fit the vertical post over the solid rod and weld the post to the base plate.
h. Base plate for vertical guardrail post mounted to flange of metal structure:
   1) 3/8 x 3 x 8 IN plate.
   2) Predrilled to accept two (2) fasteners.
   3) Provide a 2 IN DIA x 8 IN long solid aluminum rod welded to the base plate.
   4) Fit the vertical post over the solid rod and weld the post to the base plate.
i. Mounting bracket for vertical guardrail post mounted to vertical concrete surface or web of metal structural member:
   1) Pair of 3/8 IN angles or bent plates.
   2) Predrilled to accept two (2) fasteners each.
   3) Weld angles or bent plates to vertical posts.
j. Provide 3/8 IN x 4 IN flat bar toeboards or 1/4 IN minimum thickness x 4 IN high extruded toeboard with stiffener ribs on back side at all elevated walkways, platforms and stair landings, and where indicated on the Drawings or required by OSHA Standards.

9. Railing infill panels shall consist of 4 IN x 4 IN x 1/8 IN aluminum wire mesh in a rectangular grid secured to a perimeter frame. Pass mesh through and securely clinch to four sided frame, attach infill panel to railing with manufacturer's standard stand-off tabs. Panel finish to be clear aluminum, anodized.
10. Fit exposed ends of guardrails and handrails with solid terminations.
11. Return ends of handrail to wall, but do not attach to wall.
12. Where guardrail terminates at a wall, provide a vertical post located 4 IN off the wall to center of post.
13. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly of units at Site.

B. Finish: Mill.

C. Railing Fabrication:
1. All railings are to be welded systems.
2. Use wire welding for all joints.
3. All welding to be continuous in accordance with AWS C5.5 and AWS D1.2.
   a. All welded railing joints shall have full penetration welds unless noted otherwise.
4. All exposed welds to be ground smooth and flush to match and blend with adjoining surfaces.
   a. NAAMM AMP 521, Type 2.
5. No ragged edges, surface defects, or undercutting of adjoining surfaces will be accepted.
6. Finishing joints with filler is not acceptable.
7. Provide flush weld fittings using locking weld connectors or coped drive-on connectors.

D. Install weeps to drain water from hollow sections of railing at exterior and high humidity conditions.
1. Drill 1/4 IN weep hole in railings closed at bottom:
   a. 1 IN above walkway surface at bottom of posts set in concrete.
   b. 1 IN above solid aluminum rod at posts having base plate.
   c. At low point of intermediate rails.
   d. Do not drill weep holes:

1) In bottom of base plate.

E. Expansion Joints:
1. Joints to be designed to allow expansion and contraction of railing and still meet design loads required.
   a. Top rail splices and expansion joints shall be located within 8 IN of post or other support.
   b. Where railings span building or tank expansion joints; provide a railing expansion joint in the span crossing the building or tank expansion joint.
2. Provide expansion joints in any continuous run exceeding 20 FT in length.
   a. Space expansion joints at not more than 40 FT on center.
3. Provide minimum 0.10 IN of expansion joint for each 20 FT length of top rail for each 25 DegF differential between installation temperature and maximum design temperature.
   a. Maximum expansion joint width at time of installation shall not exceed 3/8 IN.
      1) Provide additional expansion joints as required to limit expansion joint width.
4. Provide slip-joint with internal sleeve.
   a. Extend slip joint min 2 IN beyond joint at maximum design width.
   b. Fasten internal sleeve securely to one side
      1) Provide allen-head set screw located in bottom of rail.
      2) Rivets or exposed screw heads are not acceptable.

PART 3 EXECUTION

3.1 PREPARATION

A. Prior to installation, inspect and verify condition of substrate.
B. Correct surface defects or conditions which may interfere with or prevent a satisfactory installation.
   1. Field welding aluminum is not permitted unless approved in writing by Owner.

3.2 INSTALLATION

A. Install handrails and guardrails to meet loading requirements of the Building Code.
B. Install products in accordance with manufacturer's instructions.
C. Set work accurately in location, alignment and elevation; plumb, level and true.
   1. Measure from established lines and items which are to be built into concrete, masonry or similar construction.
D. Align railings prior to securing in place to assure proper matching at butting and expansion joints and correct alignment throughout their length.
   1. Provide shims as required.
E. Install proper sized expansion joints based on temperature at time of installation and differential coefficient of expansion of materials in all railings as recommended by manufacturer.
   1. Lubricate expansion joint splice bar for smooth movement of railing sections.
F. Provide removable railing sections where indicated on Drawings.
G. Attach handrails to walls or guardrail with brackets designed for condition:
   1. Provide brackets which provide a minimum 1-1/2 IN clearance between handrail and nearest obstruction.
      a. Handrails shall not project more than 4-1/2 IN into required stairway width.

2. Anchor handrail brackets to concrete or masonry walls with 1/2 IN stainless steel adhesive anchors with stainless steel hex head bolts.

H. Anchor railings to concrete with minimum 1/2 IN stainless steel adhesive anchors with stainless steel bolts, nuts and washers unless noted otherwise in the Contract Documents.
   1. Where exposed, bolts shall extend minimum 1/2 IN and maximum 3/4 IN above the top nut.
      a. If bolts are cut off to required height, threads must be dressed to allow nuts to be removed without damage to the bolt or the nut.
      b. Bevel the top of the bolt after cutting to provide a smooth surface.

I. Anchor railings to metal structure with minimum 3/4 IN stainless steel bolts, nuts and washers.

J. Install toeboards to fit tight to the walking surface.
   1. Notch toeboards at base plates or other obstructions.
   2. Bottom of toeboard shall not exceed 1/4 IN above walking surface.

K. Coat aluminum in contact with dissimilar metal or concrete in accordance with Section 09905 (Painting and Protective Coatings).

L. Provide railings as required for stair construction identified in Section 05505 (Metal Fabrications).

END OF SECTION

SECTION 05920

FLAT PANEL FISH SCREENS AND ASSOCIATED METAL WORKS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. The work includes design and installation of a complete and functional fish screen system as shown on the Drawings and as specified herein.
      a. Intake Screens, Bulkheads or Solid Panels, and Perforated Plate Assemblies (including screen design).
      b. Screen Seats and Supports.
      c. Trash Rack and Observation Window Picket Panels.
      d. Auxiliary Water Supply Diffuser Panels.

1.2 SUBMITTALS

A. Product Data:
   1. Submit manufacturer's descriptive literature and installation instructions for the following:
      a. Fasteners
      b. Headed Concrete Anchors.
      c. Grout.
B. Shop Drawings:
   1. Submit shop drawings for metal fabrication items
      a. Indicate profiles, sizes, connection attachments, tolerances, reinforcing, anchorage, size, and type of fasteners.
      b. Include erection drawings, elevations, and details. Contractor shall verify field dimensions for all metal fabrications and provide shop drawings for all fabricated items prior to shop fabrication.
      c. Indicate welded connections, in accordance with AWS A2.4. Indicate weld lengths. Include data for welding materials and methods to be used. Piping welds shall be tested to insure proper function for intended applications.
      d. Include fish screen inserts on doorways as indicated on the drawings. Show the fish screen inserts on the shop drawings for the doors specified by Section 08220 (Fiberglass Reinforced Plastic (FRP) Doors and Frames, Aluminum Flood Gate Security Gates).
C. Procedures
   1. Welder/Welding operator performance qualification
   2. Welding procedure specification and procedure qualification records
   3. Weld repair procedure
D. Quality Assurance/Control Submittals:
   1. Qualification Statements:
      a. Weld Inspector qualifications, per paragraph 1.3A
      b. Welder's Qualifications
   2. Screen manufacturer shall provide a calculation for maximum headloss through the screens with an approach velocity of 0.33 fps.

E. Hydraulic Evaluation Plan:
   1. Prepare Hydraulic Evaluation Plan for review and approval by Owner. Plan must follow guidelines of regulatory agencies and include procedures for flowrate testing, perforated plate adjustment and certifying the intake screens. At a minimum the plan shall include maximum flow, minimum flow and typical flows that will flow through the screen including flows through the auxiliary water supply. The plan shall be submitted at least 90 days prior to start-up of the fish screens.
   2. Submit Hydraulic Evaluation Plan test results in final report format. The results shall be submitted within 15 days of start-up of the fish screens.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Fabricator's shop shall comply with IBC, Section 1705.
   2. Steel: Visually inspect steel plates and shapes for defects, such as laminations and non-metallic inclusions prior to use.
   3. Welding Requirements. Comply with AWS. D1.1.
      a. Qualification. Comply with AWS D1.1 for welder qualification. Welders or welding operators shall have qualified within the last twelve (12) months, or shall be pre-qualified for each process used. Welders qualified in accordance with ASME, Section IX need not be re-qualified to AWS D1.1.
      b. Stud Welding. All stud welding shall be pre-production tested, in accordance with AWS D1.1, paragraph 7.7.1.
      c. Inspection. Unless all welding is performed by an approved fabricator all shop welds shall be inspected by a special inspector, in compliance with the IBC Chapter 17. Field welding will be subject to review and acceptance by the Owner.
      d. Fit up. The fit up of all full and partial penetration welds shall be subject to review and acceptance by Owner.
      e. Visual Inspection. All shop welds shall be visually inspected prior to shipping. Shop welding will also be reviewed for acceptance by the Owner upon delivery to the site, and prior to installation. All field welds shall be subject to review and acceptance by the Owner

1.4 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
   1. General. Store and handle in such a manner which will insure final installation in an undamaged condition. Perform lifting using only designated pick points, or as required, to prevent distortion of the item. Use particular care in handling screen panels, embeds, and other items which require special fit up requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Intake Screen:
   1. Hendrick Screen Company
      3074 Medley Road
      PO Box 22075
      Owensboro KY, 42304
      (270) 685-5138

2. Or Approved Equal.

2.2 MATERIALS

A. Comply with the following:
   1. Carbon Steel Bars, Plates, and Shapes: ASTM A36
   2. Stainless Steel Plates: ASTM A167 or A240, Type 304
   3. Stainless Steel Bars and Shapes: ASTM A276, Type 304
   4. Bolts: ASTM A193, B8
   5. Nuts: ASTM A194
   6. Stainless Steel Pipe: ASTM A376, Type 304
   7. Structural Tubing: ASTM A500, Grade B
   8. Welding Electrodes: E70XX or Type 308-15, as required for base metal
   9. Screening Materials: Type 304 Stainless Steel

B. Bolting materials, air piping and intake screen assembly shall be stainless steel. Unless otherwise specified, all other materials shall be carbon steel.

2.3 FABRICATION

A. Shop Assembly:
   1. Comply with AISC Specification for all steel fabrication.
   2. Verify all measurements and take all necessary field measurements prior to fabrication. Provide materials and parts necessary to complete the installation of each item, even if such details are not shown. Drilling and punching shall produce clean true lines and surfaces.
   3. In addition to the welded connection shown, all welded connections shall be seal welded around the entire faying surfacing (matching edges of the pieces being joined), to seal this surface. Grind seal welds flush, as required for assembly.

2.4 CONNECTION

A. Furnish all connectors, fasteners, welded metal, and miscellaneous items required to complete and construct the items shown on the Drawings.

B. Furnish washers and lock washers, of the same materials as fasteners and connections, for all bolted connections, unless otherwise specified.

2.5 WELDING

A. Comply with AWS D1.1, or ASME Section IX, for all shop welding.

2.6 FINISH

A. Stainless steel shall be provided to a standard mill finish, which has been cleaned of all foreign matter, and with all rough edges ground to a smooth finish.

2.7 INTAKE SCREENS

A. Screen assemblies shall be constructed of Type 304 Stainless Steel.

B. Screening materials shall have a profile bar design, with continuous 1.75 mm slots, and a minimum effective open area of twenty seven percent (27%).

C. Configuration of screen panel assembly shall be determined by the supplier to conform to the sizes shown on the drawing. Configuration shall leave no gaps which create a path through the assembly, other than through the screen slots. Screen slots shall be oriented perpendicular to flow direction. Assembly shall be designed by the supplier for the loading conditions indicated on the Drawings.

D. Screen manufacturer shall also provide a calculation for maximum headloss through the screens with an approach velocity of 0.33 fps.
E. Screen material shall be continuously welded to framing around the entire perimeter and to intermediate frame members.
F. Contractor shall design and fabricate a strongback device for each intake screen, for lifting/placing each screen assembly into position, with the strongbacks becoming the property of the Owner. The device shall be designed to place the assembly in and out of position using pick points on the top edge of the screens.
G. The flatness across the entire screen should be + or - 3/16”" and no more than .030" in any square ft. area.

2.8 BULKHEADS OR SOLIDS PANELS, PERFORATED PLATE ASSEMBLIES, SCREEN SEATS/SUPPORTS, TRASH RACK, OBSERVATON WINDOW PICKET PANELS, AND AUXILIARY WATER SUPPLY DIFFUSER PANELS

A. Bulkheads or solids panels, perforated plate assemblies, screen seats/supports, trash rack, observation window picket panels, and auxiliary water supply diffuser panels shall be designed for a minimum water differential load of 13 ft.
B. Provide assemblies constructed of stainless steel and in configuration, dimensions, and quantities, as shown on Drawings. Alternate hole diameters and panel thicknesses may be proposed in Contractor’s Shop Drawing submittal, to achieve required % open area.
C. Provide erection holes for bolting embeds to formwork during placement. No erection holes shall be put in screen seats. Positions of erection holes shall be shown on shop drawings and are subject to the review and acceptance by the Owner.
D. Apply heat evenly while welding to prevent warping or distortion. Seat plates shall be true and square to allow for proper seating of screen and air manifold/screen support. Prior to shipment, pre-assemble seat frame for each bay, and utilizing a template verify that seats are flush with template around entire perimeter and square with template mating surface.
E. Seats may be machined to remove a maximum of 3/16-inch thickness, if required to achieve required flatness. Top of embeds and all other dimensions shall be modified accordingly.
F. Piping interior shall be cleaned to remove any metal from drilling air discharge holes.
G. All holes shall be clean, true, and free of any debris, paint or irregular blockage prior to review and acceptance by the Owner for final assembly in place.
H. Assemblies shall be fastened in place with stainless steel bolts, lock washers, and double nuts.

2.9 GROUT

A. Furnish and install "Master Builders, Masterflow 713" nonshrink, natural aggregate grout or Approved Equal in accordance with manufacturer's recommendations.

PART 3 EXECUTION

3.1 INSTALLATION

A. Installation shall comply with the Drawings, manufacturer's installation instructions, and the AISC Specifications, subject to modifications of the Owner.

3.2 GENERAL REQUIREMENTS

A. Work shall be accurately set to establish lines and grades and securely fastened in place. Use particular care during installation of screen seats, manifold supports, air

manifold/screen support, screen panels, and other items requiring special fit up requirement.

3.3 FISH SCREEN SEATS AND MANIFOLD SUPPORTS

A. Place all metalwork to be embedded in concrete accurately and hold securely in place during concrete placement. Surface of embedments shall be set so that edges are flush and square with the floor and/or wall. Thoroughly clean all rust, dirt grease, loose scale, grout, and other foreign matter, from surfaces which will be in contact with concrete and coat with coal tar epoxy.

3.4 WELDING

A. Comply with AWS D1.1, or ASME Section IX for all field welding.

3.5 BOLTING

A. Make all steel member bolted connection snug tight with double nuts or lockwashers.

3.6 SCREEN PANEL ASSEMBLY

A. Upon final assembly, and without any external force applied, the screen panels shall rest upon the supports and seats with no gaps in excess of 1/16 inch.

3.7 HYDRAULIC EVALUATION

A. A hydraulic evaluation must be performed on the fish screens using a combination of the perforated plate panel assemblies, under maximum flows, minimum flows and normal operating conditions prior to start-up and operation of the fish screens. The evaluation shall include velocity testing in accordance with state and federal regulatory requirements. The required work shall include:
   1. Conduct hydraulic evaluation per the approved Hydraulic Evaluation Plan. The field testing shall start immediately after start-up of the fish screens.
   2. Submit Hydraulic Evaluation Plan results in final report format to Owner.

END OF SECTION

DIVISION 6

WOOD AND PLASTICS

SECTION 06100

ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

A. Related Specification Sections include but are not necessarily limited to:
   1. Section 05500 (Metal Fabrications).

1.2 REFERENCES

A.	APA PRP-108	Performance Standards and Qualification Policy for Structural Use Panels
B.	APA U450E	Storage and Handling of APA Trademarked Panels
C.	APA Y510T	Plywood Design Specification
D.	ASTM D2898	Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing
E.	ASTM D4442	Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials
F.	ASTM D4444	Standard Test Method for Laboratory Standardization and Calibration of Hand-Held Moisture Meters
G.	ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
H.	AWPA U1	Use Category System: User Specification for Treated Wood
I.	NIST PS-1	Construction and Industrial Plywood
J.	NIST PS-2	Performance Standard for Wood-Based Structural-Use Panels
K.	NIST PS-20	American Softwood Lumber Standard
L.	UL 723	Standard for Test for Surface Burning Characteristics of Building Materials

1.3 SUBMITTALS

A. Shop Drawings:
   1. Fabrication drawings of all fabricated items.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions for all products specified.
   3. Certifications:
      a. Chemicals used in treatment process are registered with and approved by EPA.
      b. Moisture content of material prior to treatment: 25 percent maximum.
      c. Material has been kiln-dried after treatment (KDAT) to the moisture content specified.
   4. Documentation of treatment of preservative and fire retardant treated material in accordance with standards referenced.

B. Samples:
   1. Manufacturer's complete line of solid surface material colors and patterns.
   2. Manufacturer's complete color selection of roof shingles; color card or brochure is not acceptable.

3. Ice dam membrane.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Wood Treatment Plant: AWPA M3.
   2. Treated Wood Inspection: AWPA M2.
B. Miscellaneous:
   1. Factory marking:
      a. Lumber:
         1) Identify type, grade, moisture content, inspection service, producing mill, and other qualities specified.
         2) Marking may be omitted, as allowed by Building Code, if certificate of inspection is provided for each shipment.

1.5 DELIVERY AND STORAGE

A. Delivery, storage and handling of untreated wood products:
   1. Lumber: As recommended by the grading agency indicated on the grade stamp.
   2. Plywood: APA U450E.
B. Delivery, storage, handling and disposal of treated wood products: AWPA M4.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.

2.2 MATERIALS

A. General:
   1. Lumber (for framing, blocking, nailers, furring, grounds and similar members):
      a. NIST PS-20.
      b. Species:
         1) Treated material: As indicated in the appropriate AWPA standard {and as required to achieve UL rating listed herein}.
      c. Grade:
         1) For nominal sizes up to and including 2 x 4: Standard and better.
         2) For nominal sizes up to 2 IN thick and wider than 4 IN: #2 and better.
   2. Structural plywood:
      a. NIST PS-1, NIST PS-2.
      b. APA PRP-108, APA Y510T.
      c. Sheathing , Structural I Rated Sheathing:
         1) Exposure: EXT.
         2) Span rating: 24/0
            (a) All plywood furnished for a single span rating to be the same thickness.
         3) Thickness: 5/8 IN.
      d. Underlayment :
         1) Exposure: EXT.
         2) Span rating: 24 OC.
         3) All plywood furnished for a single span rating to be the same thickness.
         4) Thickness: As indicated on Drawings.

5) Tongue-and-groove edges.
6) Touch sanded.

3. Moisture content:
   a. Kiln-dry, ASTM D4442 and ASTM D4444.
   b. Lumber, 19 percent maximum.
   c. Wood structural panels , 15 percent maximum.

B. Preservative Treated Material:
1. Moisture content:
   a. Prior to treatment: 25 percent.
   b. Kiln-dry after treatment (KDAT), ASTM D4442 and ASTM D4444:
      1) Lumber: 19 percent maximum.
      2) Plywood: 18 percent maximum.
2. Preservative:
   a. Waterborne, AWPA P5.
   b. As indicated in the appropriate AWPA standard.
3. Pressure-treat material in accordance with AWPA U1 and the following:
   a. Lumber: AWPA U1.
   b. Plywood: AWPA U1.
4. Wherever practicable, material to be treated shall be manufactured in its final form prior to treatment.

C. Fire-Retardant Treated Material (FRTM):
1. Acceptable manufacturer:
   a. Hoover Treated Wood Products, Inc.:
      1) Interior: "Pyro-Guard".
      2) Exterior: "Exterior Fire-X".
   b. Or Approved Equal.
2. Maximum moisture content:
   a. Prior to treatment: 25 percent.
   b. Kiln-dry after treatment (KDAT), ASTM D4442 and ASTM D4444:
      1) Lumber: 19 percent (KDAT).
      2) Plywood: 15 percent (KD-15).
3. Fire-retardant preservative:
   a. Provide protection against decay:
      1) EPA registered for use as a wood preservative.
   b. Shall not bleed-through or adversely affect bond of any finish.
4. Pressure-treat material in accordance with AWPA U1 and the following:
   a. Lumber: AWPA U1.
   b. Plywood: AWPA U1.
5. UL Classified:
   a. FR-S, UL 723.
   b. Exterior: No increase in classification when subjected to the Standard Rain Test, ASTM D2898.
   c. Provide UL mark on each piece of FRTM.
6. Maximum flame spread rating: 25, ASTM E84.
7. Wherever practicable, material to be treated shall be manufactured in its final form prior to treatment.

D. Fasteners and Anchors:
1. Proper type, size, material, and finish for application.

2. Nuts, bolts and washers: See Section 05500 (Metal Fabrications).
3. Expansion anchors: See Section 05500 (Metal Fabrications).
4. Adhesive anchors: See Section 05500 (Metal Fabrications).

PART 3 EXECUTION

3.1 PREPARATION

A. Verify measurements, dimensions, and shop drawing details before proceeding.
B. Coordinate location of studs, nailers, blocking, grounds and similar supports for attached Work.
C. Eliminate sharp projections which would puncture roofing, flashing or underlayment material.

3.2 ERECTION AND INSTALLATION

A. General:
   1. Provide treated material in accordance with appropriate AWPA standard for intended end use.
   2. Provide preservative treated material for all wood used:
      a. Outside building.
      b. Below grade.
   3. Provide fire-retardant treated material for all wood used:
      a. Inside building.
      b. Within exterior building walls.
      c. In roof construction.
      d. For roofing nailers.
B. Attach Work securely by anchoring and fastening as indicated or required to support applied loading.
   1. Provide washers under bolt heads and nuts.
   2. Fasten plywood in accordance with APA recommendations.
   3. Use galvanized nails and fasteners unless indicated otherwise.
      a. When anchoring treated wood material use appropriately treated fasteners for corrosion protection against the chemicals used in the wood treatment process.
   4. Use common wire nails or screws for general Work.
   5. Use fasteners of size that will not penetrate members where opposite side will be exposed to view or receive finish materials.
   6. Install fasteners without splitting of wood; pre-drill as required.
   7. Do not drive threaded friction type fasteners.
   8. Tighten bolts and lag screws at installation and retighten as required.
C. Set Work to required levels and lines, plumb, true.
   1. Shim as required.
   2. Cut and fit accurately.
D. Provide wood grounds, nailers, or blocking where required for attachment of other Work and surface applied items.
   1. Form to shapes indicated or required.
      a. Field treat cuts and holes in preservative and fire-retardant treated material in accordance with AWPA M4 and manufacturer's published recommendations.
         1) FRTM lumber:
            (a) Do not rip or mill.

(b) Cross-cutting and drilling are allowable in accordance with manufacturer's recommendations and UL requirements.
(c) Resurfacing, planing or fabrication of special shapes or profiles shall be done prior to treatment.
2) FRTM plywood:
(a) Cross-cutting, ripping and drilling are allowable in accordance with manufacturer's recommendations and UL requirements.
3) Light sanding as permitted by UL to remove raised grain or prepare for finishing is allowable.
2. Grounds:
a. Dressed, key beveled lumber minimum 1-1/2 IN wide of thickness required to bring face of ground even with finish material.
b. Remove temporary grounds when no longer required.
3. Install roofing nailers as indicated:
a. Install per roofing manufacturer's recommendations.
b. Match height of nailers to insulation.
c. Anchor nailers to resist force of 75 PLF unless required otherwise by roofing manufacturer.
1) Metal decking attachment:
(a) Attach base nailer to metal roof deck using self-tapping stainless steel sheet metal screws (STSMS) with plate washers or with minimum 3/8 IN Type 304 stainless steel hex head bolts with nuts and washers.
(b) Countersink heads of bolts flush with top of nailer.
(c) Provide size and spacing of STSMS as required to meet loading criteria specified.
(d) Provide spacing of minimum 3/8 IN hex head bolts as required to meet loading criteria specified.
2) Concrete decking attachment:
(a) Attach base nailer to concrete roof deck using minimum 3/8 IN stainless steel adhesive anchors with minimum 3 IN embedment.
(b) Countersink heads of bolts flush with top of nailer.
(c) Provide spacing of minimum 3/8 IN stainless steel adhesive anchors as required to meet loading criteria specified.
d. Provide 1/2 IN vent spaces between lengths of nailers.
e. Install nailers over vapor retarder where indicated.

E. Install wood furring plumb and level with closure strips at all edges and openings.
F. When wood has been exposed to moisture allow to completely dry out prior to covering with additional wood or another material.
G. Correct or replace wood which shows bowing, warping or twisting to provide a straight, plumb and level substrate for applications of other materials.

END OF SECTION

DIVISION 7

THERMAL AND MOISTURE PROTECTION

SECTION 07131

MULTIPLE COMPONENT BENTONITE WATERPROOFING

PART 1 GENERAL

1.1 SUMMARY

A. Related Sections:
   1. Section 03348 (Concrete Finishing and Repair of Surface Defects).

1.2 SUBMITTALS

A. Shop Drawings:
   1. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Jointing, sealing, and fastening details not shown on Drawings but required by the Project.
   2. Certification of Contractor and installer's approval by manufacturer.
   3. Manufacturer authorized representative written documentation of substrate acceptability.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Contractor and all installers working on the project must be approved in writing by manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Tremco Inc. "PARASEAL".
   2. Or Approved Equal.

2.2 MANUFACTURED UNITS

A. Waterproofing System for horizontal and vertical surfaces:
   1. Minimum 1 LB/SF of bentonite evenly distributed and laminated to 200 mil thick high density polyethylene.
      a. 4 FT x 24 IN rolls.
B. Accessory Items:
   1. As required by manufacturer.
C. Protection Board: 1 IN expanded polystyrene.

PART 3 EXECUTION

3.1 PREPARATION

A. Ensure that concrete has been cured in accordance with manufacturer's recommendations.
B. Remove free standing water, debris, and loose material.
C. Fill all voids, seal all penetrations, and remove all sharp fins and ridges.
D. Patch all voids in concrete in accordance with Section 03348 (Concrete Finishing and Repair of Surface Defects).

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
   1. Seal around all penetrations in accordance with manufacturer's recommendations.
   2. Provide all waterstops, panels, sealant, tubing, termination bars, fasteners and other accessories required for a watertight installation.
B. Avoid panel damage during pouring and vibrating of concrete for slab Work and during backfilling operations for wall Work.
C. Install protection board.

3.3 FIELD QUALITY CONTROL

A. Provide manufacturer-authorized representative to observe substrate prior to installation and instruct installer's personnel during application of system.
   1. Manufacturer's authorized representative shall provide written documentation that substrate has been inspected and is acceptable surface for installation of system.

3.4 PROTECTION

A. Protect panels as required from pre-hydration caused by precipitation or other construction activities.
B. Protect system from physical damage until backfilling is completed.
C. Repair or replace damaged or pre-hydrated materials in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 07162

DAMPPROOFING

PART 1 GENERAL

1.1 REFERENCES

A. ASTM D1227 Standard Specification for Emulsified Asphalt Used As a Protective Coating for Roofing

1.2 DEFINITIONS

A. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
B. Warranty.
C. Miscellaneous Submittals:
   1. Applicator qualifications.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Licensed or approved in writing by coating manufacturer.

1.5 WARRANTY

A. Provide written warranty signed jointly by applicator and manufacturer.
B. Warranty for period of five (5) years from date of acceptance by Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Dampproofing system:
      a. Karnak 83 or 86 - Karnak Chemical Corporation.
      b. Hydrocide 700 or 700B - Sonneborn.
      c. Sealmastic Type 2 or 3 - W. R. Meadows Inc.
      d. Or Approved Equal.

2.2 MATERIALS

A. Dampproofing:
   1. Fibrated asphalt emulsion coating for trowel, spray or brush application.
   2. Primer as recommended by coating manufacturer.

3. ASTM D1227, Type 1.

PART 3 EXECUTION

3.1 PREPARATION

A. Allow masonry and/or concrete to cure per manufacturer's recommendations.

3.2 APPLICATION

A. Install products in accordance with manufacturer's instructions.
B. Apply dampproofing to exterior face of exterior walls below grade where indicated as "DAMPPROOFING." Extend coating to finished grade line.
C. Apply two (2) coats each at manufacturer's recommended coverage rates.
D. Do not backfill for 48 HRS; however, backfilling is to be completed within seven (7) days of coating application.
E. Provide protection for coating during backfilling operation.
F. Repair any damage to coating caused prior to or during backfilling.
G. Remove coating from adjacent surfaces as required.

3.3 FIELD QUALITY CONTROL

A. Test wet film thickness and comply with listed manufacturer's recommended coverage rates.
   1. Apply additional material as required.

END OF SECTION

SECTION 07176

LIQUID WATER REPELLENT

PART 1 GENERAL

1.1 SUMMARY

A. Related Sections:
   1. Section 03348 (Concrete Finishing and Repair of Surface Defects)

1.2 SUBMITTALS

A. Shop Drawings:
   1. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   2. Miscellaneous Submittals:
      a. Field conducted water spray test results.
      b. Warranty.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Material must not inhibit the adhesion of future paint coatings.
B. Mock-Ups:
   1. Product shall be applied to mock-up erected under Division 03 (Concrete).

1.4 WARRANTY

A. Special Warranty:
   1. Provide manufacturer's standard five (5) year performance warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Liquid water repellent:
      a. L&M Construction Chemicals, Inc.
      b. Chemprobe Technologies, Inc.
      c. Hydrozo, Inc.
      d. Degussa.
      e. Or Approved Equal.

2.2 MATERIALS

A. Liquid Water Repellent:
   1. Clear, deep penetrating sealer formulated for sealing vertical concrete and brick surfaces.
      a. Water based, VOC compliant, odorless.
         1) VOC: less than 195 g/L.
      b. Non-yellowing, non-staining.

c. Provides both surface barrier and penetrating chemical action barrier.
2. Surface barrier shall protect against water intrusion, mildew, dirt and airborne contaminants.
3. L&M Construction Chemicals, Inc. "HYROPEL WB" or Approved Equal.

PART 3 EXECUTION

3.1 PREPARATION

A. Protection:
1. Protect adjacent surfaces not intended to be covered.

B. Surface Preparation:
1. Clean surfaces to be covered in accordance with manufacturer's recommendations.
2. Make all mortar repairs at least 48 HRS prior to application.
3. Cure concrete surfaces in accordance with manufacturer's recommendations.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
1. At a minimum apply material in accordance with manufacturer's recommended application rates using procedures and equipment recommended by manufacturer.
a. Apply two (2) coats of material.

B. Apply liquid water repellent to interior and exterior concrete.

3.3 FIELD QUALITY CONTROL

A. Site Tests:
1. Manufacturer or manufacturer's designated representative shall conduct a water spray test to an area of the mock-up wall specified in Section 03348 (Concrete Finishing and Repair of Surface Defects) for a period of 5 HRS.
a. Water from the spray shall impact the wall at a 45-degree angle to the vertical and shall cover an area of not less than 9 SF.
b. Water flow shall be minimum 5 gpm at 60 psi pressure.
c. If, within 5 HRS, moisture appears on the inside face of the wall within the test area, the wall shall be recoated.
2. Retest as required.
3. Recoat as required until wall area remains dry within limits of testing procedure.
4. Results of this test shall be used to determine material quantity in excess of manufacturer's minimum recommended amounts to be applied per square foot to the building surface.
5. Protect adjacent materials not required to be coated.

END OF SECTION

SECTION 07900

JOINT SEALANTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sealing all joints which will permit penetration of dust, air or moisture, unless sealing Work is specifically required under other Sections.
      a. Work may include the following:
         1) Wall joints.
         2) Isolation joints.
         3) Concrete construction, control and expansion joints, exterior and interior.
         4) Joints at penetrations of walls, floors and decks by piping and other services and equipment.
         5) Sealing of plumbing fixtures to floor or wall.
         6) Sealing around piping, duct or conduit penetrations through roof, floors, interior and exterior walls.
         7) Other joints where calking, sealant, expanding foam sealant or compressible sealant is indicated.

1.2 REFERENCES

A.	ACI 302.1R	Guide for Concrete Floor and Slab Construction
B.	ASTM C920	Standard Specification for Elastomeric Joint Sealants
C.	ASTM C1521	Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints
D.	NSF 61	Drinking Water System Components – Health Effects.

1.3 DEFINITIONS

A. "Caulk(ing)," "calk(ing)," and "sealant": Joint sealant Work.
B. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.
C. Finish sealant: Sealant material per this Specification applied over face of compressible sealant or expanding foam sealant specified, to provide a finished, colored sealant joint.
D. Defect(ive): Failure of watertightness or airtightness.
E. Interior wet areas: Entire area is considered wet.
F. “Seal,” “sealing” and “sealant”: Joint sealant Work.

1.4 SUBMITTALS

A. Product Data:
   1. Acknowledgement that products submitted meet requirements of standards referenced.
   2. Manufacturer's installation instructions.
   3. Manufacturer's recommendations for joint cleaner, primer, backer rod, tooling and bond breaker.
B. Shop Drawings:

C. Samples:
   1. Cured sample of each color for Owner's color selection.
   2. Color chart not acceptable.
D. Quality Assurance/Control Submittals:
   1. Test Results:
      a. Provide adhesion test results for each sealant sample providing adhesion results compared to adhesion requirements.
      b. Manufacturer's authorized factory representative recommended remedial measure for all failing tests.
   2. Certification from sealant manufacturer stating product being used is recommended for and is best suited for joint in which it is being applied.

1.5 QUALITY ASSURANCE

A. Mock-Ups:
   1. Before sealant Work is started, a mock-up of each type of joint shall be sealed where directed by the Owner.
      a. The approved mock-ups shall show the workmanship, bond, and color of sealant materials as specified or selected for the Work and shall be the minimum standard of quality on the entire project.
      b. Each sample shall cure for a minimum of seven (7) days at which time the sealant manufacturer’s authorized factory representative shall perform adhesion tests on each sample joint.
         1) Perform adhesion tests per ASTM C1521.
         2) If mock-up is not acceptable or if adhesion test fails, provide additional mock-up and adhesion testing as required until acceptable to Owner.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver material in manufacturer's original unopened containers with labels intact: Labels shall indicate contents and expiration date on material.

1.7 WARRANTY

A. Material and Labor Warranty:
   1. Sealant Work free of defects for a period of three (3) years from date of Final Acceptance.
   2. Remove any defective Work or materials and replace with new Work and materials.
   3. Warranty signed jointly by Applicator and sealant manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Polyurethane sealants:
      a. Pecora.
      b. Sika Chemical Corp.
      c. BASF Sonneborn.
      d. Tremco.
      e. Or Approved Equal.
   2. Silicone sealants:
      a. ChemLink.

b. GE Construction Sealants.
c. Dow Corning.
d. Tremco.
e. Or Approved Equal.

3. Compressible sealant:
   a. Polytite Manufacturing Corporation.
   b. Emseal.
   c. Norton.
   d. Sandell.
   e. Or Approved Equal.
4. Polysulfide rubber sealant:
   a. Pecora.
   b. BASF Sonneborn.
   c. PolySpec.
   d. Or Approved Equal.
5. Polyether sealants:
   a. BASF Sonneborn.
   b. ChemLink, Inc.
   c. Or Approved Equal.
6. Expanding foam sealant:
   a. Macklanburg Duncan.
   b. Convenience Products.
   c. FAI International, Inc.
   d. Or Approved Equal.
7. Polyurea joint filler:
   a. Dayton Superior Specialty Chemical Corporation.
   b. Euclid Chemical Co.
   c. L & M Construction Chemicals, Inc.
   d. BASF Sonneborn.
   e. Or Approved Equal.
8. Backer rod, compressible filler, primer, joint cleaners, bond breaker: As recommended by sealant manufacturer.

2.2 MATERIALS

A. Sealants - General:
   1. Provide colors matching materials being sealed.
   2. Where compound is not exposed to view in finished Work, provide manufacturer's color which has best performance.
   3. Nonsagging sealant for vertical and overhead horizontal joints.
   4. Sealants for horizontal joints: Self-leveling pedestrian/traffic grade.
   5. Joint Cleaner, Primer, Bond Breaker: As recommended by sealant manufacturer.
   6. Sealant Backer Rod and/or Compressible Filler:
      a. Closed cell polyethylene, polyethylene jacketed polyurethane foam, or other flexible, nonabsorbent, nonbituminous material recommended by sealant manufacturer to:
         1) Control joint depth.
         2) Break bond of sealant at bottom of joint.
         3) Provide proper shape of sealant bead.
         4) Serve as expansion joint filler.

B. Compressible Sealant:
   1. Size so that width of material is twice joint width.
   2. Foamed polyurethane strip saturated with polymerized polybutylene waterproofing coated on front face with nonreactive release agent that will act as bond breaker for applied sealant.
      a. Polytite Manufacturing Corp. "Polytite-B" or Approved Equal.
   3. Fire rated where required.
   4. Adhesive: As recommended by sealant manufacturer.
C. Expanding Foam Sealant:
   1. One (1) or two (2) component fire rated moisture cured expanding urethane.
   2. Shall not contain formaldehyde.
   3. Density: Minimum 1.5 pcf.
   4. Closed cell content: Minimum 70 percent closed cell content.
   5. R-value minimum 5.0/IN.
   6. Flame spread: Less than 25.
   7. Smoke developed: Less than 25.
D. Polysulfide Rubber Sealant:
   1. One (1) or two (2) component.
   2. Meet ASTM C920.
      a. Pecora Synthacalk GC2+.
      b. Sonneborn - Sonolastic - two-part polysulfide sealant.
      c. Morton Polymer Systems - Thiokol Sealants.
      d. Or Approved Equal.
E. Polyether Sealant:
   1. Silyl-terminated polyether polymer.
   2. ASTM C920, type S, Grade NS, Class 50, Use NT, M, A, and O.
      a. BASF Sonneborn Sonolastic 150 with VLM Technology.
      b. ChemLink DuraLink.
      c. Or Approved Equal.
F. Polysulfide Rubber Sealant:
   1. One (1) or two (2) component.
   2. Meet ASTM C920.
      a. Pecora Synthacalk GC2+.
      b. BASF Sonneborn – Sonolastic Polysulfide Sealant.
      c. PolySpec THIOKOL 2235.
      d. Or Approved Equal.
G. Polyurea Joint Filler:
   1. Two (2) component, semi-rigid material for filling control, sawcut and construction joints in interior concrete floors.
      a. Dayton Superior Specialty Chemical Corp. "Joint Fill, Joint Seal, Joint Saver II" as required for condition and recommended by manufacturer.
      b. Euclid Chemical Co. "EUCO QWIK" joint.
      c. L & M Construction Chemicals, Inc. "Joint Tite 750".
      d. BASF Sonneborn "TF-100" control joint filler.
      e. Or Approved Equal.
   2. Comply with ACI 302.1R performance recommendations regarding control and construction joints.
   3. Color: Gray.

H. Polyurethane Sealant:
   1. One (1) or two (2) components.
   2. Paintable.
   3. Meet ASTM C920 type S or type M, Grade NS or P, Class 25, Use NT, T, M, A and O.
      a. Pecora Dynatrol-IXL, Dynatrol II, Urexpan NR-200, NR-201.
      b. Sika Chemical Corporation Sikaflex-1a, Sikaflex-2C NS/SL.
      c. BASF Sonneborn Sonolastic NP-1, NP-II, SL-1 SL-2.
      d. Tremco Dymonic or Dymeric, Vulkem 116,227,45, 245.
      e. Or Approved Equal.
I. Silicone Sealant:
   1. One (1) component.
   2. Meet ASTM C920, Type S, Grade NS, Class 25, Use NT, G, A, O.
      a. ChemLink: DuraSil.
      b. General Electric: Silpruf, Silglaze II.
      c. General Electric: Sanitary 1700 sealant for sealing around plumbing fixtures.
      d. Dow Corning: 786 for sealing around plumbing fixtures.
      e. Dow Corning: 790, 795.
      f. Tremco: Spectrem 1, Spectrem 3, Tremsil 600.
      g. Or Approved Equal.
   3. Mildew resistant for sealing around plumbing fixtures.

PART 3 EXECUTION

3.1 PREPARATION

A. Before use of any sealant, investigate its compatibility with joint surfaces, fillers and other materials in joint system.
B. Use only compatible materials.
C. Where required by manufacturer, prime joint surfaces.
   1. Limit application to surfaces to receive calking.
   2. Mask off adjacent surfaces.
D. Provide joint depth for joints receiving polyurea joint filler in accordance with manufacturer's recommendations.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions and UL requirements.
B. Clean all joints.
C. Make all joints water and airtight.
D. Make depth of sealing compounds, except expanding foam and polyurea sealant, not more than one-half width of joint, but in no case less than 1/4 IN nor more than 1/2 IN unless recommended otherwise by the manufacturer.
E. Provide correctly sized backer rod, compressible filler or compressible sealant in all joints to depth recommended by manufacturer:
   1. Take care to not puncture backer rod and compressible filler.
   2. Provide joint backer rod as recommended by the manufacturer for polyurea joint filler.
F. Apply bond breaker where required.
G. Tool sealants using sufficient pressure to fill all voids.
H. Upon completion, leave calking with smooth, even, neat finish.
I. Where piping, conduit, ductwork, etc., penetrate wall, seal each side of wall opening.

J. Install compressible sealant to position at indicated depth.
   1. Size so that width of material is twice joint width.
   2. Take care to avoid contamination of sides of joint.
   3. Protect side walls of joint (to depth of finish sealant).
   4. Install with adhesive faces in contact with joint sides.
   5. Install finish sealant where indicated.

K. Install expanding foam sealant to minimum 4 IN depth or thickness of wall being penetrated if less than 4 IN or as indicated on drawings.
   1. Provide adequate fire rated backing material as required.
   2. Hold material back from exposed face of wall as required to provide backer rod and finish sealant.
      a. Allow expanding foam sealant to completely cure prior to installing backer rod and finish sealant.
   3. Material shall be minimum of 70 DegF prior to and during installation.
   4. Trim off excess material flush with surface of the wall if not providing finished sealant.

3.3 FIELD QUALITY CONTROL

A. Adhesion Testing:
   1. Perform adhesion tests in accordance with ASTM C1521 per the following criteria:
      a. Water bearing structures: One (1) test per every 1000 LF of joint sealed.
      b. Exterior precast concrete wall panels: One (1) test per every 2000 LF of joint sealed.
      c. Chemical containment areas: One (1) test per every 1000 LF of joint sealed.
      d. Building expansion joints: One (1) test per every 500 LF of joint sealed.
      e. All other type of joints except butt glazing joints: One (1) test per every 3000 LF of joint sealed.
      f. Manufacturer's authorized factory representative shall recommend, in writing, remedial measures for all failing tests.

3.4 SCHEDULE

A. Furnish sealant as indicated for the following areas:
   1. Exterior areas:
      a. Above grade: Polyether Polyurethane.
      b. Below grade: Polyurethane.
   2. Interior areas:
      a. Noncorrosive areas:
         1) Wet exposure: Polyether Polyurethane.
         2) Dry exposure: Polyether Polyurethane, unless noted otherwise.
            (a) Sound insulated construction: Acoustical sealant.
      b. Sealant exposed to or having the potential of being exposed to concentrated chlorine gas or chlorine liquid: Polysulfide.
      c. Casework, countertops and solid surface materials: Silicone.
         1) Sinks, fixtures or other areas subject to potential splash, spillage or condensation: Mildew Resistant Silicone.
   3. Immersion:
      a. Prolonged contract with or immersion in:
         1) Potable water:
            (a) Polysulfide.
            (b) NSF 61 approved.
         2) Nonpotable water, wastewater or sewage: Polysulfide.

4. Exterior wall penetrations: Expanding urethane foam, with finish sealant.
   a. Finish sealant:
      1) Exterior side:
         (a) Above grade: Polyether.
         (b) Below grade: Polyurethane.
      2) Interior side:
         (a) Noncorrosive area:
            (i) Wet exposure: Polyether Polyurethane.
            (ii) Dry exposure: Polyether Polyurethane, unless noted otherwise.
         (b) Corrosive area:
            (i) Wet exposure: Polysulfide.
            (ii) Dry exposure: Polyurethane.

END OF SECTION

DIVISION 8

DOORS AND WINDOWS

SECTION 08220

FIBERGLASS REINFORCED PLASTIC (FRP) DOORS AND FRAMES, ALUMINUM FLOOD GATE, AND SECURITY GATES

PART 1 GENERAL

1.1 SUMMARY

A. Related Sections:
   1. Section 08700 (Finish Hardware).

1.2 REFERENCES

A.	ASTM A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
B.	DHI/ANSI A115.1	Preparation of Mortise Locks in 1-3/8 IN and 1-3/4 IN Standard Doors and Frames
C.	SDI 117	Manufacturing tolerances Standard Steel Doors and Frames

1.3 DEFINITIONS

A. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project Site.
   2. Installer and applicator are synonymous.

1.4 SUBMITTALS

A. Product Data:
   1. Acknowledgement that products submitted meet requirements of standards referenced.
   2. Manufacturer's installation instructions.
B. Shop Drawings:
   1. Schedule of doors, gates and frames specific to this Section, using same reference numbers as used on Drawings.
C. Samples:
   1. Provide one (1) 6 x 6 IN sample of frame and one (1) 6 x 6 IN sample of standard door specified. Provide standard color chips for Owner's color selection.
      a. Frame sample shall show corner construction.
      b. Door sample shall show core specified and reinforcing construction.
D. Installation, Operation, and Maintenance Manual:
E. Miscellaneous Submittals:
   1. Warranty.
F. Certifications:
   1. Certification that doors and frames have been protected against chemical exposures listed.
   2. UL certification for fire rated doors and frames.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Doors and frames shall be fabricated and prepared for hardware by single manufacturer except for fire rated frames.

2. All door hardware is to be provided per Section 08700 (Finish Hardware).

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store doors and frames in a dry, weather protected area.
   1. Place units on wood skids providing a minimum 6 IN air space above the ground.
   2. Do not store units flat, set frames and doors on edge providing a minimum 1/2 IN air circulation space between each unit.
   3. Provide covering which will ensure air flow around each unit to prevent trapping moisture.
   4. If door wrapper becomes wet, remove immediately and provide dry protection equivalent to wrapper removed.
B. Storage recommendations by unit manufacturer shall take precedence over the above requirements.

1.7 WARRANTY

Warranty all FRP components to be free of defects in materials and workmanship for one (1) year and from degradation or failure due to corrosion for minimum of five (5) years from date of Final Acceptance.
   1. Warranty against door warpage of more than 1:100 when measured diagonally across the door.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. FRP doors and frames:
      a. Corrin Company.
      b. Tiger Door FRP.
      c. Simon.
      d. Or Approved Equal.
   2. Hinged flood gate with pneumatic seals:
      a. Prespray.
      b. Or Approved Equal.
   3. Security gates:
      a. Custom fabricate as shown on drawings.

2.2 MATERIALS

A. Face Panel: Fiberglass reinforced plastic.
B. Supports and Reinforcing:
   1. Non-swelling polymer or equivalent non-corrosive material.
   2. Or Approved Equal.
C. Inserts, Bolts and Fasteners: Stainless steel.
D. Core:
   1. Non-fire rated:
      a. Rigid, end grain balsa.
      b. Thickness: Minimum 1-1/2 IN.
      c. Density: 8.5 - 9.0 pcf.
      d. Compressive strength: Minimum 1400 psi.

E. Frames:
   1. Non-fire rated: Fiberglass reinforced plastic.

2.3 ACCESSORIES

A. Frame Anchors:
   1. Jamb anchors in masonry: 9 GA steel, masonry wire anchor, galvanized per ASTM A153, G60 coating.
   2. Floor anchors: 12 GA steel, galvanized per ASTM A153, G60 coating.
   3. Anchors in existing openings: Stainless steel machine screws and stainless steel expansion shield.

2.4 FABRICATION

A. General:
   1. Fabricate rigid, neat in appearance and free from defects.
   2. Form to sizes and profiles indicated on Drawings.
      a. Sizes indicated in DOOR SCHEDULE are nominal.
      b. Refer to Architectural details for actual conditions affecting actual size of rough openings.
   3. Fit and assemble in shop wherever practical.
   4. Mark Work that cannot be fully assembled in shop to assure proper assembly at Site.
   5. For door frames, all surfaces, both exposed and concealed, shall be gel coated to prevent acid attack of the glass reinforcing.
   6. Fabricate doors and frames to tolerance requirements of SDI 117.
   7. Fit doors to SDI clearances.
   8. Provide fire doors which are approved and labeled by UL.
   9. Doors shall be fabricated to withstand splash and spillage attack from the following chemicals for a period of 8 HRS.
      a. Sodium hydroxide 25 percent concentration.

B. FRP Doors:
   1. General:
      a. Construction:
         1) 1-3/4 IN thick, minimum.
         2) Face sheets, 0.125 IN thick, minimum.
         3) Fabricate with flush top closure.
         4) Doors with a maximum size of 48 IN wide x 96 IN tall shall be fabricated in one (1) piece.
         5) Fill and dress all joints.
         6) Resin: Polyester or vinyl ester as required to meet chemical resistance requirements.
         7) Fiberglass content (by weight): Minimum 30 percent, maximum 40 percent.
         8) UV stabilized.
         9) Core:
            (a) End grain balsa for non-fire rated doors.
            (b) Mineral core for fire rated doors.
      b. Finish:
         1) Minimum 15 mil gel coat thickness.
         2) Gel coat color per 1.4 c.
   2. Exterior:
      a. SDI Grade III, Model 4, seamless.

1) Face sheet 0.125 IN thickness.
3. Interior:
   a. SDI Grade II, Model 4, seamless with Balsa core.

C. Frames:
1. General:
   a. Frame size to be 2 IN x 5-3/4 IN with equal rabbets on each side.
   b. One (1) piece or if shipped knocked down, all joints shall be filled with fiberglass compound, ground and sanded smooth and finished with gel coat.
   c. Minimum thickness: 0.1875 IN.
   d. Resin: Polyester or vinyl ester as required to meet chemical resistance requirements.
   e. Fiberglass content (by weight): Minimum 30 percent, maximum 40 percent.
   f. UV stabilized.
2. FRP frames:
   a. Corner reinforcement: Minimum 4 x 4 x 0.25 IN FRP angle attached to top reinforcing bar with concealed stainless steel screws.
   b. Hinge reinforcement: Minimum 0.25 IN thick polymer plate attached to frame.
   c. Minimum 0.25 IN thick polymer plate reinforcement bonded and mechanically fastened to frame for strikes, closers and surface-mounted hardware.

D. Prepare for finish hardware in accordance with hardware schedule, templates provided by hardware supplier, and DHI/ANSI A115.1.
1. Locate finish hardware in accordance with SDI.
2. See Specification Section 08700 (Finish Hardware) for hardware.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install doors and frames, in accordance with SDI and manufacturer's instructions.
1. Manufacturer's instructions take precedent over SDI.

B. Place frames prior to construction of enclosing walls and ceilings.
C. Plumb, align, and brace securely until permanently anchored.
D. After completion of walls, remove temporary braces and spreaders.
E. Use plastic plugs to keep silencer holes clear during construction.
F. Immediately after erection, repair damaged areas of gel coat.
1. Fill corner miter joints with fiberglass compound as recommended by frame manufacturer.
   a. Filling miter joints with sealant is not acceptable.
2. Sand filled area to match adjacent frame and coat with minimum 15 mil gel coating to match adjacent frame finish.

G. On doors not requiring weatherstripping, sound seals or smoke seals, install three (3) silencers on strike jamb of single door frame and two (2) on head of double door frame.
H. Number and location of anchors shall be in accordance with frame manufacturer's recommendation with minimum of three (3) anchors per jamb.
I. Protect frames during construction.
J. Cover all thru bolts and other stainless steel accessories with minimum 15 mil gel coating to match door frame.

3.2 FIELD QUALITY CONTROL

A. Provide for services of manufacturer's authorized representative to be present during and observe the installation of the first three (3) doors and frames.
   1. If project has less than three (3) doors and frames, manufacturer's authorized representative shall be present for installation of all doors and frames.
   2. Manufacturer's representative shall instruct installer on proper methods for installing doors and frames, repairing damaged gel coating, repairing scratches in finish and filling and finishing all joints.

END OF SECTION

SECTION 08310

ACCESS HATCHES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Floor hatch.

1.2 REFERENCES

A. ASTM A666 — Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

1.3 DEFINITIONS

A. Heavy Duty: Will support live load of 300 psf.
B. Traffic-Rated: Will support AASHTO H-20 wheel load with a maximum deflection of 1/150th of the span. Manufacturer to provide structural calculations stamped by a registered professional engineer. (Note: For installation in an off-street location where not subject to high density, fast moving traffic.)

1.4 SUBMITTALS

A. Product Data:
   1. Acknowledgement that products submitted meet requirements of standards referenced.
   2. Manufacturer's installation instructions.
   3. Engineering calculations.

1.5 WARRANTY

A. Provide manufacturer's standard warranty: materials shall be free of defects in material and workmanship for a period of (25) twenty-five years from the date of Substantial Completion. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Heavy-Duty and Traffic-Rated Floor Doors:
   1. Bilco Company.
   2. Babcock Davis Associates.
   3. Dur-Red Products.
   4. Halliday Products.
   5. USF Fabrication Inc.
   6. Or Approved Equal.

2.2 MANUFACTURED UNITS

A. All access doors shall be provided by the same manufacturer when possible.
B. Floor Doors (Heavy Duty) and Traffic-Rated:
   1. Frame: 1/4 IN mill finished aluminum.
   2. Bituminous coated where in contact with concrete.

3. Cover: 1/4 IN mill finished diamond plate aluminum. For traffic-rated cover provide reinforcing as required to comply with AASTO HS-20 loading.
4. Hinges: Shall be specifically designed for horizontal installation and shall be through bolted to the cover with tamperproof type 316 stainless steel lock bolts and shall be through bolted to the frame with Type 316 stainless steel bolts and locknuts.
5. All hardware: Stainless steel.
6. Grip handle: Vinyl.
7. Fabricate frame with built-in neoprene cushion and strap anchors bolted to exterior.
8. Reinforce cover with aluminum stiffeners.
9. Fabricate doors to open to 90 degrees with assistance of spring operators and automatically lock into open position.
10. Furnish with slam lock and removable key handle.
11. Size(s): Refer to drawings.
12. Bilco J-AL (heavy duty), J-ALH-20 (traffic rated) or Approved Equal.

2.3 ACCESSORIES

A. Load Rating Plates:
1. Minimum 18 GA Type 316 stainless steel, ASTM A666.
2. Engraved with maximum design live load allowed for unit on which it will be mounted.
3. Load shall be displayed in English units as well as metric units.
4. Size as required for text as needed.
5. Text:
   a. Font: Helvetica Narrow, all caps.
   b. Size: 1/4 IN height.
   c. Depth of engraving: 3 mils.
6. Finish:
   a. Text:
      1) Black epoxy baked on paint.
      2) Plate to have finish conductive to paint application.
   b. Entire plate shall be coated with baked on clear coat on front and back side.
7. Attach to top of all floor, and H-20 loading access doors using stainless steel screws in location determined by manufacturer.
   a. Provide a neoprene gasket under the plate to separate the stainless steel from the aluminum cover or frame.

B. Ladder Safety Post:
1. Provide permanent-mount type telescoping safety posts for installation at access door ladders. Posts shall be ladder up type by Bilco, or Approved Equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

3.2 SCHEDULES

A. See drawings.

END OF SECTION

SECTION 08700

FINISH HARDWARE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Finish Hardware
   2. Inspection and testing of door operation.
B. Related Sections:
   1. Section 05525 (Steel Railings).
   2. Section 08130 (Stainless Steel Doors and Frames).

1.2 REFERENCES

A. ANSI/BHMA A156.1 Butts and Hinges.
B. ANSI/BHMA A156.6 Architectural Door Trim.
C. ANSI/BHMA A156.8 Door Controls – Overhead Stops and Holders.
D. ANSI/BHMA A156.13 Mortise Locks and Latches Series 1000.
E. ANSI/BHMA A156.16 Auxiliary Hardware.
F. ANSI/BHMA A156.18 Materials and Finishes.
G. NFPA 101 Life Safety Code.

1.3 DEFINITIONS

A. AHC: Architectural Hardware Consultant, certified by DHI.
B. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.
C. All weather: Capable of operation from -50 to +120 DegF.
D. Active Leaf: Right-hand leaf when facing door from keyed side unless noted otherwise on Drawings.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Qualifications:
      a. AHC certification.
      b. No submittals will be reviewed until Owner has received AHC certification.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   3. Schedule of all hardware being used on each door.
      a. Number hardware sets and door references same as those indicated on Drawings.
   4. Technical data sheets on each hardware item proposed for use.
   5. Warranty information for all hardware devices having extended warranties.

B. Miscellaneous Submittals:
   1. Certification from AHC stating all door hardware has been provided per approved Shop Drawings, has been installed in accordance with manufacturer's recommended installation instructions and all doors have been inspected and tested and found to be in proper working order.
      a. Door assemblies required to swing in the direction of egress have been inspected and tested in accordance with NFPA 101.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. All door hardware shall be provided by a single hardware supplier.
      a. Hardware is to be provided under this Section 08700, unless noted otherwise, for doors specified in:
         1) Section 05525 (Steel Railings).
         2) Section 08130 (Stainless Steel Doors and Frames).
   2. Installation shall be inspected by a certified Architectural Hardware Consultant (AHC).

1.6 WARRANTY

A. Special Warranty:
   1. Provide all individual manufacturers' extended warranties as advertised.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Locksets and latchsets:
      a. Corbin/Russwin.
      b. Best Access Systems.
      c. Or Approved Equal.
   2. Hinges:
      a. Stanley Works.
      b. Hager Hinge Co.
      c. McKinney Manufacturing Co.
      d. Or Approved Equal.
   3. Door stops and holders:
      a. Trimco.
      b. Rockwood.
      c. Ives.
      d. Or Approved Equal.
   4. Door bolts, strikes:
      a. Ives.
      b. Trimco.
      c. Hager.
      d. Rockwood.
      e. Dorma.
      f. Or Approved Equal.
   5. Other materials: As noted.

2.2 MATERIALS

A. Fasteners: Stainless steel or aluminum.
B. Kickplates:
   1. Stainless steel.
C. Keys: Brass or bronze.
D. Pulls and Push Plates: Stainless steel.
E. Silencers: Rubber.

2.3 ACCESSORIES

A. Strikes:
   1. Curved lips.
      a. Extended lips when required.
   2. Provide strike boxes.
   3. Appropriate for function and hardware listed.

2.4 FABRICATION

A. Hardware - General:
   1. Generally prepare for Phillips head machine screw installation.
   2. Exposed screws to match hardware finish or, if exposed in surfaces of other work, to match finish of other work as closely as possible.
   3. Provide concealed fasteners unless thru bolted.
   4. Through bolt closers on all doors.
   5. Furnish items of hardware for proper door swing.
   6. Furnish lock devices which allow door to be opened from inside room without a key or any special knowledge.
B. Hardware:
   1. Provide integral knurling on lever for doors.
   2. Provide following ANSI/BHMA A156.18 finishes:
      a. Locksets, latchsets and strikes: 630.
      b. Door pulls, push bars, push plates: 630.
      c. Kickplates:
         1) Stainless steel: 630.
      d. Butt hinges: 630.
      e. Door stops, dead locks, mortise bolts, and miscellaneous hardware: 630 if available, 626 if 630 not available.
C. Mortise Locks and Latches:
   1. ANSI/BHMA A156.13, Series 1000, Operational Grade 1, Security Grade 1.
      a. Meet requirements of ADA.
   2. Antifriction two-piece mechanical latchbolt with stainless steel anti-friction insert.
      a. One-piece stainless steel deadbolt, minimum 1-1/4 IN x 9/ 16 IN thick with 1 IN throw.
      b. 2-3/4 IN backset.
      c. Cylinder: Brass, 6 pin, with interchangeable core.
      d. ADA compliant thumb turn lever.
   3. Locking, latching and retracting mechanism and lock case:
      a. Steel, unless noted otherwise.
         1) Chrome or zinc dichromate plated.
   4. Trim design: Corbin/Russwin "NSP" or Approved Equal.

a. Functions as indicated in following table in accordance with ANSI/BHMA A156.13.
   1) All electric lock hardware to be 24 Vdc.

MORTISE LOCK NUMBERS		
ANSI	FUNCTION	CORBIN/RUSSWIN or Approved Equal
F13	Entrance or Office	ML2065

5. Lockset guard. Per drawings.

D. Hinges:
1. Butt hinges:
   a. ANSI/BHMA A156.1.
      1) A5111: Stainless steel, full-mortise, anti-friction bearing, Grade 1.
   b. Ball bearing.
   c. Flat button tips.
   d. Butt hinges:
      1) Hager BB1199.
      2) McKinney T4B3386.
      3) Or Approved Equal.
   e. Transfer hinge:
      1) Hager BB1199ETW.
      2) McKinney T4B3386CC.
      3) Or Approved Equal.
   f. Hinge size:
      1) Doors up to and including 46 IN wide: 4.5 IN x 4.5 IN.
      2) Doors over 46 IN up to and including 60 IN wide: 5 IN high x 4.5 IN.

E. Door Stops:
1. ANSI/BHMA A156.16.
   a. Wall stops: Ives WS406-CVX or WS406-CCV.

F. Overhead Door Holders/Stop:
1. ANSI/BHMA A156.8.
2. Provide 'hold-open' function on all stops unless noted otherwise.
   a. Do not provide ‘hold-open’ function at fire rated doors.
3. Surface mounted stops: Rockwood N14400 Series or Glynn Johnson 90 Series or Approved Equal.
4. Concealed stops: Rockwood N11000 Series or Glynn Johnson 100 Series or Approved Equal.

G. Kickplates:
1. ANSI/BHMA A156.6.
2. 8 IN high x 2 IN less than door width.
3. Beveled on all edges.
4. Thickness:
   a. Stainless steel: 0.050 IN.

H. Silencers:
1. Hollow metal frames: Trimco 1229A or Rockwood 608 or Approved Equal..
2. Self-adhesive silencers are not acceptable.

I. Keying:
1. Establish keying with Owner.

a. Provide and set up complete visible card indexed system with key tags and control slips.
b. Tag and identify keys.
c. Provide two (2) keys for each lock or cylinder.
d. Master key and key in groups as directed.
e. Provide construction master keys for all exterior doors.

J. Bolts:
1. ANSI/BHMAA 156.16.
2. Surface bolts: Ives SB1640 Series or Approved Equal with top and bottom strikes.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's installation instructions, supervised or inspected by an AHC.
B. Provide all hardware in accordance with Building Code.
C. Fit hardware before final door finishing.
D. Permanently install hardware after door finishing operations are complete.
E. Use SDI mounting heights for hardware.
F. Butt Hinges:
1. Provide non-removable pin (NRP) at:
a. Exterior doors.
b. Reverse handed doors equipped with locks.
2. Quantities:
a. Door height 61-90 IN: Three (3).
b. Door height 91-114 IN: Four (4).
c. Door height 115-144 IN: Five (5).
d. Doors over 48 IN wide and over 96 IN high:
1) Provide top butt hinge within 6 IN of the top of the door to top of hinge.
2) Provide one (1) additional butt hinge approximately 6 IN below the bottom of the top butt hinge.
3. Provide transfer hinge as necessary where electrified lockset or exit device is specified or as otherwise indicated in Hardware Schedule.
G. Provide coordinator when required by hardware specified.
H. Overhead Stops:
1. Provide overhead stop when corrosion resistant closer is specified.
2. Provide concealed overhead stop on doors scheduled to receive closer mounted on pull side of door.
3. Provide at interior doors not scheduled to receive a closer as follows:
a. Doors that swing more than 105 degrees without encountering a wall or obstruction.
1) Stop shall limit swing of door from impacting wall or obstruction.
b. Inactive leafs of pairs of doors.
I. Wall Mount Door Stops:
1. Provide where specifically indicated on Hardware Schedule and at doors not otherwise indicated to receive:
a. Overhead stop.
b. Closer with integral stop.
J. Floor mounted stops are not acceptable unless noted otherwise in this Section 08700.

K. Provide silencers for door frames.
   1. Stainless steel frames: See Section 08130 (Stainless Steel Doors and Frames).
L. Mount kickplates on push side of doors.

3.2 FIELD QUALITY CONTROL

A. Inspection:
   1. AHC shall inspect and test door assemblies and provide written certification that door assemblies are in proper working order.
      a. Door assemblies required to swing in the direction of egress shall be inspected and tested in accordance with NFPA 101.

3.3 ADJUSTING

A. Adjust and check each operating item of hardware to assure proper operation or function.
   1. Lubricate moving parts with lubricant recommended by manufacturer.
B. During week prior to startup, make a final check and adjustment of all hardware items.
   1. Clean and lubricate as necessary to assure proper function and operation.

3.4 SCHEDULES

A. Hardware Schedule:

HW-1: Butt Hinges
Lockset F13
Stop
Kickplate

END OF SECTION

SECTION 08800

OBSERVATION WINDOWS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Factory fabricated underwater viewing windows and glazing.
B. Related Sections:
   1. Section 07900 (Joint Sealants).

1.2 REFERENCES

A. ANSI Z97.1	Glazing Materials Used in Buildings – Safety Performance Specifications and Methods of Test
B. ASTM C1036	Standard Specification for Flat Glass
C. ASTM C1048	Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass
D. Consumer Product Safety Commission (CPSC) 16	Safety Standard for Architectural Glazing Materials

1.3 DEFINITIONS

A. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   2. Installer and applicator are synonymous.
B. Safety Glazing: Glazing meeting the requirements of the Building Code and CPSC 16 CFR 1201.
C. Other terms as identified in CSPC 16 CFR 1201.
D. Underwater Window System:
   1. A glazing system for exhibit space intended for viewing water environment.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Submit engineered calculations for windows based on water depth of final installed units.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Shop drawings.

1.5 WARRANTY

A. Provide manufacturer’s standard 20 year product warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Underwater window system:
      a. Reynolds Polymer Technology.
      b. Holland Aqua Sight.
      c. Hydrosight Corp.
      d. Or Approved Equal.
   2. Gaskets, glazing compounds, setting blocks, spacers, sealant, sealant tape, etc., as recommended by glass manufacturer, glass unit fabricator, or as required by NFPA.

2.2 MATERIALS

A. Laminated Safety Glass:
   1. Thickness, strength and frame as indicated on the drawings.
   2. Clear.
B. Glazing Compounds:
   1. Manufacturer's recommendation.
C. Gaskets:
   1. Manufacturer's recommendation.
D. Setting Blocks and Spacers as needed per manufacturer.
E. Shims, Clips, Springs, Angles, Beads, Attachment Screws and Other Miscellaneous Items: As required by condition.
F. Frames:
   1. Fabricate frames of low carbon stainless steel, type 304 or 316.
   2. Provide frame with integral anchoring tabs for rigid attachment to wall structure.
G. Seals:
   1. Provide manufacturer standard polymeric sealant to ensure a completely watertight installation.
H. Windows shall be fully assembled at the factory, sealed, and shipped ready for field installation.

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide safety glazing in all locations where required by CPSC 16 CFR 1201.
B. Install in accordance with recommendations of manufacturer, GANA Glazing Manual and IGMA TM-3000.
C. Install setting blocks in adhesive or sealant.
D. Install spacers as recommended by manufacturer.
E. See Section 07900 (Joint Sealants) for sealants.

3.2 FIELD QUALITY CONTROL

A. Do not install glass with edge damage.
B. Do not apply anything to surfaces of glass.
C. Remove and replace damaged glass.

3.3 CLEANING

A. Maintain glass reasonably clean during construction, so that it will not be damaged by corrosive action and will not contribute to deterioration of other materials.
B. Wash and polish glass on both faces not more than seven (7) days prior to acceptance of work in each area.
   1. Comply with glass manufacturer's recommendations.

END OF SECTION

DIVISION 9

FINISHES

SECTION 09905

PAINTING AND PROTECTIVE COATINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Painting and protective coatings.
   2. Minimum surface preparation requirements.
   3. Concrete, galvanized steel and stainless steel shall be left unpainted unless noted otherwise.

1.2 REFERENCES

A.	ASTM E84	Test Method for Surface Burning Characteristics of Building Materials
B.	NFPA 101	Life Safety Code
C.	SSPC PA-2	Measurement of Dry Paint Thickness with Magnetic Gages
D.	SSPC SP-1	Solvent Cleaning
E.	SSPC SP-7	Brush-off Blast Cleaning

1.3 DEFINITIONS

A. Installer or Applicator: Installer or applicator is the person actually installing or applying the product in the field at the Site.
   1. Installer and applicator are synonymous.
B. Factory Finish: Factory applied finish on a product in compliance with the finish specified in the Section where the product is specified.
C. Corrosive Environment: Immersion in, or not more than 6 IN above, or subject to frequent condensation, spillage or splash of a corrosive material such as water or solutions with pH range of 5 or above 9.
D. Exposed Exterior Surface: Surface which is exposed to weather but not necessarily exposed to view as well as surface exposed to view.
E. Paint: Includes fillers, primers, sealers, emulsions, oils, alkyds, latex, enamels, thinners, stains, epoxies, vinyls, chlorinated rubbers, urethanes, shellacs, varnishes, and any other applied coating specified within this Section.
F. Surface Hidden from View: Surfaces such as those within pipe chases, and between top side of ceilings (including drop-in tile ceilings) and underside of floor or roof structure above.

1.4 SUBMITTALS

A. Manufacturer's statement regarding Applicator instruction on product use.
B. Manufacturer's recommendation for universal barrier coat.
C. Shop Drawings:
   1. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's application instructions.
      c. Manufacturer's surface preparation instructions.
      d. Contractor's written plan of action for containing airborne particles created by blasting operation and location of disposal of spent contaminated blasting media.

e. Coating manufacturer's recommendation on abrasive blasting.

D. Samples:
1. Manufacturer's full line of colors for Owner color selection.
2. After initial color selection by Owner provide two 3 x 5 IN samples of each color selected.

E. Miscellaneous Submittals:
1. Approval of Applicator and application equipment.
2. Applicator's daily record:
a. Submit daily record at end of each week in which painting Work is performed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver in original containers, labeled as follows:
1. Name or type number of material.
2. Manufacturer's name and item stock number.
3. Contents, by volume, of major constituents.
4. Warning labels.
5. VOC content.

1.6 QUALIFICATIONS

A. Coating manufacturer's authorized representative shall provide written statement attesting that Applicator has been instructed on proper preparation, mixing and application procedures for coatings specified.

1.7 MISCELLANEOUS

A. Furnish paint through one manufacturer unless noted otherwise.
B. Coating used in all corridors and stairways shall meet requirements of NFPA 101 and ASTM E84.
C. Deviation from specified mil thickness or product type is not allowed without written authorization of Owner.
D. Material may not be thinned unless approved, in writing, by paint manufacturer's authorized representative.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Tnemec.
2. Ameron Protective Coatings Div.
3. ICI Devoe.
4. Valspar Corp.
5. Carboline Protective Coatings.
6. Sherwin Williams.
7. Dampney Company, Inc.
8. Or Approved Equal.

2.2 MATERIALS

A. Materials used must contain not more than 2.8 LBS/GAL VOC.
B. For unspecified materials such as thinner, provide manufacturer's recommended products.

C. Paint Systems - General:
   1. P=prime coat. F1, F2 . . . Fn = first finish coat, second finish coat . . … . nth finish coat, color as selected by Owner.
   2. If two finish coats of same material are required, Contractor may, at its option and by written approval from paint manufacturer, apply one coat equal to mil thickness of two coats specified.
D. Products specified in Paint Systems are manufactured by Tnemec. Equivalent products from approved manufactures are also acceptable.
E. Paint Systems:
   1. System #1 - Polyamidoamine Epoxy Primer with Polyamidoamine Epoxy or Aliphatic Acrylic Polyurethane Enamel Finish Coat(s).
      a. Prime coat:
         1) P1=1 coat, 3 mils, Series N69 Epoxoline (Polyamidoamine Epoxy), VOC=2.11
      b. Finish coat(s):
         1) Interior:
            (a) F1=1 coat, 3 mils, Series N69 Epoxoline (Polyamidoamine Epoxy)
            (b) F2=1 coat, 3 mils, Series N69 Epoxoline (Polyamidoamine Epoxy)
         2) Exterior:
            (a) F1=1 coat, 3 mils, Series N69 Epoxoline (Polyamidoamine Epoxy)
            (b) F2=1 coat, 2.5 mils, Series 1074 Endura-Shield (Aliphatic Acrylic Polyurethane Enamel), VOC=1.81
   2. System #2 - NOT USED.
   3. System #3 - Polyamidoamine Epoxy Primer with Polyamidoamine Epoxy or Aliphatic Acrylic Polyurethane Enamel Top Coat(s).
      a. Prime coat:
         1) P1=1 coat, 5 mils, Series N69 Epoxoline (Polyamidoamine Epoxy), VOC=2.11
      b. Finish coat(s):
         1) Interior:
            (a) F1=1 coat, 5 mils, Series N69 Epoxoline (Polyamidoamine Epoxy)
         2) Exterior:
            (a) F1=1 coat, 2.5 mils, Series 1074 Endura-Shield (Aliphatic Acrylic Polyurethane Enamel), VOC=2.80
   4. System #4 – NOT USED.
   5. System #5 - Polyamide Epoxy Primer with Polyamidoamine Epoxy or Aliphatic Acrylic Polyurethane Enamel Top Coat(s).
      a. Prime coat:
         1) P1=1 coat, 2.0 mils, Series N27 F.C. Typoxy (Polyamide Enamel), VOC=2.49
      b. Finish coat(s):
         1) Interior:
            (a) F1=1 coat, 2.5 mils, Series N69 Epoxoline (Polyamidoamine Epoxy), VOC=2.11
         2) Exterior:
            (a) F1=1 coat, 2.0 mils, Series 1074 Endura-Shield (Aliphatic Acrylic Polyurethane Enamel), VOC=2.45
            (b) F1=1 coat, 2.0 mils, Series 1075 Endura-Shield (Aliphatic Acrylic Polyurethane Enamel), VOC=1.82
   6. System #6 - NOT USED.
   7. System #7 - NOT USED.

8. System #8 - NOT USED.
9. System #9 - NOT USED.
10. System #10 - NOT USED.
11. System #11 - Zinc-Rich Aromatic Urethane Primer.
    a. Prime coat:
        1) P1=1 coat, 3.0 mils, 90-97 Tneme-Zinc (Zinc-Rich Urethane), VOC=2.67
12. System #12 - NOT USED.
13. System #13 - NOT USED.
14. System #14 - NOT USED.
15. System #15 - NOT USED.
16. System #16 - NOT USED.
17. System #17 - NOT USED.
18. System #18 - NOT USED.
19. System #19 - Polyamidoamine Epoxy Coating.
    a. Prime coat:
        1) P1=1 coat, 5 mils, Series N69 Epoxoline (Polyamidoamine Epoxy), VOC=2.11
20. System #20 - NOT USED.
21. System #21 - NOT USED.
22. System #22 - NOT USED.
23. System #23 - NOT USED.
24. System #24 - NOT USED.
25. System #25 - NOT USED.
26. System #26 - NOT USED.
27. System #27 - NOT USED.
28. System #28 - NOT USED.
29. System #29 - NOT USED.
30. System #30 - NOT USED.
31. System #31 - NOT USED.
32. System #32 - NOT USED.

PART 3 EXECUTION

3.1 ITEMS TO BE PAINTED

A. Exposed Exterior Surfaces including:
    1. Piping, valves, pumps, strainer, fittings, and hydrants.
    2. Miscellaneous ferrous metal surfaces other than galvanized or stainless steel finish.
B. Surfaces in Areas Not Considered Finished:
    1. Paint following surfaces in areas not considered as finished area:
        a. Piping, valves, pumps, strainer, fittings, and hydrants.
        b. Miscellaneous ferrous metal surfaces other than galvanized or stainless steel finish.
C. New and/or Existing Equipment:
    1. Paint new and/or existing equipment, except:
        a. Where noted in this Section 09905.
        b. Where specified elsewhere in the Contract Documents.
D. Surfaces without factory finish, hidden from view but located in a corrosive or highly corrosive area.

3.2 ITEMS NOT TO BE PAINTED

A. General: Do not paint items listed in Article 3.2 unless specifically noted in the Contract Documents to be painted.
B. Items with Factory Finish.
C. Surfaces hidden from view.
D. Other Items:
   1. Stainless steel surfaces.
   2. Aluminum surfaces except:
      a. Where specifically shown in the Contract Documents.
      b. Where in contact with concrete.
      c. Where in contact with dissimilar metals.
   3. Fiberglass surfaces except:
      a. Fiberglass piping.
      b. Piping supports.
   4. Interior of pipe and conduits.
   5. Moving parts of mechanical and electrical units where painting would interfere with the operation of the unit.
   6. Code labels and equipment identification and rating plates.
   7. Steel deck.
   8. Contact surfaces of friction-type connections.
   9. Galvanized steel items.

3.3 SCHEDULE OF ITEMS TO BE PAINTED AND PAINTING SYSTEMS

	PAINTING SYSTEM NUMBER
A. Miscellaneous Ferrous Metals:	1
1. Not for coating products with factory finishes.	
2. Not for coating galvanized steel or stainless steel.	
B. Ferrous Metals:	5
1. For products with approved factory finishes.	
2. Pumps.	
3. Strainers.	
C. Field touch-up of galvanized surfaces not requiring a finish top coat.	11
a. Paint only damaged areas.	
D. Electrical Conduit:	
1. Galvanized.	No Paint
2. PVC coated.	No Paint
E. Pipe, Valves, and Fittings:	
1. Steel, cast-iron, and uncoated ductile iron.	1
2. PVC.	3
F. Aluminum buried in concrete and between dissimilar metals which are not below liquid level.	19
G. Sheet Pile.	No Paint

3.4 PREPARATION

A. General:
   1. Prepare surfaces to be painted in accordance with coating manufacturer's instructions and this Section 09905, unless noted otherwise in the Specification.
   2. Remove all dust, grease, oil, compounds, dirt and other foreign matter which would prevent bonding of coating to surface.

B. Protection:
   1. Protect surrounding surfaces not to be coated.
   2. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items; or provide ample in-place protection.

C. Prepare and Paint Before Assembly: Where component is subject to corrosive or highly corrosive environment, prepare and paint, before assembly, all surfaces which may be subject to environment which are inaccessible after assembly.

D. Ferrous Metal:
   1. Prepare ductile iron pipe in accordance with pipe manufacturer's recommendations and applicable AWWA standards.
   2. Complete fabrication, welding or burning before beginning surface preparation.
      a. Chip or grind off flux, spatter, slag or other laminations left from welding.
      b. Remove mill scale.
      c. Grind smooth rough welds and other sharp projections.
   3. Solvent clean in accordance with SSPC SP-1 all surfaces scheduled to receive additional SSPC surface preparation.
   4. Restore surface of field welds and adjacent areas to original surface preparation.

E. Galvanized Metal:
   1. Solvent clean in accordance with SSPC SP-1 followed by abrasive brush blast in accordance with SSPC SP-7 to provide 1 mil profile.

F. Preparation by Abrasive Blasting:
   1. All abrasive-blasted ferrous metal surfaces shall be inspected immediately prior to application of paint coatings.
      a. Inspection shall be performed to determine cleanliness and profile depth of blasted surfaces and to certify that surface has been prepared in accordance with this Section 09905.
   2. Schedule the abrasive blasting operation so blasted surfaces will not be wet after blasting and before painting.
   3. Perform additional blasting and cleaning as required to achieve surface preparation required. Prior to painting, re-blast surfaces allowed to set overnight or surfaces that show rust bloom.
      a. Surfaces allowed to set overnight or surfaces which show rust bloom prior to painting shall be reinspected prior to paint application.
   4. Profile depth of blasted surface: Not less than 1 mil or greater than 2 mils unless required otherwise by coating manufacturer.
   5. Provide compressed air for blasting that is free of water and oil. Provide accessible separators and traps.
   6. Confine blast abrasives to area being blasted.
      a. Provide shields of polyethylene sheeting or other such barriers to confine blast material.
      b. Plug pipes, holes, or openings before blasting and keep plugged until blast operation is complete and residue is removed.

7. Protect nameplates, valve stems, rotating equipment, motors and other items that may be damaged from blasting.
8. Re-blast surfaces not meeting requirements of this Section 09905.
9. Abrasive blasting media may be recovered, cleaned and reused providing Contractor submits, for Owner review, a comprehensive recovery plan outlining all procedures and equipment proposed in reclamation process.
10. Properly dispose of blasting material contaminated with debris from blasting operation not scheduled to be reused.

3.5 APPLICATION

A. General:
1. Thin, mix and apply coatings by brush, roller, or spray in accordance with manufacturer's installation instructions.
   a. Application equipment must be inspected and approved in writing by coating manufacturer.
2. Temperature and weather conditions:
   a. Do not paint surfaces when surface temperature is below 50 DegF unless product has been formulated specifically for low temperature application or approved in writing by Owner and paint manufacturer's authorized representative.
   b. Avoid painting surfaces exposed to hot sun.
   c. Do not paint on damp surfaces.
3. Immediately after surface has been inspected apply structural steel and miscellaneous steel prime coat in the factory.
   a. Finish coats shall be applied in the field.
   b. Prime coat referred to here is prime coat as indicated in this Section 09905. Structural and miscellaneous steel prime coating applied in factory (shop) as part of fabricator's standard rust inhibiting and protection coating is not acceptable as replacement for specified prime coating.
4. Provide complete coverage to mil thickness specified.
   a. Thickness specified is dry mil thickness.
   b. All paint systems are "to cover." In situations of discrepancy between manufacturer's square footage coverage rates and mil thickness, mil thickness requirements govern.
   c. When color or undercoats show through, apply additional coats until paint film is of uniform finish and color.
5. If so directed by Owner, do not apply consecutive coats until Owner has had an opportunity to observe and approve previous coats.
6. Apply materials under adequate illumination.
7. Evenly spread to provide full, smooth coverage.
8. Work each application of material into corners, crevices, joints, and other difficult to work areas.
9. Avoid degradation and contamination of blasted surfaces and avoid intercoat contamination.
   a. Clean contaminated surfaces before applying next coat.
10. Smooth out runs or sags immediately, or remove and recoat entire surface.
11. Allow preceding coats to dry before recoating.
   a. Recoat within time limits specified by coating manufacturer.
   b. If recoat time limits have expired reprepare surface in accordance with coating manufacturer's printed recommendations.

12. Allow coated surfaces to cure prior to allowing traffic or other Work to proceed.
13. Coat aluminum in contact with dissimilar materials.

B. Prime Coat Application:
1. Prime all surfaces indicated to be painted. Apply prime coat in accordance with coating manufacturer's written instructions and as written in this Section 09905.
2. Ensure field-applied coatings are compatible with factory-applied coatings. Ensure new coatings applied over existing coatings are compatible.
   a. If field-applied coating is found to be incompatible, provide the coating manufacturer's technical representative recommendation, in writing, product to be used as barrier coat, thickness to be applied, surface preparation and method of application.
   b. At Contractor's option, coatings may be removed, surface reprepared, and new coating applied using appropriate paint system listed in this Section 09905.
      1) Damage to surface as result of coating removal shall be repaired to original condition or better by Contractor at no additional cost to Owner.
3. Prime ferrous metals embedded in concrete to minimum of 1 IN below exposed surfaces.
4. Maintain continuous agitation while applying zinc-rich primersEnsure abrasive blasting operation does not result in embedment of abrasive particles in paint film.
5. Brush or spray bolts, welds, edges and difficult access areas with primer prior to primer application over entire surface.
6. Touch up damaged primer coats prior to applying finish coats. Restore primed surface equal to surface before damage.

C. Finish Coat Application:
1. Apply finish coats in accordance with coating manufacturer's written instructions and in accordance with this Section 09905.
2. Touch up damaged finish coats using same application method and same material specified for finish coat. Prepare damaged area in accordance with this Section 09905.

3.6 FIELD QUALITY CONTROL

A. Maintain daily record:
1. Provide the following information prior to each coat at beginning and end of each Day's painting Work for each different area painted:
   a. Start time, end time, and all breaks taken by painters.
   b. Sky condition.
   c. Air temperature.
   d. Relative humidity.
   e. Wind speed and direction.
   f. Moisture content of substrate prior to each coat.
   g. Provisions utilized to maintain work area within manufacturer's recommended application parameters.
   h. Surface temperature of substrate to which paint is being applied.
2. Date and time of application for each following coat.
3. Moisture content of substrate prior to each coat.
4. Provisions utilized to maintain temperature and humidity of work area within manufacturer's recommended ranges.

B. Measure wet coating with wet film thickness gages.

C. Measure coating dry film thickness in accordance with SSPC PA-2 using Mikrotest gage calibrated against National Bureau of Standards "Certified Coating Thickness Calibration Standards."
   1. Owner may measure coating thickness at any time during project to ensure conformance with this Section 09905.
D. Measure surface temperature of items to be painted with surface temperature gage specifically designed for such.
E. Measure substrate humidity with humidity gage specifically designed for such.
F. Provide wet paint signs.
G. Thickness and Holiday checking:
   1. Thickness of coatings and paint shall be checked by Contractor with a nondestructive, magnetic-type thickness gauge. Coating integrity of all interior coated surfaces shall be tested by Contractor with an approved holiday testing device. Holiday detectors shall not exceed the voltage recommended by the manufacturer of the coating system. No pinholes or other irregularities will be permitted in the final coating.
H. Contractor to provide on-Site testing of materials to verify VOC content.

3.7 CLEANING

A. Clean paint spattered surfaces. Use care not to damage finished surfaces.
B. Upon completion of painting, replace hardware, accessories, plates, fixtures, and similar items.
C. Remove surplus materials, scaffolding, and debris. Leave areas broom clean.

3.8 CORRECTION OF DEFECTIVE WORK

A. All Defective Work shall be repaired in strict accordance with this specification and to the satisfaction of Owner, as required pursuant to Document 00630 (Guaranty).
B. If an area of failure exceeds 25 percent of the total coated or painted surface, the entire coating or paint system on the entire area shall be removed and repainted in accordance with the original specification.

END OF SECTION

DIVISION 10

SPECIALTIES

SECTION 10405

IDENTIFICATION, STENCILING, AND TAGGING SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Tag, tape and stenciling systems for equipment, piping, valves, pumps, and similar items, and hazard and safety signs

1.2 REFERENCES

A.	ASME A13.1	Scheme for the Identification of Piping Systems
B.	NEMA/ANSI Z535.1	Safety Color Code
C.	NEMA/ANSI Z535.2	Environmental and Facility Safety Signs
D.	NEMA/ANSI Z535.3	Criteria for Safety Symbols
E.	NEMA/ANSI Z535.4	Product Safety Signs and Labels
F.	NFPA 70	National Electrical Code (NEC)
G.	OSHA 29 CFR 1910.145	Specification for Accident Prevention Signs and Tags

1.3 SUBMITTALS

A. Shop Drawings:
   1. Product technical data including:
      a. Catalog information for all identification systems.
      b. Acknowledgement that products submitted meet requirements of standards referenced.
   2. Identification register, listing all items in Part 3 to be identified, type of identification system to be used, lettering, location and color.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. W.H. Brady Co.
   2. Panduit.
   3. Seton.
   4. National Band and Tag Co.
   5. Carlton Industries, Inc.
   6. Or Approved Equal.

2.2 MANUFACTURED UNITS

A. Type A1 - Round Metal Tags:
   1. Materials:
      a. Aluminum or stainless steel.
      b. Stainless steel shall be used in corrosive environments.
   2. Size:
      a. Diameter: 1-1/2 IN minimum.
      b. Thickness: 0.035 IN (20 GA) minimum.

3. Fabrication:
   a. 3/16 IN minimum mounting hole.
   b. Legend: Stamped and filled with black coloring.
4. Color: Natural.

B. Type A2 - Rectangle Metal Tags:
1. Materials: Stainless steel.
2. Size:
   a. 3-1/2 IN x 1-1/2 IN minimum.
   b. Thickness: 0.036 IN (20 GA) minimum.
3. Fabrication:
   a. 3/16 IN minimum mounting hole.
   b. Legend: Stamped and filled with black coloring.
4. Color: Natural.

C. Type A3 - Metal Tape Tags:
1. Materials: Aluminum or stainless steel.
2. Size:
   a. Width 1/2 IN minimum.
   b. Length as required by text.
3. Fabrication:
   a. 3/16 IN minimum mounting hole.
   b. Legend: Embossed.
4. Color: Natural.

D. Type B1- Square Non-Metallic Tags:
1. Materials: Fiberglass reinforced plastic.
2. Size:
   a. Surface: 2 x 2 IN minimum.
   b. Thickness: 100 mils.
3. Fabrication:
   a. 3/16 IN mounting hole with metal eyelet.
   b. Legend: Preprinted and permanently embedded and fade resistant.
4. Color:
   a. Background: Manufacturer standard or as specified.
   b. Lettering: Black.

E. Type B2 - Non-Metallic Signs:
1. Materials: Fiberglass reinforced or durable plastic.
2. Size:
   a. Surface: As required by text.
   b. Thickness: 60 mils minimum.
3. Fabrication:
   a. Rounded corners.
   b. Drilled holes in corners with grommets.
   c. Legend: Preprinted, permanently embedded and fade resistant for a 10 year minimum outdoor durability.
4. Color:
   a. Background: Manufacturer standard or as specified.
   b. Lettering: Black.
5. Standards for OSHA signs: NEMA/ANSI Z535.1, NEMA/ANSI Z535.2, NEMA/ANSI Z535.3, NEMA/ANSI Z535.4, OSHA 29 CFR 1910.145.

F. Type C - Phenolic Name Plates:
   1. Materials: Phenolic.
   2. Size:
      a. Surface: As required by text.
      b. Thickness: 1/16 IN.
   3. Fabrication:
      a. Two (2) layers laminated.
      b. Legend: Engraved through top lamination into bottom lamination.
      c. Two (2) drilled side holes, for screw mounting.
   4. Color: Black top surface, white core, unless otherwise indicated.
G. Type D - Self-Adhesive Tape Tags and Signs:
   1. Materials: Vinyl tape or vinyl cloth.
   2. Size:
      a. Surface: As required by text.
      b. Thickness: 5 mils minimum.
   3. Fabrication:
      a. Indoor/Outdoor grade.
      b. Weather and UV resistant inks.
      c. Permanent adhesive.
      d. Legend: Preprinted.
      e. Wire markers to be self-laminating.
   4. Color: White with black lettering or as specified.
   5. Standards for OSHA signs: NEMA/ANSI Z535.1, NEMA/ANSI Z535.2, NEMA/ANSI Z535.3, NEMA/ANSI Z535.4, OSHA 29 CFR 1910.145.
H. Type E - Heat Shrinkable Tape Tags:
   1. Materials: Polyolefin.
   2. Size: As required by text.
   3. Fabrication:
      a. Legend: Preprinted.
   4. Color: White background, black printing.
I. Type F - Underground Warning Tape:
   1. Materials: Polyethylene.
   2. Size:
      a. 6 IN wide (minimum).
      b. Thickness: 3.5 mils.
   3. Fabrication:
      a. Legend: Preprinted and permanently imbedded.
      b. Message continuous printed.
      c. Tensile strength: 1750 psi.
   4. Color: As specified within this section.
J. Type G - Stenciling System:
   1. Materials:
      a. Exterior type stenciling enamel.
      b. Either brushing grade or pressurized spray can form and grade.
   2. Size: As required.
   3. Fabrication:
      a. Legend: As required.
   4. Color: Black or white for best contrast.

K. Underground Tracer Wire:
   1. Materials:
      a. Wire:
         1) 12 GA AWG.
         2) Solid.
      b. Wire nuts: Waterproof type.
      c. Split bolts: Brass.

2.3 ACCESSORIES

A. Fasteners:
   1. Bead chain: #6 brass, aluminum or stainless steel.
   2. Plastic strap: Nylon, urethane or polypropylene.
   3. Screws: Self-tapping, stainless steel.
   4. Adhesive, solvent activated.

2.4 MAINTENANCE MATERIALS

A. Where stenciled markers are provided, clean and retain stencils after completion and include in extra stock, along with required stock of paints and applicators.

PART 3 EXECUTION

3.1 GENERAL INSTALLATION

A. Install identification devices at specified locations.
B. All identification devices to be printed by mechanical process, hand printing is not acceptable.
C. Attach tags to equipment with sufficient surface or body area with solvent activated adhesive applied to back of each tag.
D. Attach tags with 1/8 IN round or flat head screws to equipment without sufficient surface or body area, or porous surfaces.
   1. Where attachment with screws should not or cannot penetrate substrate, attach with plastic strap.
E. Single items of equipment enclosed in a housing or compartment to be tagged on outside of housing.
   1. Several items of equipment mounted in housing to be individually tagged inside the compartment.
F. Tracer Wire:
   1. Attach to pipe at a maximum of 10 FT intervals with tape or tie-wraps.
   2. Continuous pass from each valve box and above grade at each structure.
   3. Coil enough wire at each valve box to extend wire a foot above the ground surface.
   4. 1,000 FT maximum spacing between valve boxes.
   5. If split bolts are used for splicing, wrap with electrical tape.
   6. If wire nuts are used for splicing, knot wire at each splice point leaving 6 IN of wire for splicing.
   7. Use continuous strand of wire between valve box where possible.
      a. Continuous length shall be no shorter than 100 FT.

3.2 SCHEDULES

A. Process Systems:
   1. General:

a. Provide arrows and markers on piping.
   1) At 20 FT maximum centers along continuous lines.
   2) At changes in direction (route) or obstructions.
   3) At valves, risers, "T" joints, machinery or equipment.
   4) Where pipes pass through floors, walls, ceilings, cladding assemblies and like obstructions provide markers on both sides.
b. Position markers on both sides of pipe with arrow markers pointing in flow direction.
   1) If flow is in both directions use double headed arrow markers.
c. Apply tapes and stenciling in uniform manner parallel to piping.

2. Trenches with piping:
   a. Tag type: Type F - Underground Warning Tape
   b. Location: Halfway between top of piping and finished grade.
   c. Letter height: 1-1/4 IN minimum.
   d. Natural gas:
      1) Color: Yellow with black letters.
      2) Legend:
         (a) First line: “CAUTION CAUTION CAUTION”
         (b) Second line: “BURIED GAS LINE BELOW”
   e. Potable water:
      1) Color: Blue with black letters.
      2) Legend:
         (a) First line: “CAUTION CAUTION CAUTION”
         (b) Second line: “BURIED WATER LINE BELOW”
   f. Storm and sanitary sewer lines:
      1) Color: Green with black letters.
      2) Legend:
         (a) First line: “CAUTION CAUTION CAUTION”
         (b) Second line: “BURIED SEWER LINE BELOW”
   g. (Nonpotable) water piping, except 3 IN and smaller irrigation pipe:
      1) Color: Green with black letters.
      2) Legend:
         (a) First line: “CAUTION CAUTION CAUTION”
         (b) Second line: “BURIED NONPOTABLE WATER LINE BELOW”
   h. Chemical feed piping (e.g., chlorine solution, polymer solution, caustic solution, etc.):
      1) Color: Yellow with black letters.
      2) Legend:
         (a) First line: “CAUTION CAUTION CAUTION”
         (b) Second line: “BURIED CHEMICAL LINE BELOW”
   i. Other piping (e.g., compressed air, irrigation, refrigerant, heating water, etc.):
      1) Color: Yellow with black letters.
      2) Legend:
         (a) First line: “CAUTION CAUTION CAUTION”
         (b) Second line: “BURIED PIPE LINE BELOW”
3. Yard valves, buried, with valve box and concrete pad:
   a. Tag type: Type A2 - Rectangle Metal Tags.

b. Fastener: 3/16 IN x 7/8 IN plastic screw anchor with 1 IN #6 stainless steel pan head screw.
c. Legend:
1) Letter height: 1/4 IN minimum.
2) Valve designation as indicated on the Drawings (e.g., "V-xxx").

4. Valves and slide gates:
a. Tag type:
1) Outdoor locations: Type B1 - Square Non-Metallic Tags.
2) Indoor non-corrosive:
(a) Type A1 - Round Metal Tags.
(b) Type B1 - Square Non-Metallic Tags.
3) Indoor corrosive:
(a) Stainless steel Type A1 - Round Metal Tags.
(b) Type B1 - Square Non-Metallic Tags.
b. Fastener:
1) Type A1: Chain of the same material.
2) Type B1: Stainless steel chain.
c. Color: Per ASME A13.1 corresponding to the piping system.
d. Legend:
1) Letter height: 1/4 IN minimum.
2) Valve designation as indicated on the Drawings (e.g., "V-xxx").

5. Process equipment (e.g., pumps, pump motors, etc.):
a. Tag type:
1) Type B2 - Non-Metallic Signs.
2) Type D - Self-Adhesive Tape Tags and Signs.
3) Type G - Stenciling System.
b. Fastener:
1) Self.
2) Screws.
3) Adhesive.
c. Legend:
1) Letter height: 1/2 IN minimum.
2) Equipment designation as indicated on the Drawings (e.g., "Vertical Turbine Pump P-xxx").

6. Piping systems:
a. Tag type:
1) Outdoor locations: Type G - Stenciling System.
2) Indoor locations:
(a) Type D - Self-Adhesive Tape Tags and Signs.
(b) Type G - Stenciling System.
b. Fastener: Self.
c. Color: Per ASME A13.1.
d. Legend:
1) Letter height: Manufacturers standard for the pipe diameter.
2) Mark piping in accordance with ASME A13.1.
3) Use piping designation as indicated on the Drawings.
4) Arrow: Single arrow.

7. Equipment that starts automatically:
    a. Tag type:
        1) Type B2 - Non-Metallic Signs.
        2) Type D - Self-Adhesive Tape Tags and Signs.
    b. Fastener:
        1) Type B2 - Screw or adhesive.
        2) Type D - Self.
    c. Size: 5 IN x 7 IN
    d. Location: Vertical Turbine Pumps.
    e. Legend:
        1) OSHA Warning Sign.
        2) Description of Warning: "THIS MACHINE STARTS AUTOMATICALLY".

B. Instrumentation Systems:
1. Instrumentation Equipment (e.g., flow control valves, primary elements, etc.):
    a. Tag type:
        1) Outdoor locations: Type B1 - Square Non-Metallic Tags.
        2) Indoor non-corrosive:
            (a) Type A1 - Round Metal Tags.
            (b) Type B1 - Square Non-Metallic Tags.
        3) Indoor corrosive:
            (a) Stainless steel Type A1 - Round Metal Tags.
            (b) Type B1 - Square Non-Metallic Tags.
    b. Fastener:
        1) Type A1: Chain of the same material.
        2) Type B1: Stainless steel chain.
    c. Legend:
        1) Letter height: 1/4 IN minimum.
        2) Equipment ISAS designation as indicated on the Drawings (e.g., "FIT-xxx").
2. Enclosure for instrumentation and control equipment, (e.g., PLC control panels, etc.):
    a. Tag type: Type C - Phenolic Name Plates.
    b. Fastener: Screws.
    c. Legend:
        1) Letter height: 1/2 IN minimum.
        2) Equipment name (e.g., "PLC CONTROL PANEL PCP-xxx").
3. Components inside equipment enclosure, (e.g., PLC's, control relays, contactors, and timers):
    a. Tag type: Type D - Self-Adhesive Tape Tags.
    b. Fastener: Self.
    c. Legend:
        1) Letter height: 3/16 IN minimum.
        2) Description or function of component (e.g., "PLC-xxx" or "CR-xxx").
4. Through enclosure door mounted components (e.g., selector switches, controller digital displays, etc.):
    a. Tag type: Type C - Phenolic Name Plates.
    b. Fastener: Screws.
    c. Legend:
        1) Letter height: 1/4 IN minimum.
        2) Component ISAS tag number as indicated on the Drawings (e.g., "HS-xxx").

C. HVAC Systems:
   1. Enclosure for instrumentation and control equipment, (e.g., fan control panels, etc.):
      a. Tag type: Type C - Phenolic Name Plates.
      b. Fastener: Screws.
      c. Legend:
         1) Letter height: 1/2 IN minimum.
         2) Equipment designation as indicated on the Drawings (e.g., "FAN CONTROL PANEL FCP-xxx").
   2. Components inside equipment enclosure, (e.g., controller's, control relays, contactors, and timers):
      a. Tag type: Type D - Self-Adhesive Tape Tags and Signs.
      b. Fastener: Self.
      c. Legend:
         1) Letter height: 3/16 IN minimum.
         2) Description or function of component (e.g., "CR-xxx").
   3. Through enclosure door mounted equipment (e.g., selector switches, controller digital displays, etc.):
      a. Tag type: Type C - Phenolic Name Plates.
      b. Fastener: Screws.
      c. Legend:
         1) Letter height: 1/4 IN minimum.
         2) Component tag number as indicated on the Drawings or as defined by contractor (e.g., "HS-xxx").
D. Electrical Systems:
   1. Trenches with ductbanks, direct-buried conduit, or direct-buried wire and cable.
      a. Tag type: Type F - Underground Warning Tape.
      b. Letter height: 1-1/4 IN minimum.
      c. Location:
         1) Where trench is 12 IN or more below finished grade: In trench 6 IN below finished grade.
         2) Where trench is less than 12 IN below finished grade: In trench 3 IN below finished grade.
      d. Electrical power (e.g., low and medium voltage):
         1) Color: Red with black letters.
         2) Legend:
            (a) First line: "CAUTION CAUTION CAUTION".
            (b) Second line: "BURIED ELECTRIC LINE BELOW".
      e. Communications (e.g., telephone, instrumentation, LAN, SCADA):
         1) Color: Orange with black letters.
         2) Legend:
            (a) First line: "CAUTION CAUTION CAUTION".
            (b) Second line: "BURIED COMMUNICATION LINE BELOW".
   2. Switchgear, switchboards and motor control centers:
      a. Tag type: Type C - Phenolic Name Plates.
      b. Fastener: Screws.
      c. Main equipment legend:
         1) Letter height:
            (a) First line: 1 IN minimum.

(b) Subsequent lines: 3/8 IN minimum.
2) First line: Equipment name (e.g., "MAIN SWITCHBOARD MSBxxx").
3) Second line:
(a) Source of power (e.g., "FED FROM MCCxxx LOCATED IN ROOM xxx").
(b) The source of power room number is only required when there are multiple electrical rooms, if the source is in another building, the building name or number shall be used.
4) Third line: System voltage and phase (e.g., “480/277 V, 3PH”).
d. Main and feeder device legend:
1) Letter height: 3/8 IN minimum.
2) Description of load (e.g., “MAIN DISCONNECT”, "PUMP Pxxx" or "PANELBOARD HPxxx").
3. Panelboards and transformers:
a. Tag type: Type C - Phenolic Name Plates.
b. Fastener: Screws.
c. Legend:
1) Letter height:
(a) First line: 3/8 IN minimum.
(b) Subsequent lines: 3/16 IN minimum.
2) First line: Equipment name (e.g., "PANELBOARD LPxxx" or "TRANSFORMER Txxx").
3) Second line (panelboards only): System voltage and phase (e.g., “208/120V, 3PH”).
4. Transfer switches:
a. Tag type: Type C - Phenolic Name Plates.
b. Fastener: Screws.
c. Legend:
1) Letter height:
(a) First line: 3/8 IN minimum.
(b) Subsequent lines: 3/16 IN minimum.
2) First line: Equipment name (e.g., "AUTOMATIC TRANSFER SWITCH ATSxxx").
5. Safety switches, separately mounted circuit breakers and motor starters, VFD’s, etc.:
a. Tag type: Type C - Phenolic Name Plates.
b. Fastener: Screws.
c. Legend:
1) Letter height: 1/4 IN minimum.
2) First line: Description of load equipment is connected to (e.g., "PUMP Pxxx").
6. Enclosure for instrumentation and control equipment, (e.g., lighting control panels, etc.):
a. Tag type: Type C - Phenolic Name Plates.
b. Fastener: Screws.
c. Legend:
1) Letter height: 1/2 IN minimum.
2) Equipment name (e.g., "LIGHTING CONTROL PANEL LCPxxx").
7. Components inside equipment enclosures (e.g., circuit breakers, fuses, control power transformers, control relays, contactors, timers, etc.):
a. Tag type: Type D - Self-Adhesive Tape Tags and Signs.
b. Fastener: Self.

c. Legend:
   1) Letter height: 3/16 IN minimum.
   2) Description or function of component (e.g., "M-xxx", "CR-xxx" or "TR-xxx").

8. Through enclosure door mounted equipment (e.g., selector switches, controller digital displays, etc.):
   a. Tag type: Type C - Phenolic Name Plates.
   b. Fastener: Screws.
   c. Legend:
      1) Letter height: 1/4 IN minimum.
      2) Component tag number as indicated on the Drawings or as defined by contractor (e.g., "HS-xxx").
9. Conductors in control panels and in pull or junction boxes where multiple circuits exist.
   a. Tag type: Type D - Self-Adhesive Tape Tags.
   b. Fastener: Self.
   c. Tag conductor at both ends.
   d. Legend:
      1) Letter height: 1/8 IN minimum.
      2) Circuit number or wire number as scheduled on the Drawings or as furnished with the equipment.
10. Conductors in handholes and manholes.
   a. Tag type: Type A3 - Metal Tape Tags.
   b. Fastener: Nylon strap.
   c. Tag conductor at both ends.
   d. Legend:
      1) Letter height: 1/8 IN minimum.
      2) Circuit number or wire number as scheduled on the Drawings.
11. Grounding conductors associated with grounding electrode system in accordance with the following:
   a. Tag type: Type D - Self-Adhesive Tape Tags.
   b. Fastener: Self.
   c. Legend:
      1) Letter height: 1/8 IN minimum.
      2) Function of conductor (e.g., "MAIN BONDING JUMPER", "TO GROUND RING", "TO MAIN WATER PIPE").
12. Flash protection for switchboards, panelboards, industrial control panels and motor control centers:
   a. Tag type: Type D - Self-Adhesive Tape Signs.
   b. Fastener: Self.
   c. Legend: Per NFPA 70.
13. Entrances to electrical rooms:
   a. Tag type: Type B2 - Non-Metallic Signs.
   b. Fastener: Screw or adhesive.
   c. Size: 5 IN x 7 IN.
   d. Location: Each door to room.
   e. Legend:
      1) OSHA Danger Sign.
      2) Description of Danger: "HIGH VOLTAGE, AUTHORIZED PERSONNEL ONLY".

14. Equipment where more than one (1) voltage source is present:
    a. Tag type:
        1) Type B2 - Non-Metallic Signs.
        2) Type D - Self-Adhesive Tape Signs.
    b. Fastener:
        1) Screw or adhesive.
        2) Self.
    c. Size: 1-3/4 IN x 2-1/2 IN.
    d. Location: Exterior face of enclosure or cubical.
    e. Legend:
        1) OSHA Danger Sign.
        2) Description of Danger: "MULTIPLE VOLTAGE SOURCES".

3.3 HAZARD AND SAFETY SIGNS

A. Provide as many as 25 Hazard and Safety Signs:
    1. Type B2 or D. As required by Owner via shop drawing review process.
    2. Inscription as directed by Owner.

END OF SECTION

SECTION 10520

FIRE EXTINGUISHER AND CABINETS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fire extinguishers.
   2. Fire extinguisher cabinets.
B. Related Sections:
   1. Section 05500 (Metal Fabrications).

1.2 REFERENCES

A. NFPA 10 Standard for Portable Fire Extinguishers

1.3 DEFINITIONS

A. Authority Having Jurisdiction (AHJ): Building official, fire chief, fire marshal or other individual having statutory authority.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
B. Installation, Operation, and Maintenance Manuals:
   1. Fire extinguishers.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:
   1. Deliver and install filled and charged extinguishers prior to Final Acceptance.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Fire extinguishers:
      a. Amerex Corporation.
      b. Ansul Fire Protection.
      c. Walter Kidde.
      d. Potter - Roemer Inc.
      e. Or Approved Equal.
   2. Fire extinguisher cabinets:
      a. J. L. Industries.
      b. Larsen's Manufacturing Co.
      c. Nystrom Building Products.

d. Modern Metal Products.
e. Potter - Roemer Inc.
f. Or Approved Equal.
3. Fire extinguisher signs:
a. Seton.
b. Or Approved Equal.

2.2 MANUFACTURED UNITS

A. Fire Extinguisher Cabinet:
1. Surface mounting.
a. Meet projection limitations per ADA.
2. 22 GA epoxy coated steel box.
3. Flat trim.
4. Epoxy-coated door and trim.
5. Bronze convex acrylic bubble.
6. Provide all required closures.
7. Provide FIRE EXTINGUISHER decal for each cabinet.
8. Provide 10 LB 4A:60BC extinguisher.
9. Provide WH certified cabinets in fire-rated walls.
B. Fire Extinguisher (FEXT):
1. Steel bodied, all metal top (head) and valves.
2. Multi-purpose dry chemical with hose and horn.
3. Provide one (1) UL rated 10A-120BC extinguisher for each fire extinguisher location (FEXT) indicated on Drawings.
4. Finish: Red with epoxy finish coat.
C. Wall Brackets:
1. Bracket type to fit specified extinguisher.
2. Furnish bracket for each extinguisher not in cabinet.
3. Bracket to be finished in red or black enamel.
D. Fire Extinguisher Signage:
1. Single faced: SETON #21999 or Approved Equal.
2. Double faced: SETON #22001 or Approved Equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions and NFPA 10.
1. Install units with extinguisher top not over 48 IN above floor.
2. Install wall brackets to concrete or masonry substrate with self-tapping concrete anchors.
a. See Section 05500 (Metal Fabrications).
B. Fire extinguisher locations shown on Drawings are approximate locations.
1. Verify all extinguisher mounting locations with the AHJ.
C. Provide "FIRE EXTINGUISHER" sign for each extinguisher location.
1. Provide single or double faced sign to provide optimum visibility for extinguisher location.

END OF SECTION

SECTION 10605

WIRE MESH PARTITIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Normal duty rated wire mesh partitions.

1.2 REFERENCES

A. ASTM A36	Standard Specification for Carbon Structural Steel.
B. ASTM A53	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
C. ASTM A116	Standard Specification for Metallic-Coated, Steel Woven Wire fence Fabric.
D. ASTM A1008	Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, solution Hardened, and Baked Hardenability.

1.3 SUBMITTALS

A. Product Data:
   1. Acknowledgement that products submitted meet requirements of standards referenced.
   2. Manufacturer's installation instructions.
B. Quality Assurance/Control Submittals:
   1. Qualification Statements:
      a. Manufacturer shall be current member of Woven wire Products Association.

1.4 QUALITY ASSURANCE

A. Certifications:
   1. Certification of WWPA membership.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Wire Mesh Partitions:
   1. Acorn wire and Iron Works.
   2. GS Company.
   3. Miller Wire Works.
   4. Wire and Iron Products.
   5. Standard Wire and Steel Works.
   6. Or Approved Equal.

2.2 MATERIALS

A. Wire: Steel, ASTM A116.
B. Panel: Steel sheet, ASTM A1008.
C. Corner Posts: Steel angle or tube, ASTM A36.

D. Stiffeners and Channels: Steel, ASTM A36.

2.3 FABRICATION

A. Wire Mesh Partitions - General:
   1. Provide partitions consisting of modular steel woven wire mesh panels.
   2. Partition height: See drawings.
   3. Provide vertical stiffeners for freestanding partitions over 10 FT high or over 20 FT long.
   4. Furnish manufacturers standard fittings, fasteners, hardware, and bracing.

B. Fixed Panels (Normal Duty Rated):
   1. Panel width: As required to fit layout indicated on Drawings.
   2. Panel style: All mesh woven through intermediate horizontal framing member.
   3. Wire mesh: 10 GA minimum steel wire woven into 1-1/2 IN mesh. ASTM A116.
   4. Vertical frame members: 1-1/4 x 5/8 IN, minimum channel, ASTM A53.
   5. Horizontal frame members: 1 x 1/2 IN, minimum channel, ASTM A53.
   6. Frame joints: Mortise and tenoned.
   7. Top channel: 2-1/4 x 1 IN, minimum, continuous; bolted to panels, ASTM A53.

C. Wire Mesh Door Panel (Swinging): Same as fixed panels except:
   1. Door frame: Tube or channel with flat plate.
   2. Size to correspond with duty rating noted previously in this specification.
   3. Lock side: Angle welded to frame.
   4. Hinges: Three ball-bearing steel butt hinges, riveted or bolted to panel frame and frame of door.
   5. Locking: Provide hasp for padlock.
   6. Size 3 x 7 FT.

D. Finishes:
   1. Galvanized.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Install partitions rigid, plumb and level.
C. Secure with appropriate brackets and fasteners.
D. Set floor sockets with anchorages having minimum 3 IN penetration into concrete.
E. Touch-up damaged surfaces with appropriate paint provided by partition manufacturer.

END OF SECTION

DIVISION 11

EQUIPMENT

SECTION 11005

EQUIPMENT: BASIC REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements of this Specification Section apply to all equipment provided on the Project including that found in Divisions 11, 13, 15, and 16, even if not specifically referenced in individual "Equipment" articles of those Specification Sections.

B. Related Sections:
   1. Section 03308 (Concrete, Materials and Proportioning).
   2. Section 05500 (Metal Fabrications).
   3. Section 07900 (Joint Sealants).
   4. Section 09905 (Painting and Protective Coatings).
   5. Section 10400 (Identification Devices).
   6. Section 13442 (Primary Elements and Transmitters).
   7. Section 15061 (Pipe and Pipe Fittings: Basic Requirements).
   8. Section 16010 (Electrical: Basic Requirements).
   9. Section 16973 (Acceptance Testing).

1.2 REFERENCES

A. ACI 318	Building Code Requirements for Structural Concrete
B. ASTM F593	Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
C. NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum)
D. NEMA ICS 6	Enclosures for Industrial Control and System
E. NETA ATS	Acceptance Testing Specification for Electrical Power Distribution Equipment and Systems
F. NEC Article 430	Motors
G. UL 508A	Standard for Safety Industrial Control Panels

1.3 DEFINITIONS

A. Product: Manufactured materials and equipment.

B. Major Equipment Supports - Supports for Equipment:
   1. Located on slab-on-grade or earth with supported equipment weighing 5000 LBS or more.

C. Equipment:
   1. One (1) or more assemblies capable of performing a complete function.
   2. Mechanical, electrical, instrumentation or other devices requiring an electrical, pneumatic, electronic or hydraulic connection.
   3. Not limited to items specifically referenced in "Equipment" articles within individual Specifications.

D. Installer or Applicator:
   1. Installer or applicator is the person actually installing or applying the product in the field at the Project Site.
   2. Installer and applicator are synonymous.

1.4 SUBMITTALS

A. Shop Drawings:
   1. General for all equipment:
      a. Data sheets that include manufacturer's name and complete product model number.
         1) Clearly identify all optional accessories that are included.
      b. Acknowledgement that products submitted comply with the requirements of the standards referenced.
      c. Manufacturer's delivery, storage, handling, and installation instructions.
      d. Equipment identification utilizing numbering system and name utilized in Drawings.
      e. Equipment installation details:
         1) Location of anchorage.
         2) Type, size, and materials of construction of anchorage.
         3) Anchorage setting templates.
         4) Manufacturer's installation instructions.
      f. Equipment area classification rating.
      g. Shipping and operating weight.
      h. Equipment physical characteristics:
         1) Dimensions (both horizontal and vertical).
         2) Materials of construction and construction details.
      i. Equipment factory primer and paint data.
      j. Manufacturer's recommended spare parts list.
      k. Equipment lining and coatings.
      l. Equipment utility requirements include air, natural gas, electricity, and water.
      m. Ladders and platforms provided with equipment:
         1) Certification that all components comply fully with OSHA requirements.
         2) Full details of construction/fabrication.
         3) Scaled plan and sections showing relationship to equipment.
      n. Submit written certification that:
         1) Equipment conforms to the requirements of Section 1.5 of this specification Section 11005.
         2) Written certification to be signed and sealed by a registered professional Civil or Structural Engineer registered in the State of California. Submit certification along with shop drawings.
      o. Structural calculations for the required force level for each component as required in Section 1.5 of this specification Section 11005.
         1) Provide summary of loads to each anchor.
         2) Structural calculations shall be signed and sealed by a registered professional Civil or Structural Engineer registered in the State of California.
         3) Number calculation pages.
         4) Include equipment data sheets showing equipment plan, elevation and weight.
   2. Mechanical and process equipment:
      a. Operating characteristics:
         1) Technical information including applicable performance curves showing specified equipment capacity, rangeability, and efficiencies.
         2) Brake horsepower requirements.
         3) Copies of equipment data plates.
      b. Piping and duct connection size, type and location.

c. Equipment bearing life certification.
d. Equipment foundation data:
1) Equipment center of gravity.
2) Criteria for designing vibration, special or unbalanced forces resulting from equipment operation.

3. Electrical equipment:
a. Unless specified in a narrow-scope Specification Section, provide the following:
1) Equipment ratings: Voltage, continuous current, kVa, watts, short circuit with stand, etc., as applicable.
b. Control panels:
1) Panel construction.
2) Point-to-point ladder diagrams.
3) Scaled panel face and subpanel layout.
4) Technical product data on panel components.
5) Panel and subpanel dimensions and weights.
6) Panel access openings.
7) Nameplate schedule.
8) Panel anchorage.

4. Systems schematics and data:
a. Provide system schematics where required in system specifications.
1) Acknowledge all system components being supplied as part of the system.
2) Utilize equipment, instrument and valving tag numbers defined in the Contract Documents for all components.
3) Provide technical data for each system component showing compliance with the Contract Document requirements.
4) For piping components, identify all utility connections, vents and drains which will be included as part of the system.

5. For factory painted equipment, provide paint submittals in accordance with Section 09905 (Painting and Protective Coatings).

6. Qualifications for:
a. Electrical equipment and connections testing firm.

7. Testing plans, in accordance with PART 3 of this Section 11005:
a. Electrical Testing Program.

B. Quality Assurance/Control Submittals:
1. Preliminary report format.
2. Final report.

C. Miscellaneous Submittals:
1. Sample form letter for equipment field certification.
2. Certification that equipment has been installed properly, has been initially started up, has been calibrated and/or adjusted as required, and is ready for operation.
3. Certification for major equipment supports that equipment foundation design loads shown on the Drawings or specified have been compared to actual loads exhibited by equipment provided for this Project and that said design loadings are equal to or greater than the loads produced by the equipment provided.
4. Certification from equipment manufacturer that all manufacturer-supplied control panels that interface in any way with other controls or panels have been submitted to and coordinated with the supplier/installer of those interfacing systems.

5. Certification prior to Project closeout that electrical panel drawings for manufacturer-supplied control panels truly represent panel wiring including any field-made modifications.
6. Preliminary field quality control testing format to be used as a basis for final field quality control reporting.
7. Testing and monitoring reports in accordance with PART 2 and PART 3 of this Specification Section.

1.5 REQUIREMENTS FOR BRACING AND ANCHORING EQUIPMENT

A. General: All equipment, including machinery, tanks, piping, electrical panels, and their components and appurtenances, including their bracing, supports and anchorages, supplied by manufacturers of suppliers, shall be designed for wind and seismic forces per the 2010 California Building Code (CBC) as follows:
   1. Design for all applicable Load Combinations as indicated on Drawings and in CBC Section 1605.2 or Section 1605.3.1 and Section 1605.4.
   2. Design all equipment subject to wind forces per ASCE 7-05 Chapter 6.
      a. Design tanks and similar equipment for empty condition and wind forces.
      b. Wind Importance Factor I_P = 1.0
   3. The equipment determined to be Nonstructural Components shall comply with all requirements of ASCE 7-05 Chapter 13.
      a. Indicate in submittal calculations Component Type used per ASCE 7-05 Chapter 13 Table 13.6-1.
      b. Seismic Importance Factor I_P = 1.0
      c. W_P = Operating Weight of the Equipment Including Contents
   4. The equipment determined to be Nonbuilding Structures Not Similar to Buildings or Nonbuilding Structures Similar to Buildings shall comply with all requirements of ASCE 7-05 Chapter 15.
      a. Indicate in submittal calculations Structure Type used per ASCE 7-05 Chapter 15 Table 15.4-1 or Table 15.4-2.
      b. Seismic Importance Factor I = 1.0
      c. W_P = Operating Weight of the Equipment Including Contents
   5. Anchorage design shall comply with Appendix D of ACI 318.
      a. For Nonbuilding Structures Not Similar to Buildings or Nonbuilding Structures Similar to Buildings anchors shall comply with International Building Code Section 1908.1.16.
   6. Each piece of equipment shall be anchored to resist a minimum lateral seismic force required either by Building Code or by the manufacturer of the equipment, or a minimum lateral seismic force of 40 percent of the operating weight of the equipment, whichever is greater. No equipment shall be anchored to vertical structural elements without written approval of the Owner.
B. Seismic forces shall be considered acting at the center of gravity of the piece under consideration.
C. Anchorages shall be designed and detailed assuming that they will not receive special Inspection as defined in the 2010 California Building Code.
D. Anchorage of equipment shall be coordinated with the concrete subcontractor so that anchorage may be installed at the time of concrete placement. If calculations and anchorage details are not submitted prior to placement of concrete, the Contractor shall be responsible for any strengthening of concrete elements to resist superimposed seismic or wind loading.

E. Equipment with vibration isolators shall be provided with snubbers capable of retaining the equipment in its designated location without any material failure or deformation of the snubbers when exposed to a vertical or horizontal force at the contact surface equal to 100 percent of the operating weight of the equipment. Air gaps between retainer and equipment base shall not exceed 1/4 IN. Deflection must be considered with respect to piping attached to the equipment. Equipment without vibration isolators shall be anchored directly to the supporting floor system.
F. In addition to the anchorage, all equipment shall be internally designed so that all static and moving parts are anchored to the supporting framework to resist the imposed seismic forces. All forces must be transmitted to the base in order to be anchored as required.
G. All piping, raceways, ductwork, accessories, appurtenances, and other items furnished with equipment shall be anchored to resist lateral considered acting at the center of gravity of the piece under consideration.
H. All piping installed shall be anchored to the floor system(s) to resist lateral seismic forces without excessive deflection. This force shall be considered acting at the center of gravity of the pipe under consideration.
I. Piping with flexible connections and/or expansion joints shall be anchored such that the intended uses of these joints are maintained in the piping system.

1.6 TESTING PROGRAMS

A. Electrical Testing Program: See Section 16973 (Acceptance Testing).
B. Miscellaneous:
   1. A single manufacturer of a "product" to be selected and utilized uniformly throughout Project even though:
      a. More than one (1) manufacturer is listed for a given "product" in Specifications.
      b. No manufacturer is listed.
   2. Equipment, electrical assemblies, related electrical wiring, instrumentation, controls, and system components shall fully comply with specific NEC requirements related to area classification and to NEMA 250 and NEMA ICS 6 designations as indicated on Electrical Power Drawings and defined in Division 16.

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

A. General:
   1. Furnished equipment manufacturer's field quality control services and testing as specified in the individual equipment Specifications.
   2. Perform and report on all tests required by the equipment manufacturer's Operation and Maintenance Manual.
   3. Provide testing of electrical equipment and connections in accordance with Division 16.
   4. Equip testing and analysis personnel with all appropriate project related reference material required to perform tests, analyze results, and provide documentation including, but not limited to:
      a. Contract Drawings and Specifications.
      b. Related construction change documentation.
      c. Approved Shop Drawings.
      d. Approved Operation and Maintenance Manuals.
      e. Other pertinent information as required.

B. Equipment Monitoring and Testing Plans:
   1. Approved in accordance with Shop Drawing submittal schedule.
   2. Included as a minimum:
      a. List and description of testing and analysis equipment to be utilized.
      b. List of all equipment to be testing, including:
         1) Name and tag numbers identified in the Contract Documents.
         2) Manufacturer's serial numbers.
         3) Other pertinent manufacturer identification,
C. Instruments Used in Equipment and Connections Quality Control Testing:
   1. Minimum calibration frequency:
      a. Field analog instruments: Not more than 6 months.
      b. Field digital instruments: Not more than 12 months.
      c. Laboratory instruments: Not more than 12 months.
      d. If instrument manufacturer's calibration requirements are more stringent, those requirements shall govern.
   2. Carry current calibration status and labels on all testing instruments.
   3. See individual testing programs for additional instrumentation compliance requirements.
D. Testing and Monitoring Program Documentation:
   1. Provide reports with tabbed sections for each piece of equipment tested.
   2. Include all testing results associated with each piece of equipment under that equipment's tabbed section.
      a. Include legible copies of all forms used to record field test information.
   3. Prior to start of testing, submit preliminary report format for Owner's review and comment.
      a. Include data gathering and sample test report forms that will be utilized.
   4. In the final report, include as a minimum, the following information for all equipment tested:
      a. Equipment identification, including:
         1) Name and tag numbers identified in the Contract Documents.
         2) Manufacturer's serial numbers.
         3) Other pertinent manufacturer identification,
      b. Date and time of each test.
      c. Ambient conditions including temperature, humidity, and precipitation.
      d. Visual inspection report.
      e. Description of test and referenced standards, if any, followed while conducting tests.
      f. Results of initial and all retesting.
      g. Acceptance criteria.
      h. "As found" and "as left" conditions.
      i. Corrective action, if required, taken to meet acceptance.
      j. Verification of corrective action signed by the Contractor, equipment supplier, and Owner.
      k. Instrument calibration dates of all instruments used in testing.
   5. Provide bound final reports prior to Final Completion.
E. Electrical Testing Program:
   1. Perform testing on Division 16 equipment and connections in accordance with Division 16 requirements.

2. Repair or replace equipment shown to be out of range of the acceptable tolerance until the equipment meets or exceeds acceptability standards.

F. Other Testing:
1. Perform tests and inspections not specifically listed but required to assure equipment is safe to energize and operate.
2. Subbase that supports the equipment base and that is made in the form of a cast iron or steel structure that has supporting beams, legs, and cross members that are cast, welded, or bolted shall be tested for a natural frequency of vibration after equipment is mounted.
   a. The ratio of the natural frequency of the structure to the frequency of the disturbing force shall not be between 0.5 and 1.5.

2.2 ACCESSORIES

A. Guards:
1. Provide each piece of equipment having exposed moving parts with full length, easily removable guards, meeting OSHA requirements.
2. Interior applications:
   a. Construct from expanded galvanized steel rolled to conform to shaft or coupling surface.
   b. Utilize non-flattened type 16 GA galvanized steel with nominal 1/2 IN spacing.
   c. Connect to equipment frame with hot-dip galvanized bolts and wing nuts.
3. Exterior applications:
   a. Construct from 16 GA stainless steel or aluminum.
   b. Construct to preclude entrance of rain, snow, or moisture.
   c. Roll to conform to shaft or coupling surface.
   d. Connect to equipment frame with stainless steel bolts and wing nuts.

B. Anchorage:
1. Cast-in-place anchorage:
   a. Provide ASTM F593, Type 316 stainless steel anchorage for all equipment.
   b. Configuration and number of anchor bolts shall be per manufacturer's recommendations.
   c. Provide two (2) nuts for each bolt.
2. Drilled anchorage:
   a. Adhesive anchors per Section 05500 (Metal Fabrications).
   b. Epoxy grout per Section 03002 (Concrete and Control Density Fill).
   c. Threaded rods same as cast-in-place.

C. Data Plate:
1. Attach a stainless steel data plate to each piece of rotary or reciprocating equipment.
2. Permanently stamp information on data plate including manufacturer's name, equipment operating parameters, serial number and speed.

D. Lifting Eye Bolts or Lugs:
1. Provide on all equipment 50 LBS or greater.
2. Provide on other equipment or products as specified in the narrow-scope Specification Sections.

2.3 FABRICATION

A. Design, fabricate, and assemble equipment in accordance with modern engineering and shop practices.

B. Manufacture individual parts to standard sizes and gages so that repair parts, furnished at any time, can be installed in field.

C. Furnish like parts of duplicate units to be interchangeable.
D. Ensure that equipment has not been in service at any time prior to delivery, except as required by tests.
E. Furnish equipment which requires periodic internal inspection or adjustment with access panels which will not require disassembly of guards, dismantling of piping or equipment or similar major efforts.
   1. Quick opening but sound, securable access ports or windows shall be provided for inspection of chains, belts, or similar items.
F. Provide common, lipped base plate mounting for equipment and equipment motor where said mounting is a manufacturer's standard option.
   1. Provide drain connection for 3/4 IN PVC tubing.
G. Machine the mounting feet of rotating equipment.
H. Fabricate equipment which will be subject to Corrosive Environment in such a way as to avoid back to back placement of surfaces that cannot be properly prepared and painted.
   1. When such back to back fabrication cannot be avoided, provide continuous welds to seal such surfaces from contact with corrosive environment.
I. Control Panels Engineered and Provided with the Equipment by the Manufacturer:
   1. Manufacturer's standard design for components and control logic unless specific requirements are specified in the specific equipment Specification Section.
   2. NEMA or International Electrotechnical Commission (IEC) rated components are acceptable, whichever is used in the manufacturer's standard engineered design, unless specific requirements are required in the specific equipment Specification Section.
   3. Affix entire assembly with a UL 508A label "Listed Enclosed Industrial Control Panel" prior to delivery.
      a. Control panels without an affixed UL 508A label will be rejected.

2.4 SHOP OR FACTORY PAINT FINISHES

A. Electrical Equipment:
   1. Provide factory-applied paint coating system(s) for all electrical equipment components except those specified in Section 09905 (Painting and Protective Coatings) to receive field painting.
      a. Field painted equipment: See Section 09905 (Painting and Protective Coatings) for factory applied primer/field paint compatibility requirements.
B. Field paint other equipment in accordance with Section 09905 (Painting and Protective Coatings).
   1. See Section 09905 (Painting and Protective Coatings) for factory applied primer/field paint compatibility requirements.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install equipment as shown on Drawings and in accordance with manufacturer's directions.
B. Utilize templates for anchorage placement for slab-mounted equipment.
C. For equipment having drainage requirements provide 3/4 IN PVC or clear plastic tubing from equipment base to nearest floor or equipment drain.
D. Route clear of major traffic areas and as approved by Owner.
E. DO NOT construct foundations until major equipment supports are approved.

F. Extend all non-accessible grease fittings using stainless steel tubing to a location which allows easy access of fittings from closest operating floor level.
G. Equipment Base:
   1. Construct level in both directions.
   2. Take particular care at anchor bolt locations so these areas are flat and level.
H. Machine Base:
   1. Mount machine base of rotating equipment on equipment base.
      a. Level in both directions, using a machinist level, according to machined surfaces on base.
   2. Level machine base on equipment base and align couplings between driver and driven unit using steel blocks and shims.
      a. Size blocks and shims to provide solid support at each mounting bolt location.
         1) Provide area size of blocks and shims approximately 1-1/2 times area support surface at each mounting bolt point.
      b. Provide blocks and shims at each mounting bolt.
         1) Furnish blocks and shims that are square shape with "U" cut out to allow blocks and shims to be centered on mounting bolts.
      c. After all leveling and alignment has been completed and before grouting, tighten mounting bolts to proper torque value.
I. Grouting:
   1. After machine base has been shimmed, leveled onto equipment base, couplings aligned and mounting bolts tightened to correct torque value, place a dam or formwork around base to contain grouting between equipment base and equipment support pad.
      a. Extend dam or formwork to cover leveling shims and blocks.
      b. Do not use nuts below the machine base to level the unit.
   2. Saturate top of roughened concrete subbase with water before grouting.
      a. Add grout until entire space under machine base is filled to the top of the base underside.
      b. Puddle grout by working a stiff wire through the grout and vent holes to work grout in place and release any entrained air in the grout or base cavity.
   3. When the grout has sufficiently hardened, remove dam or formwork and finish the exposed grout surface to fine, smooth surface.
      a. Cover exposed grout surfaces with wet burlap and keep covering sufficiently wet to prevent too rapid evaporation of water from the grout.
      b. When the grout has fully hardened (after a minimum of seven (7) Days) tighten all anchor bolts to engage equipment base to grout, shims, and equipment support pad.
      c. Recheck driver-driven unit for proper alignment.

3.2 INSTALLATION CHECKS

A. For all equipment specifically required in detailed specifications, secure services of experienced, competent, and authorized representative(s) of equipment manufacturer to visit site of work and inspect, check, adjust and approve equipment installation.
   1. In each case, representative(s) shall be present during placement and start-up of equipment and as often as necessary to resolve any operational issues which may arise.
B. Secure from equipment manufacturer's representative(s) a written report certifying that equipment:
   1. Has been properly installed and lubricated.
   2. Is in accurate alignment.

3. Is free from any undue stress imposed by connecting piping or anchor bolts.
4. Has been operated under full load conditions and that it operated satisfactorily.
   a. Secure and deliver a field written report to Owner immediately prior to leaving Site.

3.3 IDENTIFICATION OF EQUIPMENT AND HAZARD WARNING SIGNS

A. Identify equipment and install hazard warning signs in accordance with Section 10405 (Identification, Stenciling, and Tagging Systems).

3.4 FIELD PAINTING AND PROTECTIVE COATINGS

A. For required field painting and protective coatings, comply with Section 09905 (Painting and Protective Coatings).

3.5 WIRING CONNECTIONS AND TERMINATION

A. Clean wires before installing lugs and connectors.
B. Coat connection with oxidation eliminating compound for aluminum wire.
C. Terminate motor circuit conductors with copper lugs bolted to motor leads.
D. Tape stripped ends of conductors and associated connectors with electrical tape.
   1. Wrapping thickness shall be 150 percent of the conductor insulation thickness.
E. Connections to carry full ampacity of conductors without temperature rise.
F. Terminate spare conductors with electrical tape.

3.6 FIELD QUALITY CONTROL

A. Furnish equipment manufacturer services as specified in the individual equipment Specifications.
B. Inspect wire and connections for physical damage and proper connection.

END OF SECTION

SECTION 11296

FISH SCREEN CLEANER

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fish Screen Cleaner.
   2. Shop and Field Testing.
   3. Installation.
   4. Field Representative.

B. Related Sections:
   1. Section 09905 (Painting and Protective Coatings).
   2. Section 13446 (Control Auxiliaries).
   3. Section 13448 (Control Panels and Enclosures).

1.2 REFERENCES

A. ASTM A36/A 36M — Standard Specification for Carbon Structural Steel

B. ASTM D4174 — Standard Practice for Cleaning, Flushing, and Purification of Petroleum Fluid Hydraulic Systems

1.3 SYSTEM DESCRIPTION

A. Fish screen cleaner shall be installed at the fish screen structure for cleaning debris from the fish screens.

B. Cleaning Cycle:
   1. To be handled in full by the manufacturers controller.
   2. Position the starting position of the horizontal brush cleaning unit at the upstream end of the fish screen structure.
   3. The brush cleaning unit shall travel downstream across the screen to the set limit switch where the brush cleaning unit shall travel back upstream along the screen to the starting position. During both passes along the screen, the dual brushes mounted on the brush arm shall be in contract with the fish screen.

C. Over-Travel Protection: Equip travel rail with limit switches and stops at both ends of rail to prevent over- travel of the carriage.

D. Overload: Equip cleaner with suitable overload protection devices that automatically stop motion at preset, adjustable overloads. Provide local and remote alarm indications of any overload condition.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Certified drawings showing installation, overall layout, components and assemblies, and essential details and related equipment.
   2. Bill of Material.
   3. Control schematics.
   4. Hydraulic schematics.
   5. Wiring diagrams.
   6. Overload protection and remote monitoring devices.

7. Equipment list with associated catalog data (product specifications and descriptions) for items of standard manufacture.
8. Quality Assurance/Control Submittals:
   a. Design Data: Calculations for all components of the fish screen brush cleaning system for all service conditions. Calculations shall include formulas, free body diagrams showing magnitude and location of applied loads, resulting reaction forces, stresses, deflections, system load capacities, and factor of safety; drive power requirements; rail; support structure with seismic loading.
   b. Painting Procedures and Specifications.
   c. Shop Test Reports.
   d. Manufacturer's Installation Instructions.
   e. Manufacturer's Field Reports.
9. List of Special Tools and Spare Parts.
   a. The Fish Screen Cleaning Manufacturer shall recommend spare parts to be furnished.
   b. Tools, appliances, handling devices, and templates to be furnished.
10. Installation, Operation, and Maintenance Manuals.
    a. Fish screen cleaner.
11. Color of coatings.

1.5 QUALITY ASSURANCE

A. Design Data:
   1. Adequacy of design:
      a. Provide a coordinated and adequate design fulfilling the requirements of these Specifications.
      b. Furnish and install items and devices not specifically called for in these Specifications but necessary to provide a complete and operational system or that may be found necessary to correct unsatisfactory operation or performance.
B. Field Representative:
   1. Furnish field representative for field assembly, checkout, and testing of equipment, who is an employee of the supplier, and who is fluent in written and spoken English. Field representative shall be knowledgeable in and shall supervise installation and testing of equipment supplied under this Section 11296.
C. Conform to applicable codes, standards, specifications, and requirements as specified herein.

1.6 DESIGN CHARACTERISTICS

A. Head lateral force (exerted on fish screen): 50 lbs.
B. Longitudinal force (brush capable of pushing debris) 50 lbs measured at the bottom of the brush arm.
C. Brushes Mechanism:
   1. Brush height shall be 6 FT with brush arm having two rows of brushes as shown on the Drawings.
   2. The entire brush arm and all other metal components/fasteners shall be stainless steel 304L.
   3. Brushes shall be made from polypropylene or Approved Equal made for submergence in water.
D. Installation location: Located outdoors with temperatures likely to range between 20-120 DegF. All non metal components shall be UV protected.

E. Sound rating: 85 dBA maximum at 3 FT from any point of cleaner.
F. Power supply: 208 V, 3 phase, 60 Hz.
G. Cleaning system Chassis: Self-propelled unit including all mechanical elements, necessary to clean the fish screen that travels along rail/beam. The Cleaning system chassis shall be able to clean the entire screen area within 3 minutes.
H. The rail/beam shall be designed by screen cleaning manufacturer and shall be ASTM A36 steel with marine rated epoxy coating as specified in Section 09905 (Painting and Protective Coatings). The Screen Cleaning Manufacturer shall provide the Owner with the locations and anchor bolt sizes for attachment to the concrete intake structure.
I. Power Cable and Festoon Cable Support System: Provide electric power to self-propelled brush cleaning system through a power cable, designed for marine environment. Provide festoon support system consisting of trolley track and cable carriers, to gather and extend the power cable as the cleaning carriage moves back and forth along the rail/beam.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Atlas Polar.
B. Or Approved Equal.

2.2 CONTROLS

A. Control Panel:
   1. NEMA 4X enclosure.
   2. Mounted on screen cleaning equipment.
   3. Maximum panel width 24 IN.
   4. Front panel nameplate.
   5. Arc flash warning label.
   6. Circuit breaker to disconnect all power with front panel mounted handle.
   7. Switches and lights.
   8. Front panel digital indicators for fish screen upstream and downstream levels.
B. Control Features and Functions:
   1. Selector Switch: Local/Off/Automatic.
      a. In the Automatic position, a sweep cycle shall be initiated by the response to the following:
         1) Elapsed time between cleaning cycles.
         2) Differential Water Level.
      b. In the Local position, a sweep cycle shall be initiated in response to the following contacts:
         1) Control Panel Pushbutton.
   2. Control may be PLC or hard device based.
C. Power Supply: 208 V, 3 phase, 60 Hz single feed to control panel.
D. Electrical Controls and Features:
   1. Provide the following controls and features:
      a. Motor starter, NEMA rated and sized for the motor provided, including motor overload protection per NEC requirements.
      b. Control power transformer, complete with primary and secondary overcurrent protection. Size transformer to provide adequate power for all control devices furnished.

c. Provide all control devices, including cycle timers, relays, pushbuttons, etc., for automatic and local manual control.

E. Wiring: Electrical components shop wired to terminal strip to minimize field wiring, see Section 13446 (Control Auxiliaries) and Section 13448 (Control Panels and Enclosures).

F. Provide isolated normally open contacts as follows for remote monitoring:
   1. Auto mode.
   2. Fail.

G. Receive 4-20 MA analog input signals for control:
   1. Fish screen upstream level.
   2. Fish screen downstream level.

H. Provide thermostatically controlled heater in control panel.

2.3 COATINGS

A. Prepare and coat interior and exterior surfaces in accordance with manufacturer's standard procedures.

B. Color: As selected by Owner.

2.4 SHOP ASSEMBLY AND TESTS

A. Perform shop assembly prior to shipment to verify design, construction, and machining for proper alignment, fits, and clearances.

B. Perform mechanical, electrical, and functional shop test on screen cleaning equipment.

C. Tests: Manufacturer's standard production tests. Shop tests to demonstrate, insofar as practical, that the equipment and accessories are fully functional and meet the performance requirements specified in these Specifications.

D. Pressure test, adjust, and calibrate gauges, switches, and meters.

E. Shop test components and devices subject to oil pressure at a pressure 50 percent greater than the rated pressure.

F. Hold pressure for 30 minutes. No leakage permitted. After testing, thoroughly clean equipment and piping of any liquids that may cause corrosive action.

G. Clean, flush, and purify hydraulic system in accordance with manufacturer's instructions and procedures before shipping, and comply with ASTM D4174.

H. Perform continuity and ground tests for all electrical components and wiring.

I. Furnish shop test report.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install equipment as specified herein, as shown on the Drawings, and in accordance with "approved" supplier's drawings, instructions, and procedures. In case of conflict between the Contract Documents and the supplier's drawings, Owner will issue correction instructions in writing.

B. Provide tools and components required for installation.

C. Provide field representative who has experience in the installation of similar equipment.

D. Ensure closure plugs for pipe, tube, hose, and equipment ports remain closed-in-place until required to be opened.

3.2 FIELD TESTS

A. Field checkout, operate, adjust, and test all equipment in accordance with supplier's instructions and procedures. Check physical connections, wiring, controls, limit switches,

etc. as required. Adjust stroke limiters, limit switches, overloads, operating cycle, etc., as required.

B. Operate and test screen cleaner to demonstrate satisfactory operation. Demonstrate capacity, automatic- continuous modes of operation (timer and differential water signals), and local manual operation.
C. Perform all tests under the direction of field representative.
D. Furnish field test report.

3.3 START-UP AND TESTING

A. Coordinate start-up and testing with manufacturer's field representative.

3.4 O&M TRAINING

A. Manufacturer's field representative shall hold an onsite training session with Owner's personnel to review operation and maintenance of the equipment for a duration no less than 16 HRS over two or three days.

END OF SECTION

DIVISION 13

SPECIAL CONSTRUCTION

SECTION 13440

INSTRUMENTATION FOR PROCESS CONTROL: BASIC REQUIREMENTS

PART 1 GENERAL

1.1 REFERENCES

A. ISA S5.1 — Instrumentation Symbols and Identification
B. ISA S5.3 — Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer Systems
C. ISA S20 — Standard Specification Forms for Process Measurement and Control Instruments, Primary Elements and Control Valves

1.2 QUALITY ASSURANCE

A. Miscellaneous:
   1. Comply with electrical classifications and NEMA enclosure types as indicated.

1.3 DEFINITIONS

A. Non-architecturally finished area: Pump, chemical, mechanical, electrical rooms and other similar process type rooms.
B. Outdoor Area: Exterior locations where the equipment is normally exposed to the weather and including below grade structures, such as vaults, manholes, handholes and in-ground pump stations.
C. Calibrate: To standardize a device so that it provides a specified response to known inputs.

1.4 SYSTEM DESCRIPTION

A. Control System Requirements:
   1. The instrument and control system consists of all primary elements, transmitters, switches, controllers, computers, indicators, panels, signal converters, signal boosters, amplifiers, special power supplies, special or shielded cable, special grounding or isolation, auxiliaries, software, wiring, and other devices required to provide complete control of the facility as specified in the Contract Documents.
B. All signals shall be directly linearly proportional to measured variable unless specifically noted otherwise.
C. Single Instrumentation Subcontractor:
   1. Furnish and coordinate instrumentation system through a single instrumentation subcontractor.
      a. The instrumentation subcontractor shall be responsible for functional operations of all systems, performance of control system engineering, supervision of installation, final connections, calibrations, preparation of Drawings and Installation, Operation and Maintenance Manuals, start-up, training, demonstration of Substantial Completion and all other aspects of the control system.
   2. Ensure coordination of instrumentation with other Work to ensure that necessary wiring, conduits, contacts, relays, converters, and incidentals are provided in order to transmit, receive, and control necessary signals to other control elements, to control panels, and to receiving stations.

1.5 SUBMITTALS

A. Shop Drawings:
   1. Product technical data including:
      a. Equipment catalog cut sheets.
      b. Instrument data sheets:
         1) ISA S20 or Approved Equal.
         2) Separate data sheet for each instrument.
      c. Materials of construction.
      d. Physical limits of components including temperature and pressure limits.
      e. Size and weight.
      f. Electrical power requirements and wiring diagrams.
      g. NEMA rating of housings.
   2. Comprehensive set of wiring diagrams.
   3. Nameplate layout drawings.
   4. Drawings, systems, and other elements are represented schematically in accordance with ISA S5.1 and ISA S5.3.
      a. The nomenclature, tag numbers, equipment numbers, panel numbers, and related series identification contained in the Contract Documents shall be employed exclusively throughout submittals.
   5. All Shop Drawings shall be modified with as-built information/corrections.
   6. Provide a parameter setting summary sheet for each field configurable device.
   7. Certifications:
      a. Documentation verifying that calibration equipment is certified with NIST traceability.
      b. Approvals from independent testing laboratories or approval agencies, such as UL, FM or CSA.
         1) Certification documentation is required for all equipment for which the specifications require independent agency approval.
   8. Testing reports: Source quality control reports.
B. Installation, Operation, and Maintenance Manuals:
   1. List of factory authorized service agents.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not remove shipping blocks, plugs, caps, and desiccant dryers installed to protect the instrumentation during shipment until the instruments are installed and permanent connections are made.

1.7 SITE CONDITIONS

A. Unless indicated otherwise, area designations are as follows:
   1. Outdoor area:
      a. Wet.
      b. Subject to temporary submergence when specifically indicated.
   2. Non-architecturally finished area: As indicated.

PART 2 PRODUCTS

2.1 NEMA TYPE REQUIREMENTS

A. Provide enclosures/housing for control system components in accordance with the following:
   1. Areas designated as wet: NEMA Type 4X.
   2. Dry area: NEMA Type 12.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

A. System Operating Criteria:
   1. Performance: All instruments and control devices shall perform in accordance with manufacturer's specifications.

2.3 ACCESSORIES

A. Provide identification devices for instrumentation system components.

PART 3 EXECUTION

3.1 INSTALLATION

A. Wherever feasible, use bottom entry for all conduit entry to instruments and junction boxes.
B. Install electrical components per Division 16.
C. Panel-Mounted Instruments:
   1. Mount and wire so removal or replacement may be accomplished without interruption of service to adjacent devices.
   2. Locate all devices mounted inside enclosures so terminals and adjustment devices are readily accessible without use of special tools and with terminal markings clearly visible.

3.2 FIELD QUALITY CONTROL

A. Maintain accurate daily log of all startup activities, calibration functions, and final setpoint adjustments.
   1. Documentation requirements include the utilization of the forms located at the end of this Section 13440.
      a. Loop Check-out Sheet.
      b. Instrument Certification Sheet.
      c. Final Control Element Certification Sheet.
B. Instrumentation Calibration:
   1. Verify that all instruments and control devices are calibrated to provide the performance required by the Contract Documents.
   2. Calibrate all field-mounted instruments, other than local pressure and temperature gages, after the device is mounted in place to ensure proper installed operation.
   3. Calibrate in accordance with the manufacturer's specifications.
   4. Replace any instrument which cannot be properly adjusted.
   5. Calibration equipment shall be certified by an independent agency with traceability to NIST.
      a. Certification shall be up-to-date.
      b. Use of equipment with expired certifications shall not be permitted.
   6. Calibration equipment shall be at least three (3) times more accurate as the device being calibrated.

C. Loop check-out requirements are as follows:
   1. Check control signal generation, transmission, reception and response for all control loops under simulated operating conditions by imposing a signal on the loop at the instrument connections.
      a. Use actual signals where available.
      b. Closely observe controllers, indicators, transmitters, HMI displays, recorders, alarm and trip units, remote setpoints, ratio systems, and other control components.
         1) Verify that readings at all loop components are in agreement.
         2) Make corrections as required.
            (a) Following any corrections, retest the loop as before.
   2. In addition to any other as-recorded documents, record all setpoint and calibration changes on Record Documents.
D. Provide verification of system assembly, power, ground, and I/O tests.
E. Verify existence and measure adequacy of all grounds required for instrumentation and controls.

END OF SECTION

Loop Check-out Sheet

Project Name:	Owner's Project No. (if applicable):	Page of
Project Owner:	Regulatory Agency Project No. (if applicable):	
HDR Project No.:	Date:	

LEAK AND TERMINATION/CONTINUITY CHECKS

DESCRIPTION	FIELD					CONTROL CAB	
	LEAK CHECK(1)			TERM/CONT CHECK(2)		TERM/CONT CHECK(2)	
	Device Tag No.	Process Conn.	Signal Tube	Device Tag No.	Termination Ident.	Device Tag No.	Termination Ident.

1. Leak check for pneumatic signal tubing to be per ISA-PR7.1.
2. Termination/continuity check includes check at terminated equipment for: (a) correct polarity, (b) appropriate signal generation, transmission and reception, and (c) correct shield & ground terminations.

OPERATOR INTERFACE CHECK-OUT

MONITORING POINTS OBSERVED

PARAMETER TYPE	TAG NO.	TAG NO.	TAG NO.	TAG NO.	TAG NO.	TAG NO.
PROCESS VAR						
EQUIP STATUS						
ALARM POINT						

OPERATOR CONTROL FUNCTIONS CHECKED

FUNCTION TYPE	TAG NO.	LOCATION	TAG NO.	LOCATION	TAG NO.	LOCATION

AS LEFT SETTINGS

TAG NO.	SWITCH & ALARM SP	CONTROLLERS			
		Gain	Reset, rpm	Deriv. (rate), min	PV Set Point

Describe all interlocks checked, equipment started/stopped, valves/operators stroked. Describe modes of operation checked, and location of operator interface (local/remote).

_____

_____

_____

_____

I certify that the control loop referenced on this page has been completely checked and functions in accordance with applicable drawings and specifications.

Certified by:_____ Date:_____
(Work Performed By)

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Loop Check-out Sheet

Project Name:	BIG PROJECT	Owner's Project No. (if applicable):	Page 1 of 2
Project Owner:	ABC Company	Regulatory Agency Project No. (if applicable):	
HDR Project No.:	10050-211-134	Date: 12/19/98	
Control Loop No.	107		

LEAK AND TERMINATION/CONTINUITY CHECKS

DESCRIPTION	FIELD					CONTROL CAB	
	LEAK CHECK(1)			TERM/CONT CHECK(2)		TERM/CONT CHECK(2)	
	Device Tag No.	Process Conn.	Signal Tube	Device Tag No.	Termination Ident.	Device Tag No.	Termination Ident.
P201 Start Sig				VFD-107	21, 22	PLC Cab	103, 104
P201, Speed inp				VFD-107	27, 28	PLC Cab	67, 68, 69
P201 Start out				VFD-107	31, 32	PLC Cab	72, 73, 74
Press transmit	PIT-107	JS	--	PIT-107	+ / -	PLC Cab	98, 99, 100

1. Leak check for pneumatic signal tubing to be per ISA-PR7.1.
2. Termination/continuity check includes check at terminated equipment for: (a) correct polarity, (b) appropriate signal generation, transmission and reception, and (c) correct shield & ground terminations.

OPERATOR INTERFACE CHECK-OUT
MONITORING POINTS OBSERVED

PARAMETER TYPE	TAG NO.	TAG NO.	TAG NO.	TAG NO.	TAG NO.	TAG NO.
PROCESS VAR	PI-107A	SI-107				
EQUIP STATUS	P201 ON	P201 OFF	V-107 open	V-107 close		
ALARM POINT	PAH-107					

OPERATOR CONTROL FUNCTIONS CHECKED

FUNCTION TYPE	TAG NO.	LOCATION	TAG NO.	LOCATION	TAG NO.	LOCATION
H-O-A sel sw	HS-107A	VFD-107				
L-O-R sel sw	HS-107B	@ P201				
S/S switch	HS-107C	MCC	HS-107D	MCC		

AS LEFT SETTINGS

TAG NO.	SWITCH & ALARM SP	CONTROLLERS			
		Gain	Reset, rpm	Deriv. (rate), min	PV Set Point
PAH-107	120 psi				
SC-107		2.0	5.0	0.2	80 psi

Describe all interlocks checked, equipment started/stopped, valves/operators stroked. Describe modes of operation checked, and location of operator interface (local/remote).

(1) HS-107B in Local: (a) start/stop operation via HS-107A and HS-107C, D (b) Manual/auto operation via HS-107A. In auto, pump stopped on hi press, started on lo press. (2) HS-107B in Remote: Observed operation from PLC-pump stopped on hi press, started on lo press. (3) Observed V-107 open/close automatically in accord with pump run condition. (4) Observed all indications and terminations shown above. (5) Tuned SC-107

I certify that the control loop referenced on this page has been completely checked and functions in accordance with applicable drawings and specifications.

Certified by: Joe Smith Date: 12/19/98
(Work Performed By)

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EXAMPLE

Loop Check-out Sheet

Project Name:	BIG PROJECT	Owner's Project No. (if applicable):	Page 2 of 2
Project Owner:	ABC Company	Regulatory Agency Project No. (if applicable):	
HDR Project No.:	10050-211-134	Date: 12/19/98	
Control Loop No.	107		

LEAK AND TERMINATION/CONTINUITY CHECKS

DESCRIPTION	FIELD					CONTROL CAB	
	LEAK CHECK(1)			TERM/CONT CHECK(2)		TERM/CONT CHECK(2)	
	Device Tag No.	Process Conn.	Signal Tube	Device Tag No.	Termination Ident.	Device Tag No.	Termination Ident.
V-107 open ZS				ZSO-107	+ / -	PLC Cab	112, 113
V-107 close ZS				ZSC-107	+ / -	PLC Cab	114, 115

1. Leak check for pneumatic signal tubing to be per ISA-PR7.1.
2. Termination/continuity check includes check at terminated equipment for: (a) correct polarity, (b) appropriate signal generation, transmission and reception, and (c) correct shield & ground terminations.

OPERATOR INTERFACE CHECK-OUT

MONITORING POINTS OBSERVED

PARAMETER TYPE	TAG NO.	TAG NO.	TAG NO.	TAG NO.	TAG NO.	TAG NO.
PROCESS VAR						
EQUIP STATUS	ZOI-107	ZCI-107				
ALARM POINT						

OPERATOR CONTROL FUNCTIONS CHECKED

FUNCTION TYPE	TAG NO.	LOCATION	TAG NO.	LOCATION	TAG NO.	LOCATION

AS LEFT SETTINGS

TAG NO.	SWITCH & ALARM SP	CONTROLLERS			
		Gain	Reset, rpm	Deriv. (rate), min	PV Set Point

Describe all interlocks checked, equipment started/stopped, valves/operators stroked. Describe modes of operation checked, and location of operator interface (local/remote).

Checked terminations and verified indications shown above.

I certify that the control loop referenced on this page has been completely checked and functions in accordance with applicable drawings and specifications.

Certified by: Joe Smith Date: 12/19/98
(Work Performed By)

(Version 1.0 Apr 99)

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EXAMPLE

Instrument Certification Sheet

Project Name:	Owner's Project No. (if applicable):
Project Owner:	Regulatory Agency Project No. (if applicable):
HDR Project No.	Date:
Control Loop No.:	
Instrument Tag No.	Transmitter/gauge span:
Manufacturer:	Switch set-point:
Model No.	Switch dead band:
Serial No.	Switch range:

TRANSMITTERS AND INDICATORS

	INCREASING INPUT			DECREASING INPUT		
% OF SPAN	**INPUT**	**OUTPUT**	**ERROR (% of span)**	**INPUT**	**OUTPUT**	**ERROR (% of span)**
0%						
25%						
50%						
75%						
100%						
Other (if applicable)						
Other (if applicable)						

SWITCHES

	INCREASING INPUT			DECREASING INPUT		
ACTUATION POINT	**INPUT**	**OUTPUT**	**ERROR (% of range)**	**INPUT**	**OUTPUT**	**ERROR (% of range)**
High (Increasing input)						
Low (Decreasing input)						

Maximum allowable error (per Contract Documents): _____

Remarks: _____

CALIBRATION EQUIPMENT UTILIZED

DEVICE TYPE	MFR/MODEL NO.	ACCURACY	NIST TRACEABILITY?

Certified by:_____ Date Certified:_____

(Version 1.0 Apr 99)

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Instrument Certification Sheet

Project Name:	BIG PROJECT	Owner's Project No. (if applicable):	
Project Owner:	ABC Company	Regulatory Agency Project No. (if applicable):	
HDR Project No.	10050-211-134	Date: 12/19/98	
Control Loop No.:	222		
Instrument Tag No.	TSH-222	Transmitter/gauge span:	
Manufacturer:	ACE, Inc.	Switch set-point:	50 F
Model No.	TL-2983-SH5	Switch dead band:	5 F
Serial No.	10293583	Switch range:	32-200 F

TRANSMITTERS AND INDICATORS

	INCREASING INPUT			DECREASING INPUT		
% OF SPAN	**INPUT**	**OUTPUT**	**ERROR (% of span)**	**INPUT**	**OUTPUT**	**ERROR (% of span)**
0%						
25%						
50%						
75%						
100%						
Other (if applicable)						
Other (if applicable)						

SWITCHES

	INCREASING INPUT			DECREASING INPUT		
ACTUATION POINT	**INPUT**	**OUTPUT**	**ERROR (% of range)**	**INPUT**	**OUTPUT**	**ERROR (% of range)**
High (Increasing input)	49.8 F	Contact Close	0.1%	45.1 F	Contact Open	0.2%
Low (Decreasing input)						

Maximum allowable error (per Contract Documents): 1.0% Switch Range

Remarks:

CALIBRATION EQUIPMENT UTILIZED

DEVICE TYPE	MFR/MODEL NO.	ACCURACY	NIST TRACEABILITY?
Temperature (dry block) calibrator	Hart Scientific XL5897T	0.1 F	Yes

Certified by: Joe Smith Date Certified: 12/19/98

EXAMPLE

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Instrument Certification Sheet

Project Name:	BIG PROJECT	Owner's Project No. (if applicable):	
Project Owner:	ABC Company	Regulatory Agency Project No. (if applicable):	
HDR Project No.	10050-211-134	Date:	12/19/98
Control Loop No.:	106		
Instrument Tag No.	PIT-106A	Transmitter/gauge span:	0-200 psi
Manufacturer:	ACE, Inc.	Switch set-point:	
Model No.	1275-X	Switch dead band:	
Serial No.	3049569TSH	Switch range:	

TRANSMITTERS AND INDICATORS

	INCREASING INPUT			DECREASING INPUT		
% OF SPAN	**INPUT**	**OUTPUT**	**ERROR (% of span)**	**INPUT**	**OUTPUT**	**ERROR (% of span)**
0%	0.00 psi	4.02 mA	0.13	0.00 psi	4.00 mA	0.00
25%	50.00 psi	8.00 mA	0.00	50.00 psi	8.01 mA	0.06
50%	100.00 psi	12.01 mA	0.06	100.00 psi	12.00 mA	0.00
75%	150.00 psi	16.00 mA	0.00	150.00 psi	16.01 mA	0.06
100%	200.00 psi	20.00 mA	0.00	200.00 psi	19.99 mA	0.06
Other (if applicable)						
Other (if applicable)						

SWITCHES

	INCREASING INPUT			DECREASING INPUT		
ACTUATION POINT	**INPUT**	**OUTPUT**	**ERROR (% of range)**	**INPUT**	**OUTPUT**	**ERROR (% of range)**
High (Increasing input)						
Low (Decreasing input)						

Maximum allowable error (per Contract Documents): 0.15% span

Remarks: Adjusted zero-otherwise no adjustments required

CALIBRATION EQUIPMENT UTILIZED

DEVICE TYPE	MFR/MODEL NO.	ACCURACY	NIST TRACEABILITY?
Pressure calibrator	Hathaway/Beta XL5946P	0.025% full scale	Yes
Pressure module	Hathaway/Beta XL5948P-6:0-150 psi	0.025% full scale	Yes

Certified by: Joe Smith Date Certified: 12/19/98

(Version 1.0 Apr 99)

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EXAMPLE

Final Control Element Certification Sheet

Project Name:	Owner's Project No. (if applicable):
Project Owner:	Regulatory Agency Project No. (if applicable):
HDR Project No.	Date:
Control Loop No.:	

Tag No.	Actuator: Pneumatic: _____ Electric: _____
Description:	Positioner: Direct: _____ Reverse: _____
Manufacturer:	Positioner: Input: _____ Output: _____
Model No.	I/P Converter: Input: _____ Output: _____
Serial No.	Valve to _____ on air failure
	Valve to _____ on power failure

I/P CONVERTER

	INCREASING INPUT			DECREASING INPUT		
% OF SPAN	INPUT	OUTPUT	ERROR (% of span)	INPUT	OUTPUT	ERROR (% of span)
0%						
25%						
50%						
75%						
100%						

Specified I/P converter accuracy: _____ % of span.

FINAL CONTROL ELEMENT

	INCREASING INPUT			DECREASING INPUT		
% OF SPAN	INPUT	TRAVEL	ERROR (% of full travel)	INPUT	TRAVEL	ERROR (% of full travel)
0%						
25%						
50%						
75%						
100%						

Remarks: _____

CALIBRATION EQUIPMENT UTILIZED

DEVICE TYPE	MFR/MODEL NO.	ACCURACY	NIST TRACEABILITY?

Certified by:_____ Date Certified:_____

(Version 1.0 Apr 99)

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Final Control Element Certification Sheet

Project Name:	BIG PROJECT	Owner's Project No. (if applicable):	
Project Owner:	ABC Company	Regulatory Agency Project No. (if applicable):	
HDR Project No.	10050-211-134	Date:	12/19/98
Control Loop No.:	056		

Tag No.	LCV-056A
Description:	Control Valve
Manufacturer:	ACE, Inc.
Model No.	XYZ-123
Serial No.	748569AP2

Actuator:	Pneumatic: X	Electric: _____
Positioner:	Direct: X	Reverse: _____
Positioner:	Input: 9-15 psi	Output: 0-100%
I/P Converter:	Input: 4-20 mA	Output: 3-15 psi
Valve to	Open	on air failure
Valve to	Open	on power failure

I/P CONVERTER

	INCREASING INPUT			DECREASING INPUT		
% OF SPAN	INPUT	OUTPUT	ERROR (% of span)	INPUT	OUTPUT	ERROR (% of span)
0%	4.00 mA	3.01 psi	0.08	4.00 mA	3.02 psi	0.17
25%	8.00 mA	6.04 psi	0.33	8.00 mA	6.05 psi	0.42
50%	12.00 mA	9.00 psi	0.00	12.00 mA	9.01 psi	0.08
75%	16.00 mA	11.97 psi	0.25	16.00 mA	12.03 psi	0.25
100%	20.00 mA	14.99 psi	0.08	20.00 mA	14.99 psi	0.08

Specified I/P converter accuracy: 0.50% % of span.

FINAL CONTROL ELEMENT

	INCREASING INPUT			DECREASING INPUT		
% OF SPAN	INPUT	TRAVEL	ERROR (% of full travel)	INPUT	TRAVEL	ERROR (% of full travel)
0%	9.00 psi	0%	-	9.00 psi	0%	-
25%	10.50 psi	25%	-	10.50 psi	25%	-
50%	12.00 psi	50%	-	12.00 psi	50%	-
75%	13.50 psi	75%	-	13.50 psi	75%	-
100%	15.00 psi	100%	-	15.00 psi	100%	-

Remarks: LCV-056A is not furnished with position transmitter, so travel checks were visual.

CALIBRATION EQUIPMENT UTILIZED

DEVICE TYPE	MFR/MODEL NO.	ACCURACY	NIST TRACEABILITY?
Multi-fct calibrator	Fluke-XL743B	0.01% Rdg + 0.015% FS	Yes
Pressure Module	Fluke-XL700POS (0-30")	0.05% FS	Yes

Certified by: Joe Smith Date Certified: 12/19/98

EXAMPLE

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SECTION 13441

CONTROL LOOP DESCRIPTIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Instrumentation control loops.
B. Related Sections:
   1. Section 13440 (Instrumentation for Process Control: Basic Requirements).

1.2 QUALITY ASSURANCE

A. See Specification Section 13440 (Instrumentation for Process Control: Basic Requirements).

1.3 SYSTEM DESCRIPTION

A. The control loop descriptions provide the functional requirements of the control loops represented in the Contract Documents.
B. The control loop descriptions are not intended to be an inclusive listing of all elements and appurtenances required to execute loop functions, but are rather intended to supplement and complement the Drawings and other Specification Sections.
   1. The control loop descriptions shall not be considered equal to a bill of materials.
C. Provide instrumentation hardware and software as necessary to perform control functions specified herein and shown on Drawings.

1.4 SUBMITTALS

A. See Section 13440 (Instrumentation for Process Control: Basic Requirements).
B. Operation and Maintenance Manuals:
   1. All field instruments.
   2. All panel mounted instruments and equipment.
C. Control Strategy for Record Documents:
   1. Obtain this Section 13441 in electronic format (Microsoft Word) from Owner at beginning of Project.
   2. Revise and update the file monthly during construction and start-up to reflect all changes that occur due to specific equipment and systems supplied on the Project.
      a. Show all revisions in 'track change' mode.
      b. Change Specification Section Title to read "Control Loop Descriptions - Contractor Record Document."
      c. Reference all changes by Request for Information (RFI) number or Change Proposal Request (CPR) number.
      d. Submit revised file monthly to Owner for review.
   3. Deliver the revised and updated file as a final control loop description Record Document in the Installation, Operation and Maintenance Manual described in Section 01330 (Submittal Procedures).

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 CONTROL LOOPS

A. All programming will be performed by the Owner. See Specification Section 11296 (Fish Screen Cleaner) for description of cleaner operation. All other equipment is manual.

END OF SECTION

SECTION 13442

PRIMARY ELEMENTS AND TRANSMITTERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Flow components.
   2. Level components.
B. Related Sections:
   1. Section 13440 (Instrumentation for Process Control: Basic Requirements).

1.2 SYSTEM DESCRIPTION

A. The instruments specified in this Section 13442 are the primary element components required.

1.3 SUBMITTALS

A. See Section 13440 (Instrumentation for Process Control: Basic Requirements).
B. Product Data:
   1. Flow meters:
      a. Flow rating: 0 – 70 cfs.
      b. Output signal: 4-20 madc.
      c. Electrical power: 120 VAC.
      d. Grounding requirements: None.
      e. Sensor NEMA rating: 6, submersible.
   2. Level transmitters:
      a. Range: 0 – 20 feet.
      b. Output signal: 4-20 madc.
      c. Transmitter NEMA rating: 4X.
C. Shop Drawings:
   1. Flow meters.
   2. Wiring diagram.
D. Quality Assurance/Control Submittals:
   1. Manufacturers instructions:
      a. Flow meter installation.
E. Installation, Operation and Maintenance Manual:
   1. Flow meters.
   2. Level transmitters.
   3. Certification sheets for flow meter and level transmitter calibration.
   4. Name, address and phone number of nearest equipment service representative.

1.4 WARRANTY

A. Special Warranty:
   1. Flow meter and level transmitter:
      a. One year manufacturer warranty on materials and workmanship.
      b. One year manufacturer warranty to perform to AWWA New Equipment Accuracy.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed in the Articles describing the elements are acceptable.

2.2 FLOW COMPONENTS

A. Strap on Doppler Flow Meter:
   1. Acceptable manufacturers:
      a. Polysonics/Thermo SX50.
      b. Or Approved Equal.
   2. Sensor head design and fabrication:
      a. Dual strap on sensors with 30 FT cables.
      b. Sensor heads to be encapsulated, rated for submersion.
      c. All exposed metal to be stainless steel.
   3. Transmitter:
      a. 120 VAC input; 4-20 ma output.
      b. Front panel indicator and totalizer.
      c. Rated NEMA 4X, wall mounting.
   4. Schedule:

TAG NUMBER	SERVICE	FLOW RANGE (cfs)	PIPE SIZE (IN)
FE/FIT-001	Russian River Water	0 – 70	36

2.3 LEVEL ELEMENTS

A. Submersible Level Sensor/Transmitter:
   1. Acceptable manufacturers:
      a. Keller Nonfouling Level Rat.
      b. Or Approved Equal.
   2. Select range closest to measured span.
   3. Cable length to reach terminal connection panel, approximately 250 FT (Contractor to confirm).
      a. Transmitter to be self supporting from cable.
      b. Cable to be suitable for wet location.
      c. Cable to include transmitter venting.
   4. 4-20 mA output, loop powered, 24 VDC.
   5. Accessories:
      a. Cable venting/desiccant unit for mounting in control panel.
      b. Surge protector for mounting in control panel.
      c. Kellum grip type cable hanger.
   6. Schedule:

TAG	RANGE, FEET
LT-001	0 – 20
LT-002	0 – 20
LT-003	0 - 20

2.4 ACCESSORIES

A. Furnish all mounting brackets, hardware and appurtenances required for mounting primary elements and transmitters.
   1. Materials, unless otherwise specified, shall be as follows:
      a. Bolts, nuts, washers, expansion anchors: 316 stainless steel.
      b. Mounting brackets:
         1) Standard: 316 stainless steel.
      c. Mounting plates, angles:
         1) Standard: Galvanized carbon steel.
         2) Wet and corrosive areas: 316 stainless steel.
      d. Instrument pipe stands:
         1) Standard: Hot-dip galvanized 2 IN schedule 40, ASTM A106, Grade B carbon steel.
         2) Wet and corrosive areas: 316 stainless steel.
B. Tubing Support Angles and Brackets: Type 316 stainless steel.
C. Tubing Tray or Channel:
   1. Aluminum.
   2. Provide dielectric material between tray or channel and tubing.
D. Cable lengths between sensors and transmitters shall be continuous (without splices) and as required to accommodate locations as indicated.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Instrument Mounting:
   1. Mount all instruments where they will be accessible from fixed ladders, platforms, or grade.
   2. Mount all local indicating instruments with face forward toward the normal operating area, within reading distance, and in the line of sight.
   3. Mount instruments level, plumb, and support rigidly.
   4. Mount to provide:
      a. Protection from heat, shock, and vibrations.
      b. Accessibility for maintenance.
      c. Freedom from interference with piping, conduit and equipment.

3.2 TRAINING

A. Provide on-Site training.

END OF SECTION

SECTION 13446

CONTROL AUXILIARIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Signal modules.
   2. Pilot devices.
      a. Selector switches.
      b. Pushbuttons.
      c. Indicating lights.
   3. Relays/timers.
      a. Control relay.
      b. Time delay relays.
   4. Termination equipment for control panels.
      a. Terminal blocks.
      b. Fuse holders.
   5. Power supplies.
      a. DC power supplies.
   6. Wiring termination equipment subject to flooding.
   7. Running time indicator.
   8. Digital indicator.

B. Related Sections:
   1. Section 13440 (Instrumentation for Process Control: Basic Requirements).

1.2 REFERENCES

A. NEMA ICS 2-216.22 Standards for Industrial Control Devices, Controllers and Assemblies

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Section 13440 (Instrumentation for Process Control: Basic Requirements).

B. Installation, Operation and Maintenance Manuals:
   1. Loop isolators.
   2. Relays.
   3. Timers.
   4. Pilot Devices.
   5. Digital Indicators.

1.4 QUALITY ASSURANCE

A. Ensure units comply with electrical area classifications and NEMA enclosure type indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers as listed in the articles describing the devices are acceptable.

B. Provide similar components from the same manufacturer for uniformity of appearance, operations, and maintenance.

2.2 SIGNAL MODULE

A. Loop Isolators:
   1. Acceptable manufacturers:
      a. AGM Electronics.
      b. Moore Industries.
      c. Or Approved Equal.
   2. Design and fabrication:
      a. Solid state electronics.
      b. Transmit analog output signal directly proportional to measured input signal.
      c. Power source: 24 V DC.
      d. Analog input: 4-20 mA DC.
      e. Output signal: 4-20 mA DC into 1400 ohms.
      f. Impedance:
         1) Voltage input: 10 Meg.
         2) Current input: 50 ohms.
         3) Voltage output: 1 ohm.
         4) Current output: 1650 ohms.
      g. Accuracy: Better than ± 0.10 percent of span.
      h. Isolation: Up to 500 V rms (input, output and case).
      i. Temperature effect: ±0.0025 percent of span per DegF.
      j. Ambient temperature range: 0-140 DegF.
      k. Factory calibrated.

2.3 PILOT DEVICES

A. Selector Switches:
   1. Acceptable manufacturers:
      a. Eaton.
      b. Allen-Bradley.
      c. Or Approved Equal.
   2. Design and fabrication:
      a. Heavy-duty type.
      b. Oiltight.
      c. Rotary cam units conforming to NEMA ICS 2-216.22.
      d. Supply switches having number of positions required with contact blocks to fulfill functions shown and specified.
      e. UL listed.
      f. Maintained contact type.
      g. Knob type operators.
      h. Black colored operators.
      i. Designed with cam and contact block with approximate area of 2 IN SQ.
      j. Legend plate marked per Contract Documents.
      k. Contact block requirements:
         1) Dry and indoor locations: Standard contact blocks rated for 10 A continuous current.
         2) Wet or outside locations: Hermetically sealed contact blocks.

B. Pushbuttons:
   1. Acceptable manufacturers:
      a. Eaton.
      b. Allen-Bradley.
      c. Or Approved Equal.
   2. Materials:
      a. Backing diaphragm: Buna-N.
   3. Design and fabrication:
      a. Heavy-duty type.
      b. Oiltight.
      c. Conforming to NEMA ICS 2-216.22.
      d. Diaphragm backed.
      e. UL listed.
      f. Emergency stop pushbuttons to have mushroom head operator and maintained contact.
      g. Non-illuminated type:
         1) Momentary contact with necessary contact blocks.
         2) Molded, solid color melamine buttons.
         3) Standard flush operators with full shroud.
         4) Red colored buttons for START or ON and green color for STOP or OFF.
         5) Appropriate contact blocks to fulfill functions shown or specified.
      h. Contact block requirements:
         1) Dry and indoor locations: Standard contact blocks rated for 10 A continuous current.
         2) Wet or outside locations: Hermetically sealed contact blocks.
         3) Legend plate marked per Contract Documents.
      i. Illuminating type:
         1) Momentary contact with necessary contact blocks.
         2) Serves as both pushbutton control and indicating light.
         3) Red colored lenses for START or ON and green for STOP or OFF.
         4) LED full voltage light unit with lens and panel gasket.
         5) Legend plate marked per Contract Documents.
         6) Appropriate contact blocks to fulfill functions shown or specified.

C. Indicating Lights:
   1. Acceptable Manufacturers:
      a. Eaton.
      b. Allen-Bradley.
      c. Or Approved Equal.
   2. Design and fabrication:
      a. Heavy duty type.
      b. Oiltight.
      c. Type allowing replacement of bulb without removal from control panel.
      d. UL listed.
      e. Legends marked per Contract Documents.
      f. Nominal 2 IN SQ face.
      g. Glass lens, LED lamp.
      h. Color code lights as follows:
         1) Red: ON or running; valve open.

2) Blue: Standby; auto mode; ready.
3) Green: OFF or stopped; valve closed.
4) Dark grey: Fail or off-line.
5) Yellow: Alarm or error.
6) Orange: Manual mode.

i. Legend plate engraved for each light.

2.4 RELAYS/TIMERS

1. Control Relays:
2. Acceptable manufacturers:
   a. Idec.
   b. Potter & Brumfield.
   c. Allen-Bradley.
   d. Or Approved Equal.
3. Design and fabrication:
   a. Plug-in general purpose relay.
   b. Blade connector type.
   c. Switching capacity: 10 A.
   d. Contact material: Silver cadmium oxide.
   e. Provide relays with a minimum of 3 SPDT contacts.
   f. Coil voltage: 120 V AC or 24 V DC.
   g. Relay sockets are DIN rail mounted.
   h. Internal neon or LED indicator is lit when coil is energized.
   i. Clear polycarbonate dust cover with clip fastener.
   j. Check button.
   k. Temperature rise:
      1) Coil: 85 DegF max.
      2) Contact: 65 DegF max.
   l. Insulation resistance: 100 Meg min.
   m. Frequency response: 1800 operations/hour.
   n. Operating temperature: -20 to +150 DegF.
   o. Life expectancy:
      1) Electrical: 500,000 operations or more.
      2) Mechanical: 50,000,000 operations or more.
   p. UL listed or recognized.

B. Time Delay Relays:
1. Acceptable manufacturers:
   a. Eagle Signal Controls.
   b. Idec.
   c. Or Approved Equal.
2. Design and fabrication.
   a. Melt design test and performance requirements of NEMA ICS 2-218.
   b. Heavy-duty.
   c. Solid-state construction.
   d. External adjusting dial.
   e. Auxiliary relays as required to perform functions specified or indicated.
   f. Operates on 117 V AC (±10 percent) power source.
   g. Contact rating: A150 per NEMA ICS 2-125.

h. Furnish with "on" and "timing out" indicators.

2.5 TERMINATION EQUIPMENT FOR CONTROL PANELS

A. Terminal Blocks:
1. Acceptable manufacturers:
   a. Phoenix Contact.
   b. Allen-Bradley.
   c. Or Approved Equal.
2. Design and fabrication:
   a. Modular type with screw compression clamp.
   b. Screws: Stainless steel.
   c. Current bar: Nickel-plated copper allow.
   d. Thermoplastic insulation rated for -40 to +90 DegC.
   e. Wire insertion area: Funnel-shaped to guide all conductor strands into terminal.
   f. Spacing: 6 mm.
   g. Wire size: 22-12 AWG.
   h. Rated voltage: 600 V.
   i. Din rail mounting.
   j. UL listed.
3. Standard-type block.
   a. Rated current: 30 A.
   b. Color: Gray body.
4. Bladed-type block:
   a. Terminal block with knife blade disconnect which connects or isolated the two sides of the block.
   b. Rated current: 10 A.
   c. Color:
      1) Panel control voltage leaves enclosure - normal: Gray body, orange switch.
      2) Foreign voltage entering enclosure: Orange body, orange switch.
5. Grounded-type block:
   a. Electrically grounded to mounting rail.
   b. Use to terminal ground wires and analog cable shields.
   c. Color: Green and yellow body.

B. Fuse Holders:
1. Acceptable manufacturers:
   a. Phoenix Contact.
   b. Allen-Bradley.
   c. Or Approved Equal.
2. Design and fabrication:
   a. Modular-type with screw compression clamp.
   b. Screws: Stainless steel.
   c. Current bar: Nickel-plated copper alloy.
   d. Thermoplastic insulation rated for -40 to +105 DegC.
   e. Wire insertion area: Funnel-shaped to guide all conductor strands into terminal.
   f. Blocks can be ganged for multi-pole operation.
   g. Spacing: 9.1 mm.
   h. Wire size: 30-12 AWG.
   i. Rated voltage: 300 V.

j. Rated current: 12 A.
k. Fuse size: 1/4 x 1-1/4.
l. Blown fuse indication.
m. DIN rail mounting.
n. UL listed.

2.6 POWER SUPPLIES

A. DC Power Supplies:
1. Acceptable manufacturers:
a. Condor.
b. International Power.
c. Or Approved Equal.
2. Design and fabrication:
a. Converts 120 V AC input to DC power at required voltage.
b. Linear, open-frame power supply.
c. Sized as required by the load. Minimum 2.4 A output.
d. AC input: 120 V AC +10 percent -13 percent; 47 to 63 HZ.
e. Line regulation: ±0.05 percent for a 10 percent change.
f. Load regulation: ±0.05 percent for a 50 percent load change.
g. Output ripple: 3 mV +0.05 percent of output voltage, peak to peak maximum.
h. Transient response: Less than 50uS for 50 percent load change.
i. Short circuit protection: Automatic current limit/foldback.
j. Stability: ±0.05 percent for 24 HRS after warm-up.
k. Temperature rating: 0 to 50 DegC full rated, derated linearly to 40 percent at 70 DegC.
l. Temperature coefficient: +0.01 percent/DegC maximum.

2.7 DIGITAL INDICATOR

A. Design and Fabrication:
1. Line or 120 VAC powered.
2. Configurable to read in engineering units.
3. Four ½ IN high LED or LCD digits with decimal.
4. Front panel flush mount.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Mount control auxiliaries on separate subpanel in control panel.
C. Install end sections and end stops at each end of terminal strip.
D. Install machine-printed terminal markers on both sides of block.
E. Install end sections and end stops at each end of terminal strip.
F. Install machine-printed terminal markers on both sides of block.

END OF SECTION

SECTION 13448

CONTROL PANELS AND ENCLOSURES

PART 1 GENERAL

1.1 SUMMARY

A. Related Sections:
   1. Section 10405 (Identification, Stenciling, and Tagging Systems).
   2. Section 13440 (Instrumentation for Process Control: Basic Requirements).
   3. Section 13446 (Control Auxiliaries).

1.2 REFERENCES

A. NEMA ICS 4	Terminal Blocks for Industrial Use
B. NEMA ICS 6	Enclosures for Industrial Controls and Systems
C. NEMA 250	Enclosures for Electrical Equipment (1000 V Maximum)
D. UL 508	Industrial Control Equipment

1.3 DEFINITIONS

A. Panel: Any control panel or enclosure listed in the schedule included in this Section 13448.
B. Foreign voltages: Voltages present in circuit even when the panel main power is disconnected.

1.4 SUBMITTALS

A. See Section 13441 (Instrumentation for Process Control: Basic Requirements).
B. Product Data:
   1. Statement of panel wiring methods including wire type, insulation colors, insulation rating, wire sized, wire routing, and wire labeling strategy to be implemented during panel fabrication.
   2. Letter documenting UL 508 capabilities.
   3. Scaled panel face and subpanel face instrument and nameplate layout drawings.
   4. Panel and subpanel materials of construction.
   5. Panel and subpanel dimensions and weights.
   6. Panel access openings.
   7. Conduit and wiring access locations.
   8. Internal wiring and terminal block drawings.
   9. Internal component layout to scale.
   10. Nameplate text.
   11. Total electrical load of panels and enclosures.
C. Shop Drawings:
   1. As-Built Drawings:
      a. Update the control panel drawings and ship at least one copy with the control panel to the Site.
D. Quality Assurance:
   1. Obtain approved control panel layouts prior to installation of conduit feeds.
   2. Provide completely matching color tones for any individual color specified.
   3. Provide panel with the required NEMA rating per NEMA No. 250 to meet classifications indicated or specified.

4. Approved supplier of Industrial Control Equipment under provisions of UL 508. Entire assembly shall be affixed with a UL 508 label "Listed Enclosed Industrial Control Panel" prior to shipment to the Site. Any control panel which arrives to the Site without an UL 508 label shall be rejected and sent back to the panel shop.

E. Installation, Operation, and Maintenance Manual:
1. Control panel and all control devices in panel.
2. As built wiring diagrams and panel layout.

1.5 MAINTENANCE

A. Extra Materials:
1. Replacement Bulbs. Provide minimum 25 percent for replacement indicating light bulbs for each type of indicator furnished in this Project.

B. Paint Touch-Up Kit: Provide for field repair of coating damaged during shipment and installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Enclosures:
a. Hoffman Engineering Co.
b. Circle AW.
c. Or Approved Equal.

2.2 MATERIALS

A. Front Panel, Subpanel or Front Door: Steel or stainless steel as required.
B. Frame and Bottom Angles: Steel or stainless steel as required.
C. Top, Sides, Back, Sides, and Back Door: Steel or stainless steel as required.
D. Hinges: Stainless steel.
E. Nameplates: Phenolic.

2.3 ACCESSORIES

A. Panel Nameplates and Identification:
1. See Section 10405 (Identification, Stenciling, and Tagging Systems).

2.4 FABRICATION

A. General:
1. Fabricate panels with instrument arrangements as indicated.
2. Prime control panels with rust inhibitive shop applied primer and paint with two coats of ANSI 61 gray.
3. Finish interior of panel with epoxy glass white.
4. Provide control panel which meets the following requirements:
a. Enclosure sheet metal thickness per UL 508, subpart 7.3.
b. Bonding for continuity of grounding per UL 508, subpart 7.6.
c. Enclosure openings per UL 508, subparts 7.8 through 7.11.
d. Observation windows, if utilized, per UL 508, subpart 7.12.
e. Constructed in accordance with NEMA type per UL 508, subpart 7.15.
f. Corrosion protected per UL 508, subpart 8.

g. Tapped holes for conduit in a cast metal enclosure per UL 508, subpart 27.3
h. Knockouts in sheet-metal enclosure per UL 508, subpart 27.4

5. Provide cautionary markings, if required, in accordance with UL 508, subpart 59.
   a. Locate cautionary markings per UL 508, subparts 59.1, 59.3.
   b. Prefix the cautionary marking with the word "CAUTION" or "WARNING" utilizing letters sized per UL 508, subpart 59.2.
   c. If more than one disconnect switch is required to disconnect all power within a panel or enclosure, provide a cautionary marking with the word "CAUTION" and the following or equivalent, "Risk of Electric Shock-More than one disconnect switch required to de-energize the equipment before servicing."
      1) Locate the cautionary marking on the outside of the equipment or on a stationary fixed, nonremovable part inside the equipment where easily and clearly seen.

B. Free-Standing Panels:
   1. Welded construction.
   2. Completely enclosed, self-supporting, and gasketed dusttight.
   3. Edges turned back minimum of 2 IN.
   4. Seams and corners welded and ground smooth to touch and smooth in visual appearance.
   5. Provide full length flush pan doors.
   6. Provide full length piano hinges rated for 1.5 times door plus instrument weight.
   7. Provide doors with keyed alike locking handles and three point catch.
   8. Provide appropriate conduit, wiring, and instrument openings in accordance with best panel design.
   9. After cutouts have been made, finish opening edges to smooth and true surface condition.
   10. Provide each panel with lifting eyebolts. Furnish hot-dipped galvanized steel base channels.
   11. Slotted bolt holes in base, 1 1/2 long for field adjustment.

C. Wall Mounted Panels:
   1. Seams continuously welded and ground smooth.
   2. Rolled lip around all sides of enclosure door opening.
   3. Gasketed dust tight.
   4. Three-point latching mechanism operated by oil tight key-locking handle.
   5. Key doors alike.
   6. Continuous heavy GA hinge pin on doors.
      a. Hinges rated for 1.5 times door plus instrument weight.
   7. After cutouts have been made, finish opening edges to smooth and true surface condition.
   8. Front full opening door.
   9. Brackets for wall mounting.

D. Panel Front Construction:
   1. Welded construction.
   2. Edges turned and ground smooth to touch and visual appearance.
   3. At joints where panel face meets side walls, provide dustproof sponge rubber gasket entire height and face.
   4. Use full length piano hinges rated for 1.5 times door weight for panel access door.
   5. Equip doors with locking devices and handle and three point catches.
   6. Finish all instrument cutouts smooth and true.

E. Panel Wiring and Piping:
   1. See Section 13455 (Programmable Logic Controller (PLC) Control System) for PLC/field terminal wiring. Wire all PLC I/O points to terminal blocks, including all spare points.
   2. Factory wire panels to identified terminal blocks equipped with screw type lugs.
   3. Install all wiring without splicing in factory in plastic wire duct:
      a. Do not exceed manufacturer's recommended fill limits.
      b. Size raceways per NEC Article 362.
      c. Ducts shall have removable covers.
   4. Splicing and tapping of wires allowed only at terminal blocks.
   5. Wire bending space shall be in accordance with Tables 307B, C in NEMA ICS 6. Wire bunches to doors shall be secured at each end so that bending or twisting will be around longitudinal axis of wire. Protect bend area with sleeve.
   6. Keep AC power lines separate from low-level DC lines, I/O power supply cables, and all I/O rack interconnect cables. Separate by at least 6 IN, except at unavoidable crossover points and at device terminations.
   7. Arrange circuits on terminal blocks plus any spare conductors on adjacent terminals.
   8. Provide necessary power supplies for control equipment.
   9. Equip each panel with a main thermal magnetic circuit breaker. Limit load to maximum of 80 percent of circuit breaker rating.
   10. Provide all necessary stabilizing voltage transformers, balancing potentiometers and rectifiers as necessary for specific instrument requirements.
   11. Ensure each panel mounted device is bonded or otherwise grounded to panel or panel grounding system by means of locknuts or pressure mounting methods.
      a. Equip panel with grounding terminals.
      b. All sub-panels and hinged doors shall be bonded to ground.
   12. Arrange wiring with sufficient clearance for all leads. Arrange wire neatly, cut to proper length, and remove surplus wire.
   13. Wiring to subpanels or rotary switches shall be individually bundled and installed with a "flexible loop" of sufficient length to permit the component to be removed from panel for maintenance without disconnecting wiring.
   14. AC and DC circuit conductors shall be type MTW stranded copper suitable for operation at 600 V as specified in the NEC. Conductor size shall be as required for load and 16 AWG minimum.
   15. Analog signal cables shall be of 600 V, stranded copper, twisted-shielded pairs of 18 AWG minimum. Ground analog cable drain conductors on grounded terminal blocks at one end of the cable only.
   16. Use only high precision 250 ohm resistors with 0.25 percent accuracy to convert 4-20 mA analog signals to 1-5 V DC analog signals. Resistor leads shall be landed under terminal clamp by itself and not with any other wires.
   17. Analog signals for devices in separate enclosures shall not be wired in series. Loop isolators shall be used where analog signals are transmitted between control enclosures.
   18. Identify all wires with plastic sleeve type (heat-shrinkable) wire markers at each end. Markers shall:
      a. Identify circuit numbers.
      b. Identify function and polarity.
   19. Provide at least 6 IN of separation between all circuits and intrinsically safe devices and wires.

20. Termination requirements:
    a. Terminal block markings, mechanical characteristics and electrical characteristics shall be in accordance with NEMA ICS 4.
    b. Terminals shall facilitate wire sizes as follows:
        1) 120 V AC applications: Wire size 12 AWG and smaller.
        2) Other: Wire size 14 AWG and smaller.
    c. Provide terminal blocks with continuous marking strip.
    d. Tag each I/O terminal to indicate tag number of the connected device.
    e. Provide terminals for individual termination of each signal shield.
    f. Provide 20 percent excess terminals for future expansion.
    g. Use terminal blocks with bladed switch where control voltages enter or leave the control panel. Bladed terminal block body to be orange where foreign voltages connect to the panel.
    h. Use fused terminal blocks where the control circuit is energizing a solenoid valve or where providing DC power to loop-powered transmitter. Blown fuse indicators to be utilized on all fused terminal blocks.
    i. Install DIN rail along entire terminal strip area to facilitate future expansion.
    j. Utilize busses for DC and AC control voltages within panel. Include space for expansion.
    k. Provide marked field terminal strip for all PLC I/O connections.
21. Wire lugs to be full ring type.

F. Panel Lighting and Power:
1. Receptacles:
    a. Panels less than 4 FT long:
        1) One electrical GFCI outlet.
        2) One incandescent light fixture with switch(es) and separate circuit breakers.
    b. Panels or panel faces greater than 4 FT long:
        1) One electrical GFCI outlet per 6 FT of length.
        2) Continuous fluorescent lighting strip with switches and separate circuit breakers.

G. Environmental Controls:
1. Furnish circulation fans near hot spots where required to prevent temperature from exceeding instrument rating.
    a. Circulation fans shall utilize coil windings which resist the absorption of moisture via impregnating, dipping in, or brushing with varnish, or by other acceptable means.
        1) Film coated coil wires need not have additional treatment to resist moisture absorption.
    b. Circulation fans shall incorporate locked rotor protection per UL 508, subpart 26.
2. Over-temperature switches shall be utilized to provide special cooling if required to maintain operating temperatures within the manufacturer's specified range.
3. Air conditioning applications shall include means of preventing moisture condensation.
4. For panels or control cabinets located outside, or in area classification requiring a NEMA 4 or 4X rating:
    a. Install thermostatically controlled condensation protection heaters in enclosures housing electronic equipment.

5. Each control panel and control station shall be furnished with industrial corrosion inhibitors.
    a. The inhibitor contains a chemical that vaporizes and condenses on all surfaces in the enclosure.
    b. The amount of inhibitor shall be according to manufacturer recommendation for the size of the enclosure.
    c. Inhibitor shall be installed prior to shipment to the Site.

H. Transitent Noise Protection:
1. Each control panel with PLC components shall be furnished with power protection in the form of a surge suppressor followed by an isolation transformer.
2. The control components within the control panel shall be powered from the protected power. The convenience receptacles, lighting, and cooling power need not be from the protected power.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install free-standing panels on concrete pads as indicated.
B. Anchor panel fronts rigidly into wall system with approved anchorage devices.
C. Anchor panels in a manner to prevent the enclosure from racking, which may cause the doors to become misaligned.
D. Anchor all panels in accordance with criteria for applicable seismic zone 4.

3.2 SCHEDULE

A. Gate Control Panel:
1. NEMA 12 wall mount.
2. Front door devices:
    a. Nameplate.
    b. LOS switch and run light with legend plates.
3. Rear panel devices:
    a. 480 volt terminal block.
    b. 120 volt/TSP terminal block.
    c. Control power transformer.
    d. 24 Vdc loop power supply (for LT-001, 002 and 003).
    e. I/I splitter for 4-20 mA LT-002 and 003 signals to screen control panel.
    f. Digital indicators for:
        1) LI-001, Fish Ladder Upstream Level.
        2) LI-002, Fish Ladder Upstream/Screen Upstream Level.
        3) LI-003, Screen Downstream Level.
        4) FI-001, Flow.
    g. Arc flash warning label.
4. See Section 13446 (Control Auxiliaries).
5. Analog input, 4-20 mA:
    a. Valve position command, 4-20 mA from RDS PLC.
    b. LT-001, 002 and 003.
    c. FI-001.

6. Analog output, 4-20 ma:
   a. Valve position, to RDS PLC.
   b. LT-002, 003, to RDS PLC and Screen Cleaner LCP.
   c. LT-001, to RDS PLC.
   d. FI-001, to RDS PLC.

END OF SECTION

DIVISION 15

MECHANICAL

SECTION 15010

GENERAL REQUIREMENTS FOR MECHANICAL WORK

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

A. Include the services of manufacturer's representatives where required to place equipment into proper operation or for advice on installation procedures, or where specifically called for in the Specifications.

B. Comply with manufacturer's requirements over and above those shown on the Contract Drawings or specified with respect to connections, servicing and installation of the particular equipment.

1.2 CODES

A. Codes having jurisdiction include, but are not limited to:
   1. Life Safety Code, NFPA 101
   2. International Building Code
   3. International Mechanical Code
   4. Uniform Plumbing Code
   5. National Electrical Code

B. All Work must be performed in accordance with the requirements of all pertinent National Federal, State, and local building codes and regulations. Furnish specialties and make mechanical installations in conformance with applicable codes and regulations.

C. This Section 15010 is developed to provide the general requirements for the mechanical trade portions of the Work.

D. Notify Owner in advance of ordering or fabrication of any materials or apparatus believed to be inadequate, unsuitable, in violation of laws, ordinances, rules or regulations of authorities having jurisdiction.

1.3 CONTRACT DRAWINGS

A. The accompanying Contract Drawings in some instances are diagrammatic and are intended to show the general arrangement and the extent of the Work that, when completed, shall be complete in every respect. They do not show every offset, bend or elbow which may be required in the Work for installation in the space allotted. The Contractor shall follow the Contract Drawings as closely as practical and shall install additional bends, offsets, etc. as may be required for proper installation of the Work. The exact location and arrangement of all parts shall be determined after equipment has been selected and as the Work progresses to conform, in the opinion of Owner, the best possible manner within the surroundings. Figured dimensions shall be followed without regard to scale.

B. Minor details, special conditions, and additional details as well as materials and equipment usually furnished with the systems specified shall be included in the Work as if herein specified whether mentioned or not. Items of equipment and fixtures are specified in singular; however, the Contractor shall provide the numbers of such items as are indicated on the Contract Drawings, and as required for a complete system.

1.4 PERMITS AND INSPECTIONS

A. Contractor shall:

1. Obtain and pay for all permits and licenses required by codes and ordinances and not provided by Owner.
2. Request, arrange and schedule required code inspections as Work progresses and at Final Completion of the Work. Deliver copies of inspection certificates to Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. General. Like materials shall be identical with multiple items coming from the same product line and the same manufacturer.
B. Miscellaneous steel. Provide structural steel as required for adequate support of all mechanical equipment. The structural steel shall be angle, channel, plate, I or H sections suitable for the application. Support holes shall be drilled or burned only in flanges of structural shapes. Holes shall be drilled or burned in only one leg of any one angle and as far from the center of length as possible.

2.2 MATERIALS

A. Identification of materials. The Contractor shall deliver materials to the Site with the manufacturer's labels intact and legible.
B. Material storage and handling. Materials shall be handled with care to avoid damage. Materials shall be stored protected by the weather, dirt, construction dust, and potential damage.
C. Contractor shall be responsible for all damage or vandalism to equipment while stored at the Site.

PART 3 EXECUTION

3.1 INSTALLATION

A. Locating and positioning equipment: Observe all OSHA and State of California safety codes and regulations and use good construction practices in locating and installing mechanical equipment and material so that the completed installation presents the least possible hazard. Maintain adequate clearances for repair and service to all equipment. The installation of any equipment with less than the minimum clearances indicated by the manufacturer as required for proper maintenance will not be accepted. Set fixtures, valves, and equipment to provide for ready access to any parts requiring inspection and/or service.
B. Cutting and patching. The Contractor shall not cut, burn, drill, excavate or otherwise weaken building structural members and underpinning without the written permission of Owner. Any structural members or structural surfaces adversely impacted by the Contractor's Work shall be corrected. Surfaces damaged by the Contractor shall be patched and refinished to match adjacent surfaces.
C. Protection. Protect equipment and materials during installation to prevent damage. Temporarily cap or plug all pipe openings.
D. Safety requirements. Belts, pulleys, chains, gears, couplings, and other rotating equipment located such that any person can come in close proximity to, shall be fully enclosed or properly guarded in accordance with state safety codes and OSHA requirements.
E. Electrical requirements. Electrical wiring of mechanical equipment and systems such as motors, starters, and controls shall be provided as necessary for complete and operable systems from the power source indicated on the Contract Drawings.

F. Equipment, valve and accessory labeling. Label all mechanical equipment, equipment starters, equipment switches and exposed valves and piping accessories, with equipment identification name and mark number as indicated.
G. Where dissimilar metals meet, provide protection to prevent galvanic action.
H. Review Architectural, Structural and Electrical Contract Drawings and Specifications, become familiar with the building construction and finishes, the Work of other trades, space available for mechanical equipment and installations, and obvious interferences requiring special attention.
I. Coordinate the Work of the various mechanical trades, mechanical subcontractors, and the general mechanical Work with the Work of other trades and subcontractors to avoid interferences between piping, ductwork, equipment, architectural, electrical, and structural Work.
J. Finish necessary offsets in piping and ductwork together with fittings and connections required to properly install the Work complete in place.
K. Install piping and ducts as close as possible to ceilings, walls and columns, to utilize a minimum amount of space and to not obstruct any portion of windows, light fixtures, doorways or passages.
L. In case interferences develop, Owner will decide which equipment or installation must be relocated regardless of which apparatus was first installed. Such Work shall be accomplished at no additional cost.
M. Locate and install valves, thermometers, gauges, fittings, filters and other equipment or specialties, which require frequent reading, adjustment, inspection, repair, removal, or replacement, conveniently and accessibly with reference to the finished building.
N. If necessary, make alterations and/or repairs to mechanical Work and/or Work specified in other divisions of the specifications because of lack of proper mechanical supervision and/or failure to coordinate Work and/or failure to direct locations of necessary openings, or framing. Pay all costs related to alterations or repair.

3.2 CLEANING

A. The Contractor shall clean all dirt, construction dust, and debris from all mechanical facilities and equipment leaving them in a new condition. Touch up paint shall be applied where ever necessary.

3.3 EXECUTION

A. No information given on the plans or in the specifications shall relieve the Contractor of the responsibility or coordination of the Work. Each Contractor shall cooperate with the General Contractor and all other Contractors to coordinate their Work, avoid interferences and delays, and coordinate all parts of the Work in service and appearance with all other parts.
B. Locate equipment which must be serviced, operated or maintained, in fully accessible positions. Equipment includes, but is not limited to, valves, cleanouts, motors, pumps, controllers, switchgear, filters and drain points. Minor deviations from the Contract Drawings may be made to allow for better accessibility; however, changes must be reviewed and accepted by Owner prior to installation.

END OF SECTION

SECTION 15061

PIPE AND PIPE FITTINGS: BASIC REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Process piping systems.
   2. Utility piping systems.
   3. Plumbing piping systems.

B. Related Sections:
   1. Section 09905 (Painting and Protective Coatings).
   2. Section 10405 (Identification, Stenciling, and Tagging Systems).
   3. Section 13442 (Primary elements and Transmitters).
   4. Section 15100 (Valves: Basic Requirements).

1.2 REFERENCES

A.	ANSI/AWWA C110/A21.10	Ductile Iron and Gray Iron Fittings, 3 IN through 48 IN for Water and Other Liquids
B.	ANSI/AWWA C151	Ductile-Iron Pipe, Centrifugally Cast In Metal Molds or Sand-Lined Molds for Water or Other Liquids
C.	ANSI/AWWA C153/A21.53	Ductile-Iron Compact Fittings, 3 IN Through 16 IN, for Water and Other Liquids
D.	ASTM C207	Steel Pipe Flanges for Waterworks Service - Sizes 4 IN - 144 IN (100 mm through 3600 mm)
E.	ASTM D1785	Standard Specification for Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride (CPVC) Compounds
F.	ASTM D2466	Socket Type (PVC) Plastic Pipe Fittings, Schedule 40
G.	ASTM D2467	Socket Type (PVC) Plastic Pipe Fittings, Schedule 80
H.	AWWA C111	Rubber-Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings
I.	AWWA C200	Steel Water Pipe 6 IN and Larger
J.	AWWA C207	Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 IN through 144 IN
K.	AWWA C208	Dimensions for Fabricated Steel Water Pipe Fittings
L.	AWWA C606	Grooved and Shouldered Joints

1.3 SYSTEM DESCRIPTION

A. Piping Systems Organization and Definition:
   1. Piping services are grouped into designated systems according to the chemical and physical properties of the fluid conveyed, system pressure, piping size and system materials of construction.
   2. Table A below defines each service classification, its symbol, and the designated system classification number of each service.

TABLE A. PIPING SERVICES		
SYMBOL	SERVICE	SYSTEM
AWS	Auxillary Water Supply	1
AQW	Aquifer Water	2
FM	Forcemain	2
RW	River Water	2
A	Air	3
SD	Storm Drain	4
D	Drain	4
V	Vent	3

3. See PIPING SPECIFICATION SCHEDULES in PART 3 of this Section 15061.

1.4 SUBMITTALS

A. Product Data:
   1. Acknowledgement that products submitted meet requirements of standards referenced.
   2. Copies of manufacturer's written directions regarding material handling, delivery, storage and installation.
   3. Separate schedule sheet for each piping system scheduled in this Section 15061 showing compliance of all system components. Attach technical product data on gaskets, pipe, fittings, and other components.

B. Shop Drawings:
   1. Fabrication and/or layout drawings:
      a. Exterior yard piping drawings (minimum scale 1 IN equals 10 FT) with information including:
         1) Dimensions of piping lengths.
         2) Invert or centerline elevations of piping crossings.
         3) Acknowledgement of bury depth requirements.
         4) Details of fittings, tapping locations, thrust blocks, restrained joint segments, harnessed joint segments, hydrants, and related appurtenances.
         5) Acknowledge designated valve tag numbers, instrument tag numbers, pipe and line numbers.
         6) Line slopes and vents.
      b. Schedule of interconnections to existing piping and method of connection.

C. Test Reports:
   1. Copies of pressure test results on all piping systems.
   2. Reports defining results of dielectric testing and corrective action taken.
   3. Disinfection test report.
   4. Notification of time and date of piping pressure tests.
   5. Acknowledgement of satisfactory performance of tests and inspections and inspections in writing.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect pipe coating during handling using methods recommended by manufacturer. Use of bare cables, chains, hooks, metal bars or narrow skids in contact with coated pipe is not permitted.

B. Prevent damage to pipe during transit. Repair abrasions, scars, and blemishes. If repair of satisfactory quality cannot be achieved, as determined by Owner, replace damaged material immediately.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Insulating unions:
      a. "Dielectric" by Epco.
      b. Or Approved Equal.
   2. Dirt strainers (Y type):
      a. Mueller (#351).
      b. Sarco.
      c. Armstrong.
      d. Or Approved Equal.
   3. Dry disconnect couplings:
      a. Kamlock.
      b. Or Approved Equal.
   4. Dielectric flange kit:
      a. PSI.
      b. Maloney.
      c. Central Plastics.
      d. Or Approved Equal.
   5. Pipe saddles (for gage installation):
      a. Dresser Style 91 (steel and ductile iron systems).
      b. Dresser Style 194 (non-metallic systems).
      c. Or Approved Equal.

2.2 PIPING SPECIFICATION SCHEDULES

A. Piping system materials, fittings and appurtenances are subject to requirements of specific piping specification schedules located at the end of PART 3 of this Section 15061.

2.3 COMPONENTS AND ACCESSORIES

A. Insulating Components:
   1. Dielectric flange kits:
      a. Flat faced.
      b. 1/8 IN thick dielectric gasket, phenolic, non-asbestos.
      c. Suitable for 175 psi, 210 DegF.
      d. 1/32 IN wall thickness bolt sleeves.
      e. 1/8 IN thick phenolic insulating washers.
   2. Dielectric unions:
      a. Screwed end connections.
      b. Rated at 175 psi, 210 DegF.
      c. Provide dielectric gaskets suitable for continuous operation at union rated temperature and pressure.

B. Dirt Strainers:
   1. Y-type.
   2. Composition bronze.
   3. Rated for test pressure and temperature of system in which they are installed.
   4. 20 mesh monel screen.
   5. Threaded bronze plug in the blow-off outlet.
   6. Threaded NPT end connections.
C. Reducers:
   1. Provide appropriate size reducers and reducing fittings to mate pipe to equipment connections. Connection size requirements may change from those indicated depending on equipment furnished.
D. Protective Coating and Lining:
   1. Include pipe, fittings, and appurtenances where coatings, linings, paint, tests and other items are specified.
   2. Field paint pipe in accordance with Section 09905 (Painting and Protective Coatings).
E. Underground Warning Tape:
   1. See Section 10405 (Identification, Stenciling, and Tagging Systems).
F. Pressure Gages:
   1. See Section 13442 (Primary Elements and Transmitters).
G. Dry Disconnect Couplings:
   1. Adapters:
      a. Male adapters: As indicated.
      b. Adapters:
         1) Female NPT end connection for sludge and flush applications.
         2) Male NPT end connection for chemical applications.
      c. Construct adapters for sludge applications from cast iron or steel.
      d. Construct adapters for chemical and PVC system applications 3 IN and below from polypropylene. Above 3 IN size, provide stainless steel units.
   2. Couplers:
      a. Built-in valve and spring loaded poppet which close automatically when disconnected.
      b. Designed to remain with only one arm locked in closed position.
      c. Construct couplers for sludge applications fabricated from material utilized for adapters.
      d. Construct couplers for chemical and PVC system applications 3 IN and less from polypropylene with stainless steel arms and pins. Above 3 IN, provide stainless steel units.
      e. Gasket: Compatible with conveyed liquid.
   3. Dust caps: For all adapters.
H. Valves:
   1. See schematics and details for definition of manual valves used in each system under 4 IN in size. See Drawings for valve types 4 IN and above and for automatic valves used in each system.
   2. See Section 15100 (Valves: Basic Requirements).

PART 3 EXECUTION

3.1 GENERAL

A. Coordinate flange dimensions and drillings between piping, valves, and equipment.

3.2 EXTERIOR BURIED PIPING INSTALLATION

A. Unless otherwise indicated, provide a minimum of 42 IN earth cover over exterior buried piping systems and appurtenances conveying water, fluids, or solutions subject to freezing.
B. Enter and exit through structure walls, floors, and ceilings by using penetrations and seals as shown on drawings.
C. When entering or leaving structures with buried mechanical joint piping, install joint within 2 FT of point where pipe enters or leaves structure and install second joint not more than 6 FT nor less than 4 FT from first joint unless otherwise indicated on the drawings.
D. Install expansion devices as necessary to allow expansion and contraction movement.
E. Laying Pipe In Trench:
   1. Excavate and backfill trench as indicated.
   2. Clean each pipe length thoroughly and inspect for compliance to Specifications.
   3. Grade trench bottom and excavate for pipe bell and lay pipe on trench bottom.
   4. Install gasket or joint material according to manufacturer's directions after joints have been thoroughly cleaned and examined.
   5. Except for first two joints, before making final connections of joints, install two full sections of pipe with earth tamped along side of pipe or final with bedding material placed.
   6. Lay pipe in only suitable weather with good trench conditions. Never lay pipe in water except where approved by Owner.
   7. Seal open end of line with watertight plug if pipe laying stopped.
   8. Remove water in trench before removal of plug.
F. Lining Up Push-On Joint Piping:
   1. Lay piping on route lines as indicated.
   2. Deflect from straight alignments or grades by vertical or horizontal curves or offsets.
   3. Observe maximum deflection values stated in manufacturer's written literature.
   4. Provide special bends when specified or where required alignment exceeds allowable deflections stipulated.
   5. Install shorter lengths of pipe in such length and number that angular deflection of any joint, as represented by specified maximum deflection, is not exceeded.
G. Anchorage and Blocking:
   1. Provide reaction blocking, anchors, joint harnesses, or other acceptable means for preventing movement of piping caused by forces in or on buried piping tees, wye branches, plugs, or bends.
   2. Place concrete blocking so that it extends from fitting into solid undisturbed earth wall. Concrete blocks shall not cover pipe joints.
   3. Provide bearing area of concrete in accordance with drawing detail.
H. Install underground warning: See Section 10405 (Identification, Stenciling, and Tagging Systems).
I. Install insulating components where dissimilar metals are joined together.

3.3 EXPOSED EXTERIOR PIPING INSTALLATION

A. Install piping in vertical and horizontal alignment as indicated.

B. Alignment of piping smaller than 4 IN may not be shown. However, install according to Drawing intent and with clearance and allowance for:
   1. Expansion and contraction.
   2. Operation and access to equipment, doors, windows, hoists, moving equipment.
   3. Headroom and walking space for working areas and aisles.
   4. System drainage and air removal.
C. Enter and exit through structure walls, floor and ceilings using penetrations and seals as indicated.
D. Install vertical piping runs plumb and horizontal piping runs parallel with structure walls.
E. Pipe Support:
   1. Use methods of piping support as indicated.
   2. Where pipes run parallel and at same elevation or grade, they may be grouped and supported from common trapeze-type hanger, provided hanger rods are increased in size as specified for total supported weight. The pipe in the group requiring the least maximum distance between supports shall set the distance between trapeze hangers.
   3. Size pipe supports with consideration to specific gravity of liquid being piped.
F. Locate and size sleeves and castings required for piping system. Arrange for chases, recesses, inserts or anchors at proper elevation and location.
G. Use reducing fittings throughout piping systems. Bushings will not be allowed unless specifically approved.
H. Unions:
   1. Install in position which will permit valve or equipment to be removed without dismantling adjacent piping.
   2. Mechanical type couplings may serve as unions.
   3. Additional flange unions are not required at flanged connections.
I. Install expansion devices as necessary to allow expansion/contraction movement.
J. Provide full face gaskets on all systems.
K. Anchorage and Blocking:
   1. Block, anchor, or harness exposed piping subjected to forces in which joints are installed to prevent separation of joints and transmission of stress into equipment or structural components not designed to resist those stresses.
L. Provide insulating components where dissimilar metals are joined together.
M. Instrument Connections:
   1. See drawing details.

3.4 CONNECTIONS WITH EXISTING PIPING

A. Where connection between new Work and existing Work is made, use appropriate transition fittings to transition between existing Work and new Work.
B. Undertake connections in fashion which will disturb system as little as possible.
C. Any remaining water in the River Diversion Structure cannot flow to the river.
D. Where connections to existing systems necessitate employment of past installation methods not currently part of trade practice, utilize necessary special piping components.

3.5 ACCESS PROVISIONS

A. Provide access doors or panels in walls, floors, and ceilings to permit access to valves, piping and piping appurtenances requiring service.
B. Size of access panels to allow inspection and removal of items served, minimum 10 x 14 IN size.

C. Fabricate door and frame of minimum 14 GA, stretcher leveled stock, cadmium plated or galvanized after fabrication and fitted with screw driver lock of cam type.
D. Provide with key locks, keyed alike, in public use areas.
E. Provide panels with prime coat of paint.
F. Style and type as required for material in which door installed.

3.6 CATHODIC PROTECTION

A. Isolate, dielectrically, all piping from all other metals including reinforcing bars in concrete slabs, other pipe lines, and miscellaneous metal.
B. Make all connections from wire or cable by Thermit Cadwelding.
C. Install all cables with a loop and overhead knot around each pipe and slack equal to at least 50 percent of the straight line length.
D. After cadwelding, coat all exposed metallic surfaces with hot applied tape.

3.7 FIELD QUALITY CONTROL

A. Pipe Testing - General:
   1. Test piping systems as follows:
      a. Test exposed, non-insulated piping systems upon completion of system.
      b. Test exposed, insulated piping systems upon completion of system but prior to application of insulation.
      c. Test concealed interior piping systems prior to concealment and, if system is insulated, prior to application of insulation.
      d. Test buried piping (insulated and non-insulated) prior to backfilling and, if insulated, prior to application of insulation.
   2. Utilize pressures, media and pressure test durations as specified on Piping Specification Schedules.
   3. Isolate equipment which may be damaged by the specified pressure test conditions.
   4. Perform pressure test using calibrated pressure gages and calibrated volumetric measuring equipment to determine leakage rates.
      a. Select each gage so that the specified test pressure falls within the upper half of the gage's range.
      b. Notify the Owner 24 HRS prior to each test.
   5. Completely assemble and test new piping systems prior to connection to existing pipe systems.
   6. Acknowledge satisfactory performance of tests and inspections in writing to Owner prior to Final Acceptance.
   7. Bear the cost of all testing and inspecting, locating and remedying of leaks and any necessary retesting and re-examination.
B. Pressure Testing:
   1. Testing medium: Unless otherwise specified in the Piping Specification Schedules, utilize the following test media.
      a. Liquid systems:

PIPE LINE SIZE (DIA)	GRAVITY OR PUMPED	SPECIFIED TEST PRESSURE	TESTING MEDIUM
Up to and including 48 IN	Gravity	25 psig or less	Air or water
All sizes	Pumped	250 psig or less	Water

   2. Allowable leakage rates:

a. All exposed piping systems, all pressure piping systems and all buried, insulated piping systems which are hydrostatically pressure tested shall have zero leakage at the specified test pressure throughout the duration of the test.
b. For low pressure (less than 25 psig) air testing, the acceptable time for loss of 1 psig of air pressure shall be:

PIPE SIZE (IN DIA)	TIME, MINUTES/100 FT
4	0.3
6	0.7
8	1.2
10	1.5
12	1.8
15	2.1
18	2.4
21	3.0
24	3.6
27	4.2
30	4.8
33	5.4
36	6.0
42	7.3
48	7.6

3. Hydrostatic pressure testing methodology:
   a. General:
      1) All joints, including welds, are to be left exposed for examination during the test.
      2) Provide additional temporary supports for piping systems designed for vapor or gas to support the weight of the test water.
      3) Provide temporary restraints for expansion joints for additional pressure load under test.
      4) Isolate equipment in piping system with rated pressure lower than pipe test pressure.
      5) Do not paint or insulate exposed piping until successful performance of pressure test.
   b. Soil, waste, drain and vent systems:
      1) Test at completion of installation of each stack or section of piping by filling system with water and checking joints and fittings for leaks.
      2) Eliminate leaks before proceeding with Work or concealing piping.
      3) Minimum test heights shall be 10 FT above highest stack inlet.
4. Air testing methodology:
   a. General:
      1) Ensure air is ambient temperature.
   b. Low pressure air testing:
      1) Place plugs in line and inflate to 25 psig.
      2) Check pneumatic plugs for proper sealing.
      3) Introduce low pressure air into sealed line segment until air pressure reaches 4 psig greater than ground water that may be over the pipe.

(a) Use test gage conforming to ANSI B40.1 with 0 to 15 psi scale and accuracy of 1 percent of full range.
4) Allow 2 minutes for air pressure to stabilize.
5) After stabilization period (3.5 psig minimum pressure in pipe) discontinue air supply to line segment.
6) Record pressure at beginning and end of test.

C. Dielectric Testing Methods and Criteria:
1. Provide electrical check between metallic non-ferrous pipe or appurtenances and ferrous elements of construction to assure discontinuity has been maintained.
2. Wherever electrical contact is demonstrated by such test, locate the point or points of continuity and correct the condition.

3.8 CLEANING, DISINFECTION AND PURGING

A. Cleaning:
1. Clean interior of piping systems thoroughly before installing.
2. Maintain pipe in clean condition during installation.
3. Before jointing piping, thoroughly clean and wipe joint contact surfaces and then properly dress and make joint.
4. Immediately prior to pressure testing, clean and remove grease, metal cuttings, dirt, or other foreign materials which may have entered the system.
5. At completion of Work and prior to Final Acceptance, thoroughly clean Work installed under these Specifications. Clean equipment, fixtures, pipe, valves, and fittings of grease, metal cuttings, and sludge which may have accumulated by operation of system, from testing, or from other causes. Repair any stoppage or discoloration or other damage to parts of building, its finish, or furnishings, due to failure to properly clean piping system, without cost to Owner.

3.9 SCHEDULES

A. PIPING SPECIFICATION SCHEDULE - SYSTEM 1
1. General:
a. Piping symbol and service:
1) AWS – Auxillary Water Supply.
b. Test requirements pressure lines:
1) Test medium: Water.
2) Pressure: 30 psig.
3) Duration: 6 HRS.
c. Gaskets and O-rings:
1) O-rings: Neoprene or rubber, full face.
2. System components:
a. Pipe size: 6 IN through 36 IN.
1) Exposed service and piping in aeration basins:
(a) Material: Steel, fabricated pipe.
(b) Reference: AWWA C200.
(c) Lining: Fusion bonded epoxy.
(d) Coating: Fusion bonded epoxy.
(e) Fittings: AWWA C208.
(f) Joints:
(i) Flanged.
(ii) Compression sleeve coupling (fusion bonded epoxy coated).

(iii) No field welding of joints.

B. PIPING SPECIFICATION SCHEDULE - SYSTEM 2
1. General:
   a. Piping symbol and service:
      1) AQW - Aquifer Water.
      2) RW – River Water.
      3) FM - Forcemain.
   b. Test requirements:
      1) Test medium: Water.
      2) Pressure: 150 psig.
      3) Duration: 6 HRS.
   c. Gaskets and O-rings:
      1) O-rings: Neoprene or rubber.
      2) Flanged, push-on and mechanical joints (ductile iron): Rubber, AWWA C111.
      3) Flanged joints (steel): Rubber, ANSI C207.
      4) Grooved coupling joints (ductile and steel): Rubber, AWWA C606.
2. System components:
   a. Pipe size: Smaller than 3 IN.
      1) Exposed service:
         (a) Material: PVC, Type 1, Grade 1, Schedule 80.
         (b) Reference: ASTM D1785.
         (c) Lining: None.
         (d) Coating: Paint.
         (e) Fittings: Solvent welded socket type complying with ASTM D2467.
         (f) Joints: Solvent welded with unions at valves, penetrations through structures and equipment connections for pipe 2 IN and less and flanges at those locations for pipe above 2 IN.
      2) Buried service:
         (a) Material: PVC, Type 1, Grade 1, Schedule 80.
         (b) Reference: ASTM D1785.
         (c) Lining: None.
         (d) Coating: None.
         (e) Fittings: Solvent welded socket type complying with ASTM D2466.
         (f) Joints: Solvent welded.
   b. Pipe size: 3 through 24 IN.
      1) Exposed and encased service:
         (a) Material: Ductile iron, Class 150 if flanged. If grooved type joint system, use pipe thickness per AWWA C606. With both systems, provide screwed on flanges at equipment, valves and structural penetrations.
         (b) Reference: ANSI C115.
         (c) Lining: Cement.
         (d) Coating: Paint.
         (e) Fittings: Either ANSI C110 ductile or gray iron.
         (f) Joints:
            (i) Flanged or grooved type mechanical coupling (AWWA C606) joints.
            (ii) With both systems, provide screwed-on flanges at valves, equipment, and structure penetration.
            (iii) Restrain all joints.

2) Buried service:
   (a) Materials: Ductile iron, Class 150.
   (b) Reference: ANSI C151.
   (c) Lining: Cement.
   (d) Coating: Bituminous with polyethylene encasement.
   (e) Fittings: Either ANSI C110 ductile or gray iron. Optional ANSI C153 ductile iron compact fittings for sizes 3 to 16 IN.
   (f) Joints:
      (i) Flanged or grooved type mechanical coupling (AWWA C606) joints.
      (ii) Provide screwed-on flanges at valves, equipment, and structure penetration.
      (iii) Push-on with mechanical (stuffing box type) joints at fittings and flanged joints at valves.
      (iv) Restrain joints per the following table.

Length of Restrained Joints:	
DEGREE OF BEND	REQUIRED ON EACH SIDE OF BEND
0-11-1/4 Degrees	20 FT
11 3/8-22 1/2 Degrees	40 FT
22 5/8-45 Degrees	75 FT
45 1/8-90 Degrees	180 FT

3. Install drain tees with capped nipples of IPS brass 3 IN long at low points. If low point occurs in concealed piping, provide approved flush access panel. These drains are not indicated.
4. Slope water lines down to drain points not less than 1 IN in 60 FT.
5. Install all threaded piping with clean-cut tapered threads and with ends thoroughly reamed after cutting to remove burrs. Pipe joint cement permitted only on external threads.
6. For screwed nipples for connections to flush valves, lavatory supplies, and other equipment with threaded connections use iron, copper, or brass pipe.
7. Install valves where indicated or required to adequately service all parts of system and equipment.
8. Install unions between valves and connections to each piece of equipment, and install sufficient number of unions throughout piping system to facilitate installation and servicing. On copper pipe lines, install wrought, solder-joint, copper to copper unions for lines 2 IN and smaller and, for lines 2-1/2 IN and over install brass flange unions.
9. Where exposed pipes 6 IN in size and smaller pass through floors, finished walls, or finished ceilings, fit with nickel or chrome-plated plates large enough to completely close hole around pipes. Secure plates to pipe by set screw in approved manner.
10. Size supply branches to individual fixtures as scheduled or indicated on Drawings.
11. Install piping so as to be free to expand with proper loops, anchors and joints without injury to system or structure.
12. Provide branches to wall hydrants or hose bibbs in exterior locations with interior shutoff and drain valves.
13. Provide approved type vacuum breaker and backflow preventer installations indicated or as required by Code.

14. Install concealed in finished structures such as administration and office facilities and at locations as indicated.

C. PIPING SPECIFICATION SCHEDULE - SYSTEM 3
1. General:
   a. Piping symbol and service:
      1) A – Air.
   b. Test requirements:
      1) Test medium: See the FIELD QUALITY CONTROL Article in PART 3 of this Section.
      2) Pressure: 150 psig.
      3) Duration: 6 HRS.
   c. Gaskets and O-rings:
      1) O-ring and flanged joints: Rubber or neoprene, 250 DegF.
      2) Grooved coupling joints (steel): AWWA C606, rubber, 250 DegF.
2. System components:
   a. Pipe size up to 4 IN:
      1) Exposed service:
         (a) Materials:
            (i) Threaded: Steel, Grade B, black, Schedule 40.
            (ii) Grooved type joint system: Use pipe thickness per AWWA C606.
         (b) Reference: ASTM A53.
         (c) Linings: None.
         (d) Coating: Paint.
         (e) Fittings: Malleable iron meeting ASME B16.3, ASTM A197 or steel meeting ASME B16.3, ASTM A234.
         (f) Joints:
            (i) Threaded or grooved type mechanical coupling (AWWA C606) joints.
            (ii) With both systems, provide rigid flanges at equipment, valves and structure penetrations above 2 IN and unions at those locations 2 IN and below.
      2) Buried service:
         (a) Materials: Steel, Schedule 40, Grade B, black.
         (b) Reference: ASTM A53.
         (c) Lining: None.
         (d) Coating: Bituminous.
         (e) Fittings: Malleable iron meeting ASME B16.3, ASTM A197 or steel meeting ASME B16.3, ASTM A234.
         (f) Joints: Threaded.
      3) Submerged service:
         (a) Materials: Steel, Schedule 40, Grade B, black.
         (b) Reference: ASTM A53.
         (c) Lining: None.
         (d) Coating: Bituminous with polyethylene encasement
         (e) Fittings: Malleable iron meeting ASME B16.3, ASTM A197 or steel meeting ASME B16.3, ASTM A234.
         (f) Joints: Threaded.
3. Slope all piping mains approximately 1:100 toward points of drainage.
4. Provide drip legs at low points:

a. Provide ball type isolation valve at drip legs.

D. PIPING SPECIFICATION SCHEDULE - SYSTEM 4

1. General:
   a. Piping symbol and service:
      1) D – Drain.
      2) SD – Storm Drain.
   b. Test requirements:
      1) Test medium: Water.
      2) Pressure: 25 psig.
      3) Duration: 6 HRS.
   c. Gaskets:
      1) Flanged, push-on, and mechanical joints (ductile iron): Rubber, AWWA/ANSI C111/A21.11.
2. System components:
   a. Pipe size 3 IN through 16 IN:
      1) Exposed service:
         (a) Material:
            (i) Flanged: Ductile iron, Class 350.
            (ii) Grooved type joint system: Use pipe thickness per AWWA C606.
         (b) Reference: AWWA/ANSI C115/A21.15.
         (c) Lining: Cement.
         (d) Coating: Paint.
         (e) Fittings: Either AWWA/ANSI C110/A21.10 ductile or gray iron.
         (f) Joints: AWWA/ANSI C115/A21.15 flanged joints with flanges at valves and structure penetrations.
      2) Buried service:
         (a) Materials: Ductile iron, Class 350.
         (b) Reference: AWWA/ANSI C151/A21.51.
         (c) Lining: Cement
         (d) Coating: Bituminous.
         (e) Fittings:
            (i) Either AWWA/ANSI C110/A21.10 ductile or gray iron.
            (ii) Optional: AWWA/ANSI C153/A21.53 ductile iron compact fittings for sizes 3 IN to 16 IN.
         (f) Joints: Push-on joints with mechanical (stuffing box type) joints at fittings and valves.

END OF SECTION

SECTION 15062

PIPE: STEEL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel pipe, fittings, and appurtenances.
B. Related Sections:
   1. Section 15061 (Pipe and Pipe Fittings: Basic Requirements).

1.2 REFERENCES

A.	ANSI B1.1	Unified Inch Screw Threads (UN and UNR Thread Form)
B.	ANSI B2.1	Gages and Gaging for Unified Inch Screw Threads
C.	ANSI B16.3	Malleable Iron Threaded Fittings
D.	ANSI B16.5	Pipe Flanges and Flanged Fittings
E.	ANSI B16.9	Factory-Made Wrought Steel Butt-Welding Fittings
F.	ANSI B16.11	Forged Steel Fittings, Socket Welding and Threaded
G.	ANSI B31.1	Power Piping
H.	ANSI B31.3	Chemical Plant and Petroleum Refinery Piping
I.	ANSI B31.9	Building Services Piping
J.	ASTM A36	Standard Specification for Carbon Structural Steel
K.	ASTM A53	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
L.	ASTM A181	Standard Specification for Forgings, Carbon Steel, for General-Purpose Piping
M.	ASTM A234	Standard Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
N.	ASTM A283	Low and Intermediate Tensile Strength Carbon Steel Plates
O.	ASTM A570	Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
P.	ASTM A572	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
Q.	ASTM B695	Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
R.	AWWA C200	Steel Water Pipe 6 IN and Larger
S.	AWWA C203	Coat Tar Protective Coatings and Linings for Steel water Pipeline - Enamel and Tape - Hot Applied
T.	AWWA C206	Field Welding of Steel Water Pipe
U.	AWWA C207	Steel Pipe Flanges for Waterworks Service, Sizes 4 IN through 144 IN
V.	AWWA C208	Dimensions for Fabricated Steel Water Pipe Fittings
W.	AWWA C213	Fusion Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines
X.	AWWA C606	Grooved and Shouldered Joints
Y.	AWWA M11	Steel Pipe - A Guide for Design and Installation

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Section 15061 (Pipe and Pipe Fittings: Basic Requirements).
   2. Factory test reports.
   3. If mechanical grooved type coupling system is used, submit piping, fittings, and appurtenant items which will be utilized.
   4. Coating manufacturer's qualifications.
   5. Welders certificates.

1.4 QUALITY ASSURANCE:

A. Qualifications:
   1. Use only certified welders meeting procedures and performance outlined in Section 9 of the ASME, Section 3.3.3 of AWWA C200.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Flanged adaptors:
      a. Smith-Blair (Style 913 (steel)).
      b. Dresser (Style 128 (steel)).
      c. Or Approved Equal.
   2. Insulating couplings:
      a. Smith-Blair (Style 416).
      b. Dresser (Style 39).
      c. Or Approved Equal.
   3. Reducing couplings:
      a. Smith-Blair (Style 415).
      b. Dresser (Style 62).
      c. Or Approved Equal.
   4. Transition coupling:
      a. Smith-Blair (Style 413).
      b. Dresser (Style 62).
      c. Or Approved Equal.
   5. Compression sleeve coupling:
      a. Smith-Blair (Style 411 (steel)).
      b. Dresser (Style 38 (steel)).
      c. Or Approved Equal.
   6. Mechanical couplings and fittings:
      a. Victaulic (Style 07 or 77).
      b. S.P. Fittings.
      c. Or Approved Equal.
   7. Factory-applied plastic or epoxy coatings:
      a. "Encoat" Division of Energy Coating Company.
      b. "Scotchkote" Division of 3M Company.
      c. Or Approved Equal.

2.2 MATERIALS

A. All materials used in steel piping systems defined in Section 15061 (Pipe and Pipe Fittings: Basic Requirements), shall meet or exceed pressure test requirements specified for each respective system.
B. Steel Pipe (Fabricated Type):
   1. AWWA C200:
      a. ASTM A36, Grade C Steel Plate.
      b. ASTM A283, Grade D Steel Plate.
      c. ASTM A570, Steel Sheet.
      d. ASTM A572, Steel Plate.
C. Steel Pipe (Mill Type):
   1. ASTM A53, Type E or S.
D. Fittings (For Fabricated Pipe):
   1. AWWA C208.
E. Fittings (For Mill Type Pipe):
   1. ASTM A234.
   2. ANSI B16.3.
   3. ANSI B16.5.
   4. ANSI B16.9.
   5. ANSI B16.11.
F. Flanges (Fabricated Pipe):
   1. Flange material: ASTM A283, Grade C or D, ASTM A181 Grade 1.
   2. Flange finish: Flat faced.
G. Flanges (Mill Type Pipe):
   1. ANSI B16.5.
   2. Flat faced.
   3. Slip-on flanges.
H. Nuts and Bolts:
   1. Mechanical galvanized ASTM B695, Class 40.
   2. Heads and dimensions per ANSI B1.1.
   3. Threaded per ANSI B1.1.
   4. Project ends 1/4 to 1/2 IN beyond nuts.
I. Gaskets: See individual piping systems in Section 15061 (Pipe and Pipe Fittings: Basic Requirements).

2.3 MANUFACTURED UNITS

A. Couplings:
   1. Flanged adaptors:
      a. Steel or carbon steel body sleeve, flange, followers and Grade 30 rubber gaskets.
      b. Flanges meeting standards of adjoining flanges.
      c. Entire assembly to be rated for test pressure specified on Piping Schedule for each respective application.
   2. Compression sleeve coupling:
      a. Steel sleeve, followers Grade 30 and rubber gaskets.
      b. Flanges meeting standards of adjoining flanges.
      c. Entire assembly to be rated for test pressure specified on Piping Schedule for each respective application.
      d. Provide field coating for buried couplings per AWWA C203.

3. Mechanical coupling joint:
   a. Use of mechanical grooved (AWWA C606) type couplings and fittings in lieu of flanged joints is acceptable where specifically specified in Section 15061 (Pipe and Pipe Fittings: Basic Requirements).

2.4 FABRICATION

A. Provide piping (mill or fabricated) with minimum wall thicknesses as follows:
   1. 1/8 - 5 IN DIA pipe: Schedule 40.
   2. 6 - 10 IN DIA pipe: 3/16 IN.
   3. 12 - 14 IN DIA pipe: 7/32 IN.
   4. 16 - 48 IN DIA pipe: 1/4 IN.
   5. Sizes through 24 IN are nominal OD. Sizes greater than 24 are ID.
   6. Wall thicknesses indicated are for standard weight pipe. Design pipe in accordance with operating pressures shown in Piping Schedules for a design stress limited to 50 percent of yield.
B. Furnish cast parts with lacquer finish compatible with finish coating.
C. Furnish without outside coating of bituminous material any exposed pipe scheduled to be painted.
D. Fabricated Fittings:
   1. AWWA C208.
   2. Ensure ratio of radius of bend to diameter of pipe equal to or greater than 1.0.
E. Taper cement mortar linings as required for valve interfacing.
F. Protective Coatings and Linings:
   1. Fusion bonded epoxy lined and coated in accordance with AWWA C213.
   2. Fusion bonded epoxy lining and coating required on all fittings.
   3. No field cutting and repair of fusion bonded epoxy lined and coated steel pipe is allowed.

2.5 SOURCE QUALITY CONTROL

A. Testing:
   1. Shop hydrostatic test fabricated steel pipe and fittings.
   2. Field hydrostatic test all pipe as specified in Section 15061 (Pipe and Pipe Fittings: Basic Requirements).

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Joining Methods - Flanges:
   1. Facing method:
      a. Insert slip-on flange on pipe.
      b. Ensure maximum tolerances for flange faces from normal with respect to axis of pipe is 0.005 IN per foot of flange diameter.
      c. Test flanges after welding to pipe for true to face condition and reface, if necessary, to bring to specified tolerance.
   2. Joining method:
      a. Leave 1/8 to 3/8 IN of flange bolts projecting beyond face of nut after tightening.

b. Coordinate dimensions and drillings of flanges with flanges for valves, reservoir, and other interconnecting piping systems.
c. When bolting flange joints, exercise extreme care to assure that there is no restraint on opposite end of pipe or fitting which would prevent uniform gasket compression or cause unnecessary stress, bending or torsional strains being applied to cast flanges or flanged fittings. Allow one flange free movement in any direction while bolts are being tightened.
d. Do not assemble adjoining flexible coupled, mechanical coupled or welded joints until flanged joints in piping system have been tightened.
e. Gradually tighten flange bolts uniformly to permit even gasket compression.
f. Do not overstress bolts to compensate for poor installation.

C. Joining Method - Welded Joints:
1. Perform welding in accordance with AWWA C206 and this Section 15062.
2. For flange attachment perform in accordance with AWWA C207.
3. Have each welding operator affix an assigned symbol to all welds. Mark each longitudinal joint at the extent of each operator's welding. Mark each circumferential joint, nozzle, or other weld into places 180 degrees apart.
4. Welding for all process piping shall conform with ANSI B31.3. Welding of utility piping 125 psi and less shall be welded per ANSI B31.9. Utility piping above 125 psi shall conform to ANSI B31.1.
5. Provide caps, tees, elbows, reducers, etc. manufactured for welded applications.
6. Weldolets may be used for 5 IN and larger pipe provided all slag is removed from inside the pipe.
7. Weld-in nozzles may be used for branch connections to mains and where approved by Owner.
8. Use all long radius welding elbows for expansion loops and bends.
9. Use long radius reducing welding elbows 90 degree bends and size changes are required.

D. Joining Method-Couplings:
1. Compression sleeve:
a. Install coupling to allow space of not less than 1/4 IN but not more than 1 IN.
b. Provide harnessed joint. Use joint harness arrangements detailed in AWWA M11.
c. Design harness assembly with adequate number of tie rods for test pressures indicated in Section 15061 (Pipe and Pipe Fittings: Basic Requirements) and allow for expansion of pipe.
d. Provide ends to be joined or fitted with compression sleeve couplings of the plain end type.
e. Grind smooth welds the length of one coupling on either side of joint to be fitted with any coupling.
f. Ensure that outside diameter and out-of-round tolerances are within limits required by coupling manufacturer.
2. Mechanical coupling:
a. Arrange piping so that pipe ends are in full contact.
b. Groove and shoulder ends of piping in accordance with manufacturer's recommendations.
c. Provide coupling and grooving technique assuring a connection which passes pressure testing requirements.

E. Joining Method-Threaded and Coupled (T/C):

1. Provide T/C end conditions that meet ANSI B2.1 requirements.
2. Furnish pipe with factory-made T/C ends.
3. Field cut additional threads full and clean with sharp dies.
4. Leave not more than three pipe threads exposed at each branch connection.
5. Ream ends of pipe after threading and before assembly to remove burrs.
6. Use teflon thread tape on male thread in mating joints.

F. Support exposed piping in accordance with Section 15061 (Pipe and Pipe Fittings: Basic Requirements).

G. Install buried piping per Section 15061 (Pipe and Pipe Fittings: Basic Requirements).

3.2 FIELD QUALITY CONTROL

A. Test piping systems in accordance with Section 15061 (Pipe and Pipe Fittings: Basic Requirements).

END OF SECTION

SECTION 15063

PIPE: DUCTILE IRON

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ductile iron piping, fittings, and appurtenances.
B. Related Sections:
   1. Section 09905 (Painting and Protective Coverings)
   2. Section 15061 (Pipe and Pipe Fittings: Basic Requirements).

1.2 REFERENCES

A.	ANSI B1.1	Standard for Unified Coarse Thread
B.	ASTM B695	Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
C.	ASTM C104	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
D.	AWWA C105	Polyethylene Encasement for Ductile-Iron Pipe Systems
E.	AWWA C110	Standard for Ductile-Iron and Gray-Iron Fittings
F.	AWWA C111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
G.	AWWA C115	Flanged Ductile Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
H.	AWWA C150	Standard for Thickness Design of Ductile-Iron Pipe
I.	AWWA C151	Standard for Ductile-Iron Pipe, Centrifugally Cast
J.	AWWA C203	Coal-Tar Protective Coatings and Linings for Steel Water Pipelines--Enamel and Tape--Hot-Applied
K.	AWWA C606	Grooved and Shouldered Joints

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Section 15061 (Pipe and Pipe Fittings: Basic Requirements).
   2. Certification of factory hydrostatic testing.
   3. If mechanical coupling system is used, submit piping, fittings, and appurtenant items which will be utilized to meet system requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents the following manufacturers are acceptable:
   1. Flanged adapters:
      a. Smith-Blair (Style 912 (cast)).
      b. Dresser (Style 127 (cast)).
      c. Or Approved Equal.
   2. Compression sleeve coupling:
      a. Smith-Blair (Style 441 (cast)).

   b. Dresser (Style 153 (cast)).
   c. Or Approved Equal.
3. Mechanical coupling:
   a. Victaulic (Style 31).
   b. Tyler.
   c. Or Approved Equal.
4. Insulating couplings:
   a. Smith-Blair (Style 416).
   b. Dresser (Style 39).
   c. Or Approved Equal.
5. Reducing couplings:
   a. Smith-Blair (Style 415).
   b. Dresser (Style 62).
   c. Or Approved Equal.
6. Transition coupling:
   a. Smith-Blair (Style 413).
   b. Dresser (Style 62).
   c. Or Approved Equal.
7. Polyethylene encasement tape:
   a. Chase (Chasekote 750).
   b. Kendall (Polyken 900).
   c. 3 M (Scotchrap 50).
   d. Or Approved Equal.
8. Restrained joints:
   a. American (Lock Fast) - 12 IN and below.
   b. US Pipe (TR-Flex) - 4 IN to 54 IN.
   c. American (Lock Fast) - Above 12 IN.
   d. EBAA Iron Inc. (Megalug) - 3 IN - 48 IN.
   e. Or Approved Equal.

2.2 MATERIALS

A. Ductile Iron Pipe:
   1. AWWA C115.
   2. AWWA C150.
   3. AWWA C151.
B. Fittings and Flanges:
   1. AWWA C110.
   2. AWWA C115.
   3. Flanges drilled and faced per ANSI B16.1 for both 125 and 250 psi applications.
C. Nuts and Bolts:
   1. Mechanical galvanized ASTM B695, Class 40.
   2. Heads and dimensions per ANSI B1.1.
   3. Threaded per ANSI B1.1.
   4. Project ends 1/4 to 1/2 IN beyond nuts.
D. Gaskets: See individual piping system requirements in Section 15061 (Pipe and Pipe Fittings: Basic Requirements).
E. If mechanical coupling system is used, utilize pipe thickness and grade in accordance with AWWA C606.

F. Polyethylene Encasement: See AWWA C105.
G. See Piping Schedules in Section 15061 (Pipe and Pipe Fittings: Basic Requirements).

2.3 MANUFACTURED UNITS

A. Couplings:
   1. Flanged adapters:
      a. Unit consisting of steel or carbon steel body sleeve, flange, followers, Grade 30 rubber gaskets.
      b. Supply flanges meeting standards of adjoining flanges.
      c. Rate entire assembly for test pressure specified on piping schedule for each respective application.
   2. Compression sleeve coupling:
      a. Unit consisting of steel sleeve, followers, Grade 30 rubber gaskets.
      b. Supply flanges meeting standards of adjoining flanges.
      c. Entire assembly to be rated for test pressure specified on piping schedule for each respective application.
      d. Provide field coating for buried couplings per AWWA C203.
   3. Mechanical couplings:
      a. Use of mechanical couplings and fittings in lieu of flanged joints is acceptable where specifically specified in Section 15061 (Pipe and Pipe Fittings: Basic Requirements).

2.4 FABRICATION

A. Provide without outside coatings of bituminous material any exposed pipe scheduled to be painted.
B. Furnish cast parts with lacquer finish compatible with finish coat.

2.5 LININGS AND COATINGS

A. Where specified in piping schedule, provide linings and coatings as follows:
   1. Interior coating:
      a. Cement mortar lining per AWWA C104.
   2. Outside coatings:
      a. Exposed: Paint per Section 09905 (Painting and Protective Coverings).
      b. Buried piping: Bituminous with polyethylene encasement:
         1) Provide an outside pipe coating of bituminous material approximately one mil thick except for exposed pipe scheduled to be painted.
            (a) Ensure that final coating is continuous and smooth, neither brittle when cold nor sticky when exposed to sunlight, and strongly adherent to pipe at all temperatures.
               (i) Special coatings:
               (ii) Provide any exposed pipe scheduled to be painted without outside coatings of bituminous material.
               (iii) Where required, install polyethylene encasement in compliance with ANSI A21.5 (AWWA C105).

2.6 SOURCE QUALITY CONTROL

A. Factory Test:
   1. Subject pipe to hydrostatic test of not less than 500 psi with the pipe under the full test pressure for at least 10 seconds.

PART 3 EXECUTION

3.1 INSTALLATION

A. Joining Method - Push-On Mechanical (Gland-Type) Joints:
   1. Install in accordance with AWWA C111.
   2. Assemble mechanical joints carefully according to manufacturer's recommendations.
   3. If effective sealing is not obtained, disassemble, thoroughly clean, and reassemble the joint.
   4. Do not overstress bolts.
   5. Where piping utilizes mechanical joints with tie rods, align joint holes to permit installation of harness bolts.

B. Joining Method - Push-On Joints:
   1. Install in accordance with AWWA C151.
   2. Assemble push-on joints in accordance with manufacturer's directions.
   3. Bevel and lubricate spigot end of pipe to facilitate assembly without damage to gasket. Use lubricant that is non-toxic, does not support the growth of bacteria, has no deteriorating effects on the gasket material, and imparts no taste or odor to water in pipe.
   4. Ensure the gasket groove is thoroughly clean.
   5. For cold weather installation, warm gasket prior to placement in bell.
   6. Taper of bevel shall be approximately 30 degrees with centerline of pipe and approximately 1/4 IN back.

C. Joining Method - Flanged Joints:
   1. Install in accordance with AWWA C115.
   2. Extend pipe completely through screwed-on flanged and machine flange face and pipe in single operation.
   3. Make flange faces flat and perpendicular to pipe centerline.
   4. When bolting flange joints, exercise extreme care to ensure that there is no restraint on opposite end of pipe or fitting which would prevent uniform gasket compression or would cause unnecessary stress, bending or torsional strains to be applied to cast flanges or flanged fittings.
   5. Allow one flange free movement in any direction while bolts are being tightened.
   6. Do not assemble adjoining flexible joints until flanged joints in piping system have been tightened.
   7. Gradually tighten flange bolts uniformly to permit even gasket compression.

D. Joining Method - Mechanical Coupling Joint:
   1. Arrange piping so that pipe ends are in full contact.
   2. Groove and shoulder ends of piping in accordance with manufacturer's recommendations.
   3. Provide coupling and grooving technique ensuring a connection which passes pressure testing requirements.

E. Flange Adapters 12 IN and Less:
   1. Locate and drill holes for anchor studs after pipe is in place and bolted tight.
   2. Drill holes not more than 1/8 IN larger than diameter of stud projection.

F. Cutting:
   1. Do not damage interior lining material during cutting.
   2. Use abrasive wheel cutters or saws.
   3. Make square cuts.

4. Bevel and free cut ends of sharp edges after cutting.

G. Support exposed pipe in accordance with Section 15061 (Pipe and Pipe Fittings: Basic Requirements).

H. Install buried piping in accordance with Sections 15061 (Pipe and Pipe Fittings: Basic Requirements).

I. Install restrained joint systems where specified in Section 15061 (Pipe and Pipe Fittings: Basic Requirements) under specific piping system.

3.2 FIELD QUALITY CONTROL

A. Test piping systems in accordance with Section 15061 (Pipe and Pipe Fittings: Basic Requirements).

END OF SECTION

SECTION 15090

PIPE SUPPORT SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe support and anchor systems.
B. Related Sections:
   1. Section 09905 (Painting and Protective Coatings)

1.2 REFERENCES

A.	ASME B31.3	Process Piping
B.	ASTM A36	Standard Specification for Carbon Structural Steel
C.	ASTM A575	Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades
D.	ASTM A576	Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality
E.	AWS D1.1	Structural Welding Code - Steel
F.	MSS SP-58	Pipe Hangers and Supports - Materials, Design and Manufacture

1.3 SUBMITTALS

A. Product technical data including:
   1. Acknowledgement that products submitted meet requirements of standards referenced.
   2. Manufacturer's installation instructions.
   3. Itemized list of wall sleeves, anchors, support devices and all other items related to pipe support system.
   4. Scale drawings showing guides, hangers, supports, anchors, structural members and appurtenances to describe the pipe support system.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.

2.2 MANUFACTURED UNITS

A. Hanger Rods:
   1. Material:
      a. ASTM A36.
      b. ASTM A575, Grade M1020.
      c. ASTM A576, Grade 1020.
      d. Minimum allowable tensile stress of 12,000 psi at 650 DegF per MSS SP-58.
   2. Continuously threaded.
   3. Electro-galvanized or cadmium plated after threads are cut.
   4. Load limit:

NOMINAL ROD DIAMETER	MAXIMUM SAFE LOAD, (LBS)
3/8 IN DIA (min)	610
1/2 IN DIA	1,130
5/8 IN DIA	1,810
3/4 IN DIA	2,710
7/8 IN DIA	3,770
1 IN DIA	4,960

B. Hangers:
   1. Hangers for use directly on copper pipe: Copper or cadmium plated.
   2. Hangers for use other than directly on copper pipe: Cadmium plated or galvanized.
   3. Hanger type schedule:

APPLICATION	PIPE SIZE	HANGER TYPE, OR APPROVED EQUAL
All except noted	4 IN and less	ANVIL Figure 108 with Figure 114
All except noted	Over 4 IN	ANVIL Figure 590
Steam, condensate and hot water	All	ANVIL Figure 181, Figure 82

C. Concrete Inserts for Hanger Rods:
   1. Continuous slots: Unistrut #P1000 or Approved Equal.
   2. Individual inserts: ANVIL Figure 281 or Approved Equal.
   3. Self-drilling expansion anchors: Phillips flush-end or snap-off end type or Approved Equal.
D. Beam Clamps for Hanger Rods:
   1. Standard duty.
   2. ANVIL Figure 133 or Approved Equal.
E. Trapeze Hangers for Suspended Piping:
   1. Material: Steel.
   2. Galvanized.
   3. Angles, channels, or other structural shapes.
   4. Curved roller surfaces at support point corresponding with type of hanger required.
F. Vertical Pipe Supports:
   1. At base of riser.
   2. Lateral movement:
      a. Clamps or brackets:
         1) ANVIL Figure 133 or Approved Equal.
G. Expanding Pipe Supports:
   1. Spring hanger type.
   2. MSS SP-58.
H. Pipe Support Saddle:
   1. For pipe located 3 FT or less from floor elevation, except as otherwise indicated on Drawings.
   2. ANVIL Figure 264 or Approved Equal.
I. Pipe Support Risers:

1. Schedule 40 pipe.
2. Galvanized.
3. As recommended by saddle manufacturer.

J. Pipe Support Base Plate:
1. 4 IN larger than support.
2. Collar 3/16 IN thickness, circular in shape, and sleeve type connection to pipe.
3. Collar fitted over outside of support pipe and extended 2 IN from floor plate.
4. Collar welded to floor plate.
5. Edges ground smooth.
6. Assembly hot dipped galvanized after fabrication.

K. Pipe Covering Protection Saddle:
1. For insulated pipe at point of support.
2. ANVIL Figure 167, Type B or Approved Equal.

L. Wall Brackets:
1. For pipe located near walls and 8 FT or more above floor elevation or as otherwise indicated on the Drawings.
2. ANVIL Figure 199 or Approved Equal.

M. Pipe Anchors:
1. For locations shown on the Drawings.
2. 1/4 IN steel plate construction.
3. Hot dipped galvanized after fabrication.
4. Designed to prevent movement of pipe at point of attachment.

N. Seismic Restraints:
1. Galvanized steel aircraft cables or steel angles or channels.
2. Steel aircraft cables shall be prestretched to establish a certified minimum modulus of elasticity.
   a. Cable restraints shall be designed to resist seismic tension loads and steel restraints shall be designed to resist both tension and compression loads with a minimum safety factor of 2.
3. Restraint and connections shall be steel assemblies that swivel to the final installation angle.
4. Do not mix cable and steel angle restraints to brace the same system.
5. Steel angles shall be clamped to the threaded hanger rods at the seismic sway restraint locations utilizing a minimum of two (2) ductile iron clamps.
6. Transverse bracing shall be provided at 40 FT-0 IN maximum spacing unless noted otherwise.
7. Longitudinal bracing shall be provided at 80 FT-0 IN maximum spacing unless noted otherwise.
8. Fuel gas piping shall have transverse bracing 20 FT-0 IN OC maximum and longitudinal bracing 40 FT-0 IN OC maximum.
9. At vertical pipe risers, wherever possible, support the weight of the riser at a point or points above the center of gravity of the riser.
   a. Provide lateral guides at the top and bottom of the riser, and at intermediate points not to exceed 30 FT-0 IN OC.

O. Pipe Guides:
1. For locations on both sides on each expansion joint or loop.
2. To ensure proper alignment of expanding or contracting pipe.
3. ANVIL Figure 256 or Approved Equal.

P. Sway Strut:
   1. ANVIL Figure 640 or Approved Equal.

2.3 DESIGN REQUIREMENTS

A. Supports capable of supporting the pipe for all service and testing conditions.
   1. Provide 5 to 1 safety factor.
B. Allow free expansion and contraction of the piping to prevent excessive stress resulting from service and testing conditions or from weight transferred from the piping or attached equipment.
C. Design supports and hangers to allow for proper pitch of pipes.
D. Check all physical clearances between piping, support system and structure.
   1. Provide for vertical adjustment after erection.
E. Support vertical pipe runs in pipe chases at base of riser.
   1. Support pipes for lateral movement with clamps or brackets.
F. Place hangers on outside of pipe insulation.
   1. Use a pipe covering protection saddle for insulated pipe at support point.
   2. Insulated piping 1-1/2 IN and less: Provide a 9 IN length of 9 LB density fiberglass insulation at saddle.
   3. Insulated piping over 1-1/2 IN: Provide a 12 IN length of 9 LB density fiberglass insulation on saddle.
G. Pipe Support Spacing:
   1. General:
      a. Factor loads by specific weight of liquid conveyed if specific weight is greater than water.
      b. Locate pipe supports at maximum spacing scheduled unless indicated otherwise on the Drawings.
      c. Provide at least one (1) support for each length of pipe at each change of direction and at each valve.
   2. Steel, ductile iron, cast-iron pipe support schedule:

PIPE SIZES - IN	MAXIMUM SPAN - FT
1-1/2 and less	5
2 thru 4	10
5 thru 8	15
10 and greater	20

   3. PVC pipe support schedule:

PIPE SIZES - IN	MAXIMUM SPAN - FT
1-1/4 and less	3
1-1/2 thru 3	4
4 and greater	5

* Maximum fluid temperature of 120 DegF.

   4. Support each length and every fitting:
      a. Bell and spigot piping:

1) At least one (1) hanger.
2) Applied at bell.

b. Mechanical coupling joints:
1) Place hanger within 2 FT of each side of fittings to keep pipes in alignment.

5. Space supports for soil and waste pipe and other piping systems not included above every 5 FT.
6. Provide continuous support for nylon tubing.

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide piping systems exhibiting pulsation, vibration, swaying, or impact with suitable constraints to correct the condition.
1. Included in this requirement are movements from:
a. Trap discharge.
b. Water hammer.
c. Similar internal forces.

B. Seismic Restraints:
1. Provide seismic restraints on all piping with the exception of the following:
a. Piping less than 1 IN DIA when used for gas and compressed air.
b. Piping less than 2-1/2 IN DIA for all other cases.
c. Piping suspended by individual hangers where the distance from the top of the pipe to the bottom of the support for the hanger is 12 IN or less.
d. Fuel gas piping shall have transverse bracing 20 FT-0 IN OC maximum and longitudinal bracing 40 FT-0 IN OC maximum.
e. These restraints shall be capable of resisting seismic loads as defined in the California Building Code.

C. Weld Supports:
1. AWS D1.1.
2. Weld anchors to pipe in accordance with ASME B31.3.

D. Locate piping and pipe supports as to not interfere with open accesses, walkways, platforms, and with maintenance or disassembly of equipment.

E. Inspect hangers for:
1. Design offset.
2. Adequacy of clearance for piping and supports in the hot and cold positions.
3. Guides to permit movement without binding.
4. Adequacy of anchors.

F. Inspect hangers after erection of piping systems and prior to pipe testing and flushing.

G. Install individual or continuous slot concrete inserts for use with hangers for piping and equipment.
1. Install concrete inserts as concrete forms are installed.

H. Welding:
1. Welding rods: ASTM and AWS standards.
2. Integral attachments:
a. Include welded-on ears, shoes, plates and angle clips.
b. Ensure material for integral attachments is of good weldable quality.
3. Preheating, welding and postheat treating: ASME B31.3, Chapter V.

I. Field Painting:
   1. Comply with Section 09905 (Painting and Protective Coatings).

END OF SECTION

SECTION 15100

VALVES: BASIC REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Valving, actuators and valving appurtenances.

B. Related Sections:
   1. Section 09905 (Painting and Protective Coatings).
   2. Section 15061 (Pipe and Pipe Fittings: Basic Requirements).
   3. Section 15115 (Water Control Gates)

1.2 REFERENCES

A.	ANSI B1.20.1	Pipe Threads, General Purpose
B.	ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings
C.	ANSI B16.18	Cast Copper Alloy Solder Joint Pressure Fittings
D.	AWWA C111	Rubber-Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings
E.	AWWA C207	Steel Pipe Flanges for Waterworks Service - Sizes 4 IN through 144 IN
F.	AWWA C500	Gate Valves for Water and Sewerage Systems
G.	AWWA C550	Protective Epoxy Interior Coatings for Valves and Hydrants
H.	AWWA C606	Grooved and Shouldered Joints
I.	AWWA D648	Standard Test Method for Deflection Temperature of Plastics Under Flexural Load
J.	ASTM D256	Standard Test Method for Determining the Izod Pendulum Impact Resistance Of Plastics
K.	ASTM D638	Standard Test Method for Tensile Properties of Plastics
L.	ASTM D695	Standard Test Method for Compressive Properties of Rigid Plastics
M.	ASTM D2240	Standard Test Method for Rubber Property - Durometer Hardness

1.3 SUBMITTALS

A. Shop Drawings:
   1. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Valve pressure and temperature rating.
      d. Valve material of construction.
      e. Special linings.
      f. Valve dimensions and weight.
      g. Valve flow coefficient.
      h. Wiring and control diagrams for electric or cylinder actuators.
   2. Test reports.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Refer to individual valve Sections.

2.2 MATERIALS

A. Refer to individual valve Sections.

2.3 VALVE ACTUATORS

A. Valve Actuators - General:
   1. Provide actuators as indicated or specified.
   2. Counter clockwise opening as viewed from the top.
   3. Direction of opening and the word OPEN to be cast in handwheel or valve bonnet.
   4. Size actuator to produce required torque with a maximum pull of 80 LB at the maximum pressure rating of the valve provided and withstand without damage a pull of 200 LB on handwheel or chainwheel or 300 foot-pounds torque on the operating nut.
   5. Unless otherwise specified, actuators for valves to be buried, submerged or installed in vaults or manholes shall be sealed to withstand at least 20 FT of submergence.
   6. Extension Stem:
      a. Install where indicated or specified.
      b. Solid steel with actuator key and nut, diameter not less than stem of valve actuator shaft.
      c. Pin all stem connections.
      d. Center in valve box or grating opening band with guide bushing.

B. Buried Valve Actuators:
   1. Provide screw or slide type adjustable cast iron valve box, 5 IN minimum diameter, 3/16 IN minimum thickness, and identifying cast iron cover.
   2. Box base to enclose buried valve gear box or bonnet.
   3. Provide 2 IN standard actuator nuts complying with Section 3.16 of AWWA C500.
   4. Provide at least two tee-handle keys for actuator nuts, with 5 FT extension between key and handle.
   5. Extension Stem:
      a. Provide for buried valves greater than 4 FT below finish grade.
      b. Extend to within 6 IN of finish grade.
   6. Provide concrete pad encasement of valve box for all buried valves unless otherwise indicated.

C. Plastic Valve Vault:
   1. Provide in non traffic areas as indicated.
   2. Rectangular shape with snap lock lid.
   3. Minimum inside dimension: 9-1/8 IN.
   4. Injection molded polyolefin compound with fibrous inorganic component reinforcing with following minimum strength characteristics:

	ASTM Test Criteria
a. Tensile: 3,400 psi	D638
b. Compressive: 3,350 psi	D695
c. Impact Strength, Izod: 0.6 FT LB/IN	D256

d. Durometer Hardness, Type D: 60	D2240
e. Deflection temp @ 66 psi: 230 DegF	D648

5. UV degradation stabilized.
6. Manufacturers:
   a. Ametek Plymouth Products.
   b. Or Approved Equal.

D. Exposed Valve Manual Actuators:
1. Provide for all exposed valves not having electric or cylinder actuators.
2. Provide handwheels for gate and globe valves.
   a. Size handwheels for valves in accordance with AWWA C500.
3. Provide lever actuators for plug valves, butterfly valves and ball valves 3 IN DIA and smaller.
   a. Lever actuators for butterfly valves shall have a minimum of 5 intermediate lock positions between full open and full close.
   b. Provide at least two levers for each type and size of valve furnished.
4. Gear actuators required for plug valves, butterfly valves and ball valves 4 IN DIA and larger.
5. Provide gearing for gate valves 20 IN and larger in accordance with AWWA C500.
6. Gear actuators to be totally enclosed, permanently lubricated and with sealed bearings.
7. Provide chain actuators for valves 6 FT or higher from finish floor to valve centerline.
   a. Cadmium-plated chain looped to within 3 FT of finish floor.
   b. Equip chain wheels with chain guides to permit rapid operation with reasonable side pull without "gagging" the wheel.
8. Provide cast iron floor stands where indicated. Stands to be furnished by valve manufacturer with actuator.
   a. Stand or actuator to include thrust bearings for valve operation and weight of accessories.

E. Electrical Actuators:
1. See Section 15115 (Water Control Gates).

2.4 FABRICATION

A. End Connections:
1. Provide the type of end connections for valves as required in the Piping Schedules presented in Section 15061 (Pipe and Pipe Fittings: Basic Requirements) or as indicated.
2. Comply with the following standards:
   a. Threaded: ANSI B1.20.1.
   b. Flanged: ANSI B16.1 Class 125 unless otherwise noted or AWWA C207.
   c. Bell and spigot or mechanical (gland) type: AWWA C111.
   d. Soldered: ANSI B16.18.
   e. Grooved: Rigid joints per Table 5 of AWWA C606.

B. Refer to individual valve sections for specifications of each type of valve on Project.

C. Nuts, Bolts, and Washers:
1. Wetted or internal to be bronze or stainless steel. Exposed to be zinc or cadmium plated.

D. On Insulated Piping: Provide valves with extended stems to permit proper insulation application without interference from handle.

E. Epoxy Interior Coating:
1. Provide epoxy interior coating for all ferrous surfaces in accordance with AWWA C550.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Painting Requirements:
   1. Comply with Section 09905 (Painting and Protective Coatings).
C. Setting Buried Valves:
   1. Locate valves installed in pipe trenches where buried pipe indicated.
   2. Set valves and valve boxes plumb.
   3. Place valve boxes directly over valves with top of box being brought to surface of finished grade.
   4. Install in closed position.
   5. Place valve on firm footing in trench to prevent settling and excessive strain on connection to pipe.
   6. After installation, backfill up to top of box for a minimum distance of 4 FT on each side of box.
D. Support exposed valves and piping adjacent to valves independently to eliminate pipe loads being transferred to valve and valve loads being transferred to the piping.
E. For threaded valves, provide union on one side within 2 FT of valve to allow valve removal.
F. Install valves accessible for operation, inspection, and maintenance.

3.2 ADJUSTING

A. Adjust valves, actuators and appurtenant equipment. Operate valve, open and close at system pressures.

END OF SECTION

SECTION 15101

GATE VALVES

PART 1 GENERAL

1.1 SUMMARY

A. Related Sections:
   1. Section 15100 (Valves: Basic Requirements).

1.2 REFERENCES

A.	AWWA C504	Rubber Seated Butterfly Valves
B.	AWWA C509	Resilient-Seated Gate Valves for Water and Sewerage Systems
C.	AWWA C550	Protective Epoxy Interior Castings for Valves and Hydrants
D.	MSS SP-9	Spot Facing for Bronze, Iron and Steel Flanges

1.3 DEFINITIONS

A. OS&Y: Outside Screw and Yoke.
B. NRS: Non-rising Stem.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Section 15100 (Valves: Basic Requirements).

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable.
   1. Clow.
   2. Mueller.
   3. American Flow Control.
   4. M & H.
   5. Or Approved Equal.

2.2 VALVES

A. Gate Valves Up to 24 IN DIA:
   1. Comply with AWWA C509.
   2. Materials:
      a. Stem and stem nut - bronze.
         1) Wetted bronze parts in low zinc bronze.
         2) Aluminum bronze components: heat treated per AWWA C504.
      b. Body, gate - cast iron.
      c. Resilient seat - Styrene Butadiene Rubber (SBR).
   3. Design requirements:
      a. 200 psi working pressure.
      b. Buried - NRS O-ring stem seal.
      c. Exposed - OS&Y, stuffing box stem seal, handwheel.

d. Counter clockwise open rotation.

4. Fusion bonded epoxy coating interior and exterior except stainless steel and bearing surfaces.
   a. Comply with AWWA C550.
      1) Wetted bronze parts in low zinc bronze.
      2) Aluminum bronze components: heat treated per AWWA C504.

2.3 ACCESSORIES

A. Furnish actuator integral with valve.
B. Refer to Section 15100 (Valves: Basic Requirements) for actuator requirements.

2.4 FABRICATION

A. General:
   1. Provide valves with clear waterways the full diameter of the valve.
B. Spot valves in accordance with MSS SP-9.

PART 3 EXECUTION

3.1 INSTALLATION

A. See Section 15100 (Valves: Basic Requirements).
B. Where larger buried valves utilize smaller bypass valves, provide a second valve box installed over the bypass valve operating nut.
C. Do not install gate valves inverted or with the stems sloped more than 45 degrees from the upright unless the valve was ordered and manufactured specifically for this orientation.

END OF SECTION

SECTION 15114

MISCELLANEOUS VALVES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Knife gate valves.
   2. Vacuum and air release valves.
   3. Ball check valves.
B. Related Sections:
   1. Section 11005 (Equipment: Basic Requirements)
   2. Section 15100 (Valves: Basic Requirements)

1.2 SUBMITTALS

A. Shop Drawings:
   1. See Section 15100 (Valves: Basic Requirements).

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the manufacturers listed under the specific valve types are acceptable.
B. Design Requirements:
   1. Minimum working pressure: 175 psi.
   2. Average operating temperature: 70 DegF.
   3. Maximum operating temperature: 120 DegF.

2.2 KNIFE GATE VALVE

A. Acceptable Manufacturers:
   1. Davis model 70F.
   2. No substitutions.
B. General:
   1. Bi-directional EPDM seated knife gate designed to be drip tight
   2. Solid one-piece cast body with integrally cast gate jams and guides
   3. Full port
   4. Blowout proof packing glands
   5. Nylock locking nuts
C. Material:
   1. Gate: 316 Stainless Steel
   2. Seat Retainer: 316 Stainless Steel
   3. Wiper: EPDM
   4. Seat: EPDM
   5. Stopper: A 276-304
   6. Body: 316 Stainless Steel

2.3 VACUUM AND AIR RELEASE VALVES

A. General:
   1. Conform to AWWA C512.
B. Water:
   1. Air Release Valve:
      a. Acceptable manufacturers:
         1) Vent-O-Mat, Series RBX.
         2) Or Approved Equal.
      b. Materials:
         1) Body and cover: Cast iron or semi-steel.
         2) Float: HDPE.
         3) Linkage and trim: Bronze or stainless steel.
         4) Flanges: Stainless steel.
      c. Design requirements:
         1) Size: As indicated on drawings.
         2) Working pressure: 350 psi.
         3) Release 10 cfm at 10 psi differential at 150 psi line pressure.

2.4 BALL CHECK VALVES

A. Acceptable Manufacturers:
   1. Flygt.
   2. Clow.
   3. Or Approved Equal.
B. Materials:
   1. Body and cover: Cast iron.
   2. Ball cover: Nitrile rubber.
C. Design Requirements:
   1. Rated working pressure: 145 psi.
   2. Rated working temperature: 175 DegF.
   3. Non-clog, fully automatic type for sewage and storm water use.
   4. Single moving part.
   5. Provide unrestricted flow equal to nominal pipe size when open.
   6. Sinking ball type.

2.5 ACCESSORIES

A. Furnish any accessories required to provide a completely operable valve.

2.6 FABRICATION

A. Completely shop assemble unit including any interconnecting piping, speed control valves, control isolation valves and electrical components.

2.7 SOURCE QUALITY CONTROL

A. Shop hydrostatically test to test pressure.

2.8 MAINTENANCE MATERIALS

A. Provide one (1) set of any special tools or wrenches required for operation or maintenance for each type valve.

PART 3 EXECUTION

3.1 INSTALLATION

A. General: See Section 11005 (Equipment: Basic Requirements) and Section 15100 (Valves: Basic Requirements).

3.2 FIELD QUALITY CONTROL

A. Clean, inspect, and operate valve to ensure all parts are operable and valve seats properly.
B. Check and adjust valves and accessories in accordance with manufacturer's instructions and place into operation.

END OF SECTION

SECTION 15115

WATER CONTROL GATES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Slide (fabricated) gates.
   2. Canal gates.
   3. Gate actuators.

1.2 REFERENCES

A.	ASTM A276	Standard Specification for Stainless Steel Bars and Shapes
B.	ASTM D4020	Standard Specification for Ultra-High-Molecular-Weight Polyethylene Molding and Extrusion Materials
C.	AWWA C513	Open-Channel Fabricated-Metal Slide Gates

1.3 SUBMITTALS

A. Product Data:
   1. Acknowledgment that products submitted meet the requirements of standards referenced.
   2. Product technical data including:
      a. Acknowledgment that products submitted meet the requirements of standards referenced.
B. Installation, Operation, and Maintenance Manuals:
   1. Canal gate.
   2. Slide gates.
C. Written statement that manufacturer's equipment has been installed properly, lubricated, and calibrated and is ready for operation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Water control gates:
      a. Golden Harvest.
      b. Rodney Hunt (Series 600).
      c. Waterman USA.
      d. Or Approved Equal.
   2. Canal gates:
      a. Waterman USA.
      b. Or Approved Equal.
   3. Electric gate actuators:
      a. Auma.
      b. Or Approved Equal.

2.2 SLIDE GATES

A. General:
   1. Self-contained slide gates with operators in accordance with the configuration noted in the gate schedule or shown on the Contract Drawings.
   2. Galvanized steel oil-seal pipe assembly with oil-fill plug, top and bottom oil-seal packing glands and other necessary appurtenances as indicated to be supplied by the gate manufacturer. Food-grade oil, air vent pipe, and pipe support brackets are to be supplied by the Contractor.
   3. Maximum leakage rate: Not to exceed 0.1 gpm per foot of seat perimeter with water at top of gate slide and operating in seating position.

B. Material:
   1. Slide:
      a. Aluminum: ASTM B209, alloy 6061.
   2. Frame, guides, guide rails, cross bars, and head rails:
      a. Aluminum: ASTM B209, alloy 6061.
   3. Anchor bolts:
      a. Stainless steel: ASTM A276, Type 316.
   4. Stems and stem couplings:
      a. Stems and couplings exposed to the elements are to be stainless steel: ASTM A276, Type 316.
      b. Stems and couplings encased in oil-seal pipe assembly are to be either leaded cold rolled steel: ASTM A-108, or stainless steel: ASTM A276, Type 316, as recommended by the gate manufacturer.
      c. Oil-seal pipe: Galvanized steel.

C. Fabrication:
   1. Frame and guides:
      a. Rigid, welded gate frame and guides: Composed of the guide rails, cross bars and headrails, with a clear opening the same size as the waterway, unless otherwise specified. All metal used in the frame and guide assembly shall have a minimum thickness of 1/4 IN.
      b. Ultra High Molecular Weight Polyethylene (UHMWPE), as specified in ASTM D4020, seats upstream and downstream shall form a tight seal between the frame and the slide (disc).
      c. Flatback, spigotback, embedded, or integral flange back type as indicated.
      d. Design guides for maximum rigidity: Weight not less than 9 LBS per foot.
      e. Guides of sufficient length to support two-thirds the height of the slide, when the gate is fully open.
      f. For self-contained gates, the head angle or yoke will be below the operating floor.
      g. Provide guides of sufficient strength so that no further reinforcing will be required.
      h. For self-contained gates, design yoke to support the operating device formed by members welded or bolted at the top of the guides.
      i. For self-contained gates, design yoke arrangement such that the disc and stem can be removed without disconnecting yoke.
      j. For self-contained gates, design yoke to support the lift forces when subjected to a load of 80 LB pull on the operator.
      k. For embedded type gates provide molded resilient seat mounted at bottom of disc for flush bottom closure and seal against embedded portion of the frame in the channel invert or have a resilient seat mounted on frame flush at channel invert.

2. Slide (disc):
   a. Plate reinforced slide with structural shapes welded to the plate. All metal used in the slide assembly shall have a minimum thickness of 1/4 IN.
   b. Slide cover maximum deflection: 1/360 of the span of the gate under maximum head.
   c. Extend reinforcing ribs to guides so that the seating surface of the guide is reinforced.
   d. Stem connection of either clevis type, with structural members welded to slide and a bolt to act as pivot pin, or a threaded and bolted (or keyed) thrust nut supported in welded nut pocket.
   e. Pocket and yoke of gate capable of taking at least twice the rated thrust output of the operator at 40 LBS pull. Slide material same as frame and guides.
3. Stem:
   a. Of suitable length and ample strength for the intended service.
   b. Stem diameter capable of withstanding twice the rated output of the operator at 40 LB pull, and supported such that L/r ratio for unsupported part of the stem shall not exceed 200.
   c. For gates with Electric Operators stem shall have a diameter capable of withstanding twice the rated output of the electric operator, supported such that the L/r ratio for the unsupported part of the stem shall not exceed 200, have a 1/6 pitch, single lead, and 6-turns per inch of travel.

2.3 CANAL GATES

A. Materials:
   1. Frame and cover: ASTM A-126 Cast Iron with machined seating faces.
   2. Stem: ASTM A-108 Cold Finished Steel.
   3. Hardware/fasteners: 316 stainless steel.
   4. Lift nut: Cast bronze.
B. Design Requirements:
   1. Provide Waterman C-20 canal gate or Approved Equal.
   2. Provide flatback flange attachment for connection to 36-IN AWS pipe as indicated on the drawings.
   3. Provide stem, frame and actuator for installation as indicated on the drawings.
   4. See gate schedule indicated on the drawings.

2.4 GATE OPERATORS AND LIFTS

A. General: Provide lifts in accordance with AWWA C513 or as modified in these Specifications. Provide all lifts with clear butyrate or polycarbonate plastic stem cover with Mylar open-close indicator.
B. Manual Operators:
   1. NON RISING STEM WITH FIXED NUT ASSEMBLY Centerline of crank or handwheel approximately 36 IN above operating floor. Unless otherwise shown.
   2. Maximum effort of 40 LBS on crank or handwheel shall operate gate after unseating gate from wedges bored upon seating head specified.
C. Electric Actuator (208 V, 3 PH):
   1. Provide modulating electric actuator with integral control devices. All actuator features to be non-intrusive and configurable with handheld control units.
   2. Furnish electric actuator integral with gate consisting of:
      a. Motor.

   b. Gearing.
   c. Handwheel.
   d. Limit and torque switches.
   e. Heating elements.
   f. Wiring.
   g. Completely isolated terminal compartment for motor power and control connections.
   h. Drive nut.
   i. Hand held control unit, if required.
3. Housing/enclosure:
   a. Provide cast gear housing and cast enclosure.
   b. Enclosure and housing: Aluminum.
   c. Rated for IP68 service for 20 FT submergence for 72 hours minimum.
   d. Provide double sealing.
   e. Terminal and limit switch compartment covers are to be fastened to gear housing by stainless steel fasteners with capture device to prevent loss.
   f. Provide 6 FT of rough service, UV resistant cable factory assembled and sealed to actuator for:
      1) Power input.
      2) 2 – 4-20 mA signals.
4. Motor:
   a. Provide motor that is totally enclosed, high torque design made expressly for actuator service and capable of operating the gate under full differential pressure for complete open-close and reverse cycle of travel at least twice in immediate succession without overheating.
   b. Design motor in accordance with NEMA MG 1 standards, with Class B insulation, and to operate successfully at any voltage within 10 percent above or below rated voltage.
   c. Provide positive method to ensure motor bearings are permanently lubricated.
   d. Motor housing:
      1) Aluminum.
      2) Totally enclosed nonventilated with cooling fins.
   e. Provide motor capable of operating in any position.
   f. Provide motor sealed from gearcase to allow any mounting position.
   g. Provide motor suitable for 208 V, 3 PH, 60 Hz.
5. Gearing:
   a. Provide power gearing consisting of heat treated steel helical gears, carburized and hardened alloy steel worm, and alloy bronze worm gear, all grease or oil bath lubricated, designed for 100 percent overload, and effectively sealed against entrance of foreign matter.
   b. Reduction gearing to be 180 : 1 for output rpm of 26.
   c. Design actuator so that motor comes up to speed before stem load is encountered in either opening or closing operation.
   d. Limit switch gearings and feedback device reduction gearing:
      1) Steel or bronze.
   e. Support rotating shafts with anti-friction bearings.
   f. Provide separate drive nut/thrust bearing assembly:
      1) Mounted to base of actuator.

2) High tensile bronze.
3) Actuator nut to match gate stem.
4) Provide grease fitting on drive assembly.

6. Handwheel:
   a. Permanently attached for manual operation.
   b. Positive declutch mechanism to engage and disengage handwheel.
   c. Handwheel shall not rotate during motor operation.
   d. Inoperable motor shall not prevent manual operation.
7. Limit torque and thrust loads in both closing and opening directions by torque limit switches.
   a. Provide torque switches with micrometer adjustment and reference setting indicator.
      1) Assure adjustment variation of approximately 40 percent in torque setting.
   b. Provide switches having rating of not less than 6 A at 120 Vac and 2.2 A at 115 Vdc.
   c. Limit and torque switches shall have totally sealed contacts.
8. Furnish electric actuator with two (2) geared limit switch assemblies with each switch assembly having four (4) separate limit switches:
   a. Assure each limit switch assembly is geared to driving mechanism and is independently adjustable to trip at any point at and between the fully open and fully closed valve position.
   b. Provide minimum of two (2) normally open contacts and two (2) normally closed contacts at each end of valve travel.
   c. Provide switches with inductive contact rating of not less than 6 A at 120 Vac, 3 A at 240 Vac, 1.5 A at 480 Vac, 2.2 A at 115 Vdc and 1.1 A at 230 Vdc.
   d. Limit switches shall be fully adjustable when power is applied to actuator.
9. Provide space heating elements sized to prevent condensation in both motor and geared limit switch compartment(s).
   a. Furnish heating elements rated at 120 Vac with heaters continuously energized.
10. Actuator controls:
   a. Provide control assembly with necessary holding relays, reversing starter, control transformers of sufficient capacity to provide control power, space heating element power and valve position transmitter.
   b. Provide control assembly within actuator enclosure.
   c. Proportional 4-20 mA position servo-amplifier mounted integral with the actuator control compartment.
   d. Positioning of valve shall be proportional t o a 4-20 mA signal input to the position servo-amplifier when remote control has been selected.
   e. Servo-amplifier adjustments shall include zero, span, gain, and dead-band.
   f. Provide 4-20 mA gate position transmitter integral with actuator.

2.5 ALL GATES, OPERATORS AND LIFTS

A. Provide gates, including lift, designed with a minimum factor of safety of five.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

A. Installation Check and Startup: Employ and pay for services of the equipment manufacturer's field service representative(s) fully commissioned and authorized by manufacturers to do the following:

1. Inspect equipment covered by these Specifications.
2. Supervise adjustments, calibrations and installation checks and full commissioning.
3. Perform basic operational checks.
4. Provide Owner with a written statement that manufacturer's equipment has been installed properly, lubricated, and calibrated and is ready for operation by the Owner.

B. Field Leakage Test for Slide Gate:
1. Test gate under design seating head and adjust to maximum leakage of 0.1 gpm per foot of seating perimeter.

3.2 SCHEDULE

A. See drawings for gate schedule.

END OF SECTION

DIVISION 16

ELECTRICAL

SECTION 16010

ELECTRICAL: BASIC REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Related Sections:
   1. Section 05500 (Metal Fabrications).
   2. Section 16130 (Raceway and Boxes).

1.2 QUALITY ASSURANCE

A. Where Underwriters Laboratories, Inc. (UL) test procedures have been established for the product type, use UL or ETL Testing Laboratories (ETL) approved electrical equipment and provide with the UL or ETL label.

1.3 REFERENCES

A. ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
B. ASTM A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
C. IEEE C2	National Electrical Safety Code (NESC)
D. NFPA 70	National Electrical Code (NEC)

1.4 DEFINITIONS

A. For the purposes of providing materials and installing electrical work the following definitions shall be used.
   1. Outdoor area: Exterior locations where the equipment is normally exposed to the weather and including below grade structures.
   2. Non-architecturally finished interior area: Pump, chemical, mechanical, electrical rooms and other similar process type rooms.
   3. Shop fabricated: Manufactured or assembled equipment for which a UL test procedure has not been established.

1.5 SUBMITTALS

A. Shop Drawings:
   1. General requirements:
      a. Provide manufacturer's technical information on products to be used, including product descriptive bulletin.
      b. Include data sheets that include manufacturer's name and product model number.
         1) Clearly identify all optional accessories.
      c. Acknowledgement that products are UL or ETL listed or are constructed utilizing UL or ETL recognized components.
      d. Manufacturer's delivery, storage, handling and installation instructions.
      e. Product installation details.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment from damage.
B. Protect nameplates on electrical equipment to prevent defacing.

1.7 AREA DESIGNATIONS

A. Designation of an area will determine the NEMA rating of the electrical equipment enclosures, types of conduits and installation methods to be used in that area.
   1. Outdoor areas:
      a. Wet.
   2. Indoor areas:
      a. Dry, unless indicated.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, refer to specific Division 16 Sections and specific material paragraphs below for acceptable manufacturers.
B. Provide all components of a similar type by one (1) manufacturer.

2.2 MATERIALS

A. Electrical Equipment Support Pedestals and/or Racks:
   1. Approved manufacturers:
      a. Modular strut:
         1) Unistrut Building Systems.
         2) B-Line.
         3) Globe Strut.
         4) Or Approved Equal.
   2. Material requirements:
      a. Modular strut:
         1) Galvanized steel: ASTM A123 or ASTM A153.
         2) Stainless steel: AISI Type 316.
      b. Mounting hardware:
         1) Galvanized steel.
         2) Stainless steel.
      c. Anchorage per Section 05500 (Metal Fabrications).
B. Field touch-up of galvanized surfaces.
   1. Zinc-rich primer.
      a. One (1) coat, 3.0 mils, ZRC by ZRC Products or Approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install and wire all equipment, including prepurchased equipment, and perform all tests necessary to assure conformance to the Drawings and Sections and ensure that equipment is ready and safe for energization.
B. Install equipment in accordance with the requirements of:
   1. NFPA 70 (NEC).
   2. IEEE C2.
   3. The manufacturer's instructions.
C. In general, conduit routing is not indicated.
   1. The Contractor is responsible for routing all conduits including those indicated on one-line and control block diagrams and home runs shown on floor plans.

2. Conduit routings and stub-up locations that are indicated are approximate; exact routing to be as required for equipment furnished and field conditions.

D. Do not use equipment that exceed dimensions or reduce clearances indicated or required by the NFPA 70 (NEC).
E. Install equipment plumb, square and true with construction features and securely fastened.
F. Install electrical equipment, including pull and junction boxes, minimum of 6 IN from process, gas, air and water piping and equipment.
G. Install equipment so it is readily accessible for operation and maintenance, is not blocked or concealed and does not interfere with normal operating and maintenance requirements of other equipment.
H. Provide electrical equipment support system per the following area designations:
   1. Dry areas:
      a. Galvanized system consisting of galvanized steel channels and fittings, nuts and hardware.
      b. Field touch-up cut ends and scratches of galvanized components with the specified primer during the installation, before rust appears.
   2. Wet areas:
      a. Stainless steel system and fasteners.
I. Provide all necessary anchoring devices and supports rated for the equipment load based on dimensions and weights verified from approved submittals, or as recommended by the manufacturer.
   1. Do not cut, or weld to, building structural members.
   2. Do not mount safety switches or other equipment to equipment enclosures, unless enclosure mounting surface is properly braced to accept mounting of external equipment.
J. Screen or seal all openings into equipment mounted outdoors to prevent the entrance of rodents and insects.
K. Identify electrical equipment and components with identification nameplates.
L. Arc flash warning labels shall be attached to cover of all panels and equipment containing 120 VAC or greater. Labels shall be Brady 101950 or Approved Equal.

3.2 FIELD QUALITY CONTROL

A. Verify exact rough-in location and dimensions for connection to electrified equipment, provided by others.
B. Replace equipment and systems found inoperative or defective and re-test.
C. Cleaning:
   1. Clean all equipment.
D. The protective coating integrity of support structures and equipment enclosures shall be maintained.
   1. Repair galvanized components utilizing a zinc rich paint.
   2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
   3. Repair PVC coated components utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the component.
   4. Repair surfaces which will be inaccessible after installation prior to installation.
   5. See Section 16130 (Raceway and Boxes), for requirements for conduits and associated accessories.
E. Replace nameplates damaged during installation.

3.3 DEMONSTRATION

A. Demonstrate equipment for proper operation.

END OF SECTION

SECTION 16012

SEISMIC BRACING SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. The design and installation of seismic bracing and anchorage required for electrical equipment.
B. Related Sections:
   1. Section 11005 (Equipment: Basic Requirements).

1.2 REFERENCES

A.	ASTM A36	Standard Specification for Carbon Structural Steel
B.	ASTM A307	Standard Specification Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
C.	ASTM F1554	Standard Specification for Anchor Bolts, Steel 36, 55, and 105-ksi Yield Strength

1.3 SUBMITTALS

A. Product Data:
   1. Seismic control devices.
B. Shop Drawings:
   1. Fabrication and/or layout drawings:
      a. Layout and mounting detail drawings showing system and proposed brace locations for all systems including pre-engineered systems.
      b. The specific detail for each type of brace or anchor must be referenced on a plan that identifies the required location.
      c. Supplying a book of details without referencing the proper detail to a specific location on a plan is not acceptable.
      d. Structural calculations for required lateral force level for each component.
      e. All Submittals, including pre-approved systems, shall be signed and sealed by a licensed engineer, licensed in California.

1.4 SYSTEM DESCRIPTION

A. Contractor is responsible for design and installation of seismic bracing and anchorage systems.
B. Description of Systems:
   1. Transverse and longitudinal bracing for seismic forces on suspended electrical systems including conduit, cable tray, bus duct, and equipment.
   2. Anchorage of floor and roof mounted electrical equipment.
C. Seismic Design Requirements:
   1. Seismic design criteria: Provide bracing and anchoring for equipment and conduit designed, constructed, and installed to resist stresses produced by lateral forces.
   2. Design and install seismic anchorage and bracing for all floor mounted equipment weighing 400 LBS or more and all suspended or wall mounted equipment weighing 20 LBS or more.

3. The following components are exempt from the requirements of this Section 16012:
   a. Electrical components in structures assigned to Seismic Design Category C provided that the importance factor (I_p) is equal to 1.0.
   b. Electrical components in Seismic Design Categories D, E, and F where I_p = 1.0 and flexible connections between the components and associated ductwork, piping, and conduit are provided and that are mounted at 4 FT (1.22 m) or less above a floor level and weigh 400 LBS (1780 N)or less.
   c. Electrical components in Seismic Design Categories D, E, and F weighing 20 LBS (95 N) or less where I_p = 1.0 and flexible connections between the components and conduit are provided, or for distribution systems, weighing 5 LBS/FT (7 N/m) or less.
4. Seismic forces shall be presumed to act through the center of mass of the equipment in a direction that will produce the largest single anchor force.

1.5 PROJECT CONDITIONS

A. Seismic (Earthquake) Loads: See Section 11005 (Equipment: Basic Requirements), paragraph 1.5.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Pre-engineered suspended bracing systems:
      a. International Seismic Application Technology (ISAT) "Engineered Seismic Bracing of Suspended Utilities".
      b. Unistrut.
      c. Tolco.
      d. B-Line.
      e. Or Approved Equal.

2.2 EQUIPMENT ANCHORS AND SUPPORTS

A. Drilled-in-place concrete anchors shall have an approved ICBO Evaluation Services Report.
B. Cast-in-place anchors shall comply with ASTM A36, ASTM A307, or ASTM F1554, 36 ksi.
C. Anchors permanently exposed to weather or corrosive environments shall be stainless steel or hot-dipped galvanized.
D. Structural steel for supports: ASTM A36.
E. Cold formed metal and connection material: Strut.
F. Any details provided are based on assumed equipment and arrangement.
   1. Contractor shall be responsible for design and acquiring approval for support and anchorage of equipment and arrangement which varies from equipment and arrangement assumed in detail provided.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Every run which requires bracing shall have a minimum of two (2) transverse braces and one (1) longitudinal brace.

1. A "run" is defined as suspended pipe, conduit, cable tray, bus ductor trapeze rack having a minimum 5 FT straight run length.

B. Brace spacing shall not exceed the maximum allowable brace spacing as engineered by the manufacturer or custom bracing designer.

C. Bracing may be omitted from conduit runs less than 5 FT in length.

D. Bracing may be omitted from conduit runs where rod hung supports of less than 12 IN. (305mm) in length are required.

1. Conduit shall be installed such that the lateral motion of the members will not cause damaging impact with other systems or structural members or loss of vertical support.

E. A longitudinal brace at a 90 degree change in direction may act as a transverse brace if it is located within 2 FT of the change in direction.

F. A transverse brace may act as a longitudinal brace if it is located within 2 FT of a change in direction and if the brace arm and anchorage have been sized to meet or exceed the requirements of the longitudinal brace.

G. When bracing equipment or a utility system that is suspended from an overhead deck, brace back to the overhead deck or to the supporting structure supporting the deck.

1. Do not brace to another element of the structure which may respond differently during a seismic event.

H. Obtain approval from the Owner prior to attaching any brace elements to structural steel or wood framing.

I. When utilizing cable bracing, tension the cable to remove slack without inducing uplift of the suspended element.

1. Tension seismic bracing system prior to system start-up and adjust if necessary after equipment start-up.

J. As a general rule, do not mix rigid bracing with cable bracing in the same run.

1. However, once bracing has transitioned a 90 degree change in run direction, the bracing may switch from rigid to cable or vice versa if required due to a significant change in overhead deck elevation or to provide an implementable bracing scheme in a congested area.

K. Install brace members at an angle of 45 degrees from horizontal within a tolerance of plus 2 1/2 degrees or minus 45 degrees provided the brace length is accounted for in design.

1. Brace angle may be increased to 60 degrees provided the brace spacing is reduced to 1/2 that required for a 45 degree brace.

L. Seismic bracing may not pass through a building separation joint.

1. Utility systems that pass through a separation joint must be seismically restrained no greater than 5 FT from the point of connection.
2. Any hardware designed to accommodate seismic movement across the span of the separation joint shall be installed per manufacturer's installation and listing instructions.

M. With approval of the Owner, utility systems that are suspended from the overhead deck may be braced to load bearing concrete or CMU (concrete masonry) walls provided that the walls and the overhead decks will respond similarly during a seismic event.

N. Each layer of a multiple layer trapeze rack shall be braced individually based on the weight of the individual layer.

O. Conduit constructed of non ductile material (plastic or fiberglass), shall have brace spacing reduced to 1/2 of the spacing allowed for ductile materials.

P. Where brace elements are through-bolted, the mounting hole in the element is to be no more than 1/16 IN in diameter larger then the bolt or threaded rod.

Q. Seismic braces shall directly brace the system and not the hanger.

3.2 SUSPENDED ELECTRICAL SYSTEMS

A. Install seismic bracing for all conduits 2-1/2 IN trade size or greater.
B. All trapeze assemblies supporting conduits shall be braced considering the total weight of the elements on the trapeze.
C. For the purposes of calculating weight, all conduits are to be treated as full.
D. Brace all trapeze racks which support conduit 2-1/2 IN trade size or larger.
   1. Brace all other conduit rack trapezes having a minimum weight in excess of 10 LBS/LF.
   2. Include a minimum 10 percent additional capacity for future additions.
E. Seismic bracing may be omitted from conduit suspended by rod hung supports 12 IN or less in length form the top of the element to the bottom of the structural attachment of the hanger provided lateral motion will not cause damaging impacts to other systems or loss of system vertical support.
F. All vertical risers involving conduit 2-1/2 IN in diameter or larger shall include lateral restraint at maximum 30 FT intervals and at the top and bottom of the riser.

3.3 FLOOR OR ROOF MOUNTED EQUIPMENT

A. Provide one (1) anchor on each leg or corner.
   1. Support with a minimum of three (3) 3/8 IN DIA anchors.

END OF SECTION

SECTION 16065

GROUNDING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for grounding system(s).
B. Related Sections:
   1. Section 16010 (Electrical).
   2. Section 16125 (Wire and Cable: 600 Volt and Below).
   3. Section 16130 (Raceway and Boxes).

1.2 QUALITY ASSURANCE

A. Ensure ground continuity is continuous throughout the entire Project.

1.3 REFERENCES

A. ASTM B8	Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
B. IEEE 837	Standard for Qualifying Permanent Connections Used in Substation Grounding
C. NFPA 70	National Electrical Code (NEC), Article 250, Grounding and Bonding
D. UL 467	Grounding and Bonding Equipment

1.4 SUBMITTALS

A. Product data.
   1. Provide submittal data for all products specified herein except:
      a. Grounding clamps, terminals and connectors.
      b. Exothermic welding system.
   2. See Section 16010 (Electrical: Basic Requirements), for additional requirements.
B. Quality Assurance/Control Submittals:
   1. Test Reports:
      a. Report of ground test.
         1) Grounding system resistance and continuity test reports signed by project supervising electrical forman.
         2) Include test reports in Installation, Operations and Maintenance Manual.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Ground rods and bars and grounding clamps, connectors and terminals:
      a. Burndy.
      b. Harger Lightning Protection.
      c. Heary Brothers.
      d. Joslyn.

e. Robbins Lightning Protection.
f. Thomas & Betts (Blackburn).
g. Thompson.
h. Or Approved Equal.

2. Exothermic weld connections:
   a. Erico Products Inc., Cadweld.
   b. Harger Lightning Protection.
   c. Thermoweld.
   d. Or Approved Equal.

2.2 COMPONENTS

A. Wire and Cable:
   1. Bare conductors: Soft drawn stranded copper meeting ASTM B8.
   2. Insulated conductors: Color coded green, per Section 16125 (Wire and Cable: 600 Volt and Below).
B. Conduit: As specified in Section 16130 (Raceway and Boxes).
C. Ground rods:
   1. 3/4 IN x 10 FT.
   2. Copperclad:
      a. Heavy uniform coating of electrolytic copper molecularly bonded to a rigid steel core.
      b. Corrosion resistant bond between the copper and steel.
      c. Hard drawn for a scar-resistant surface.
D. Grounding Clamps, Connectors and Terminals:
   1. Mechanical type:
      a. Standards: UL 467.
      b. High copper alloy content.
   2. Compression type for interior locations:
      a. Standards: UL 467.
      b. High copper alloy content.
      c. Non-reversible.
      d. Terminals for connection to bus bars shall have two bolt holes.
   3. Compression type suitable for direct burial in earth or concrete:
      a. Standards: UL 467, IEEE 837.
      b. High copper alloy content.
      c. Non-reversible.
E. Exothermic Weld connections:
   1. Copper oxide reduction by aluminum process.
   2. Molds properly sized for each application.

PART 3 EXECUTION

3.1 INSTALLATION

A. General:
   1. Install products in accordance with manufacturer's instructions.
   2. Size grounding conductors and bonding jumpers in accordance with NFPA 70 Article 250, except where larger sizes are indicated.

3. Remove paint, rust, or other nonconducting material from contact surfaces before making ground connections.
4. Do not splice grounding conductors except at ground rods.
5. Install ground rods and grounding conductors in undisturbed, firm soil.
   a. Provide excavation required for installation of ground rods and ground conductors.
   b. Use driving studs or other suitable means to prevent damage to threaded ends of sectional rods.
   c. Unless otherwise specified, connect conductors to ground rods with exothermic weld.
   d. Provide sufficient slack in grounding conductor to prevent conductor breakage during backfill or due to ground movement.
   e. Backfill excavation completely, thoroughly tamping to provide good contact between backfill materials and ground rods and conductors.
6. Do not use exothermic welding if it will damage the structure the grounding conductor is being welded to.

B. Supplemental Grounding Electrode:
1. Provide the following grounding in addition to the equipment ground conductor supplied with the feeder conductors whether or not indicated.
2. Equipment support rack and pedestals mounted outdoors:
   a. Connect metallic structure to a ground rod.
   b. Grounding conductor: #6 AWG minimum.

C. Raceway Bonding/Grounding:
1. All metallic conduit shall be installed so that it is electrically continuous.
2. All conduits to contain a grounding conductor with insulation identical to the phase conductors, unless otherwise indicated.
3. NFPA 70 required grounding bushings shall be of the insulating type.
4. Provide double locknuts at all panels.
5. Bond all conduit, at entrance and exit of equipment, to the equipment ground bus or lug.
6. Provide bonding jumpers if conduits are installed in concentric knockouts.
7. Make all metallic raceway fittings and grounding clamps tight to ensure equipment grounding system will operate continuously at ground potential to provide low impedance current path for proper operation of overcurrent devices during possible ground fault conditions.

D. Equipment Grounding:
1. All utilization equipment shall be grounded with an equipment ground conductor.

3.2 FIELD QUALITY CONTROL

A. Leave grounding system open until observed by Owner.
B. Test ground resistance using 3 point method and provide report of test result as detailed in 1.3 SUBMITTALS. Maximum resistance shall be 5 ohms.

END OF SECTION

SECTION 16125

WIRE AND CABLE: 600 VOLT AND BELOW

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   A. Material and installation requirements for:
      1. Building wire.
      2. Instrumentation cable.
      3. Wire connectors.
      4. Insulating tape.
      5. Pulling lubricant.
B. Related Sections:
   1. Section 16010 (Electrical: Basic Requirements).

1.2 REFERENCES

A. NEMA ICS 4	Industrial Control and Systems: Terminal Blocks
B. NFPA 70	National Electrical Code (NEC)
C. UL 44	Standard for Safety Thermoset-Insulated Wires and Cables
D. UL 83	Standard for Safety Thermoplastic-Insulated Wires and Cables
E. UL 467	Standard for Safety Grounding and Bonding Equipment
F. UL 486A	Standard for Safety Wire Connectors and Soldering Lugs for use with Copper Conductors
G. UL 486C	Standard for Safety Splicing Wire Connections
H. UL 510	Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
I. UL 1581	Standard for Safety Reference Standard for Electrical Wires, Cables, and Flexible Cords
J. UL 2250	Standard for Safety Instrumentation Tray Cable

1.3 DEFINITIONS

A. Cable: Multi-conductor, insulated, with outer sheath containing either building wire or instrumentation wire.
B. Instrumentation Cable:
   1. Multiple conductor, insulated, twisted or untwisted, with outer sheath.
   2. The following are specific types of instrumentation cables:
      a. Analog signal cable:
         1) Used for the transmission of low current (e.g., 4-20mA DC) or low voltage (e.g., 0-10 Vdc) signals, using No. 16 AWG and smaller conductors.
         2) Commonly used types are defined in the following:
            (a) TSP: Twisted shielded pair.
            (b) TST: Twisted shielded triad.
      b. Digital signal cable: Used for the transmission of digital signals between computers, PLC's, RTU's, etc.
      c. Special cable: As indicated.

C. Building Wire: Single conductor, insulated, with or without outer jacket depending upon type.

1.4 SUBMITTALS

A. Product Data:
   1. Provide submittal data for all products specified in Part 2 of this Section 16125 except:
      a. Wire connectors.
      b. Insulating tape.
      c. Cable lubricant.
   2. See Section 16010 (Electrical: Basic Requirements) for additional requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. See Section 16010 (Electrical: Basic Requirements).

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Building wire:
      a. American Insulated Wire Corporation.
      b. General Cable.
      c. Manhattan/CDT.
      d. Southwire Company.
      e. Or Approved Equal.
   2. Instrumentation cable:
      a. Analog cable:
         1) Alpha Wire Corporation.
         2) American Insulated Wire Corporation.
         3) Belden CDT Inc.
         4) General Cable.
         5) Manhattan/CDT.
         6) Or Approved Equal.
   3. Wire connectors:
      a. Burndy Corporation.
      b. Buchanan.
      c. Ideal.
      d. Ilsco.
      e. 3M Co.
      f. Teledyne Penn Union.
      g. Thomas and Betts.
      h. Phoenix Contact.
      i. Or Approved Equal.
   4. Insulating and color coding tape:
      a. 3M Co.
      b. Plymouth Bishop Tapes.
      c. Red Seal Electric Co.
      d. Or Approved Equal.

2.2 MANUFACTURED UNITS

A. Building Wire:
   1. Conductor shall be copper with 600 V rated insulation.
   2. Conductors shall be stranded, except for conductors used in lighting and receptacle circuits which may be stranded or solid.
   3. Surface mark with manufacturers name or trademark, conductor size, insulation type and UL label.
   4. Conform to NEMA/ICEA WC 70/S-95-658 and UL 83 for type THHN/THWN and THHN/THWN-2 insulation or NEMA/ICEA WC 70/S-95-658 and UL 44 for type XHHW-2 insulation.

B. Electrical Equipment Control Wire:
   1. Conductor shall be copper with 600 V rated insulation.
   2. Conductors shall be stranded.
   3. Surface mark with manufacturers name or trademark, conductor size, insulation type and UL label.
   4. Conform to UL 44 for Type SIS insulation.
   5. Conform to UL 83 for Type MTW insulation.

C. Instrumentation Cable:
   1. Surface mark with manufacturers name or trademark, conductor size, insulation type and UL label.
   2. Analog cable:
      a. Tinned copper conductors, #16 AWG minimum.
      b. 600 V PVC insulation with PVC jacket.
      c. Twisted with 100 percent foil shield coverage with drain wire.
      d. Six (6) twists per foot minimum.
      e. Individual conductor color coding: ICEA Method 1, Table K-2.
      f. Conform to UL 2250, UL 1581 and NFPA 70 Type ITC.
      g. Cables to have individual shielded pairs.

D. Wire Connectors:
   1. Twist/screw on type:
      a. Insulated pressure or spring type solderless connector, epoxy filled, waterproof.
      b. 600 V rated.
      c. Ground conductors: Conform to UL 486C and/or UL 467 when required by local codes.
      d. Phase and neutral conductors: Conform to UL 486C.
   2. Compression and mechanical screw type:
      a. 600 V rated.
      b. Ground conductors: Conform to UL 467.
      c. Phase and neutral conductors: Conform to UL 486A.
   3. Terminal block type:
      a. High density, screw-post barrier-type with white center marker strip.
      b. 600 V and ampere rating as required, for power circuits.
      c. 600 V, 20 ampere rated for control circuits.
      d. 300 V, 15 ampere rated for instrumentation circuits.
      e. Conform to NEMA ICS 4 and UL 486A.

E. Insulating and Color Coding Tape:
   1. Pressure sensitive vinyl.
   2. Premium grade.

3. Heat, cold, moisture, and sunlight resistant.
4. Thickness, depending on use conditions: 7, 8.5, or 10 mil.
5. For cold weather or outdoor location, tape must also be all-weather.
6. Color:
   a. Insulating tape: Black.
   b. Color coding tape: Fade-resistant color as specified herein.
7. Comply with UL 510.

F. Pulling Lubricant: Cable manufacturer's standard containing no petroleum or other products which will deteriorate insulation.

PART 3 EXECUTION

3.1 INSTALLATION

A. Permitted Usage of Insulation Types:
   1. Type XHHW-2 or Type THHN/THWN and THHN/THWN-2.
      a. Building wire.
      b. Building wire in conduit below grade.
   2. Type SIS and MTW:
      a. For the wiring of control equipment within control panels and field wiring of control equipment within switchgear, switchboards, motor control centers.

B. Conductor Size Limitations:
   1. Feeder and branch power conductors shall not be smaller than No. 12 AWG unless otherwise indicated.
   2. Control conductors shall not be smaller than No. 14 AWG unless otherwise indicated.
   3. Instrumentation conductors shall not be smaller than No. 18 AWG unless otherwise indicated.

C. Color Code All Wiring as Follows:
   1. Building wire:

	240 V, 208 V, 240/120 V, 208/120 V	480 V, 480/277 V
Phase 1	Black	Brown
Phase 2	Red	Orange
Phase 3	Blue	Yellow
Neutral	White	White or Gray
Ground	Green	Green

      a. Conductors No. 6 AWG and smaller: Insulated phase, neutral and ground conductors shall be identified by a continuous colored outer finish along its entire length.
      b. Conductors larger than No. 6 AWG:
         1) Insulated phase and neutral conductors shall be identified by one (1) of the following methods:
            (a) Continuous colored outer finish along its entire length.
            (b) 3 IN of colored tape applied at the termination.

2) Insulated grounding conductor shall be identified by one (1) of the following methods:
   (a) Continuous green outer finish along its entire length.
   (b) Stripping the insulation from the entire exposed length.
   (c) Using green tape to cover the entire exposed length.
3) The color coding shall be applied at all accessible locations, including but not limited to: Junction and pull boxes, wireways, manholes and handholes.

D. Install all wiring in raceway unless otherwise indicated.

E. Feeder, branch, control and instrumentation circuits shall not be combined in a raceway, cable tray, junction or pull box, except as permitted in the following:
1. Where specifically indicated.
2. Where field conditions dictate and written permission is obtained from Owner.
3. Control circuits shall be isolated from feeder and branch power and instrumentation circuits but combining of control circuits is permitted.
   a. The combinations shall comply with the following:
      1) 12 Vdc, 24 Vdc and 48 Vdc may be combined.
      2) 125 Vdc shall be isolated from all other AC and DC circuits.
      3) AC control circuits shall be isolated from all DC circuits.
4. Instrumentation circuits shall be isolated from feeder and branch power and control circuits but combining of instrumentation circuits is permitted.
   a. The combinations shall comply with the following:
      1) Analog signal circuits may be combined.
      2) Digital signal circuits may be combined but isolated from analog signal circuits.
5. Multiple branch circuits for lighting, receptacle and other 120 Vac circuits are allowed to be combined into a common raceway.
   a. Contractor is responsible for making the required adjustments in conductor and raceway size, in accordance with all requirements of the NEC, including but not limited to:
      1) Up sizing conductor size for required ampacity de-ratings for the number of current carrying conductors in the raceway.
      2) Up sizing raceway size for the size and quantity of conductors.

F. Ground the drain wire of shielded instrumentation cables at one (1) end only.
1. The preferred grounding location is at the load (e.g., control panel), not at the source (e.g., field mounted instrument).

G. Splices and terminations for the following circuit types shall be made in the indicated enclosure type using the indicated method.
1. Feeder and branch power circuits:
   a. General except dry areas:
      1) Twist/screw on type connectors, epoxy filled, waterproof.
   b. Motor terminal boxes:
      1) Twist/screw on type connectors for use on No. 10 AWG and smaller wire.
      2) Insulated mechanical screw type connectors for use on No. 8 AWG and larger wire.
2. Control circuits:
   a. Twist/screw on type connectors pre-filled with epoxy, except in dry areas use regular connectors.
   b. Control panels and motor control centers: Terminal block or strips provided within the equipment or field installed within the equipment by the Contractor.

3. Instrumentation circuits can be spliced where field conditions dictate and written permission is obtained from Owner.
    a. Maintain electrical continuity of the shield when splicing twisted shielded conductors.
    b. Junction and pull boxes: Terminal block type connector.
    c. Control panels and motor control centers: Terminal block or strip provided within the equipment or field installed within the equipment by the Contractor.
    d. Document all splices on as-built drawings.
4. Non-insulated compression and mechanical screw type connectors shall be insulated with tape or hot or cold shrink type insulation to the insulation level of the conductors.

H. Insulating Tape Usage:
1. For insulating connections of No. 8 AWG wire and smaller: 7 mil vinyl tape.
2. For insulating splices and taps of No. 6 AWG wire or larger: 10 mil vinyl tape.
3. For insulating connections made in cold weather or in outdoor locations: 8.5 mil, all weather vinyl tape.

I. Color Coding Tape Usage: For color coding of conductors.

3.2 FIELD QUALITY CONTROL

A. Replace any damaged wire or cable.

END OF SECTION

SECTION 16130

RACEWAY AND BOXES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for:
      a. Conduits.
      b. Conduit fittings.
      c. Conduit supports.
      d. Wireways.
      e. Outlet boxes.
      f. Pull and junction boxes.

B. Related Sections:
   1. Section 02072 (Demolition, Cutting and Patching).
   2. Section 16010 (Electrical: Basic Requirements).
   3. Section 16135 (Electrical: Exterior Underground).

1.2 REFERENCES

A. ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
B. ASTM A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
C. ASTM D2564	Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
D. NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum)
E. NEMA RN1	Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit (IMC)
F. NEMA/ANSI C80.1	Electric Rigid Steel Conduit (ERSC)
G. NFPA 70	National Electrical Code (NEC)
H. UL 6	Standard for Electrical Rigid Metal Conduit - Steel
I. UL 50	Enclosures for Electrical Equipment, Non-Environmental Considerations
J. UL 360	Standard for Liquid-Tight Flexible Steel Conduit
K. UL 467	Grounding and Bonding Equipment
L. UL 514B	Conduit, Tubing, and Cable Fittings
M. UL 651	Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings
N. UL 870	Standard for Wireways, Auxiliary Gutters, and Associated Fittings

1.3 SUBMITTALS

A. Product Data:
   1. Provide submittal data for all products specified in PART 2 of this Section 16130 except:
      a. Conduit fittings.
      b. Support systems.
   2. See Section 16010 (Electrical: Basic Requirements) for additional requirements.

B. Fabrication and/or layout drawings:
   1. Identify dimensional size of pull and junction boxes to be used.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment and materials.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Rigid metallic conduits:
      a. Allied Tube and Conduit Corporation.
      b. Triangle PWC Inc.
      c. Western Tube and Conduit Corporation.
      d. Wheatland Tube Company.
      e. LTV Steel Company.
      f. Or Approved Equal.
   2. PVC coated rigid metallic conduits and repair kits:
      a. Occidental Coating Company.
      b. Perma-Cote.
      c. Rob-Roy Ind.
      d. Raychem "GelTek" tape.
      e. Or Approved Equal.
   3. Rigid non-metallic conduit:
      a. Carlon.
      b. Cantex.
      c. Osburn Associates.
      d. Or Approved Equal.
   4. Flexible conduit:
      a. AFC Cable Systems.
      b. Anamet, Inc.
      c. Electri-Flex.
      d. Flexible Metal Hose Company.
      e. International Metal Hose Company.
      f. Triangle PWC Inc.
      g. LTV Steel Company.
      h. Or Approved Equal.
   5. Wireway:
      a. Hoffman Engineering Company.
      b. Wiegmann.
      c. Square D.
      d. Or Approved Equal.
   6. Conduit fittings and accessories:
      a. Appleton.
      b. Carlon.
      c. Cantex.
      d. Crouse-Hinds.

e. Killark.
f. Osburn Associates.
g. OZ Gedney Company.
h. RACO.
i. Steel City.
j. Thomas and Betts.
k. Or Approved Equal.

7. Support systems:
   a. Unistrut Building Systems.
   b. B-Line Systems Inc.
   c. Kindorf.
   d. Minerallac Fastening Systems.
   e. Caddy.
   f. Or Approved Equal.
8. Outlet, pull and junction boxes:
   a. Appleton Electric Co.
   b. Crouse-Hinds.
   c. Killark.
   d. O-Z/Gedney.
   e. Steel City.
   f. Raco.
   g. Bell.
   h. Hoffman Engineering Co.
   i. Wiegmann.
   j. B-Line Circle AW.
   k. Adalet.
   l. Rittal.
   m. Or Approved Equal.

2.2 RIGID METALLIC CONDUITS

A. Rigid Galvanized Steel Conduit (RGS):
   1. Mild steel with continuous welded seam.
   2. Metallic zinc applied by hot-dip galvanizing or electro-galvanizing.
   3. Threads galvanized after cutting.
   4. Internal coating: Baked lacquer, varnish or enamel for a smooth surface.
   5. Standards: NEMA/ANSI C80.1, UL 6.

B. PVC-Coated Rigid Steel Conduit (PVC-RGS):
   1. Nominal 40 mil Polyvinyl Chloride Exterior Coating:
      a. Coating: Bonded to hot-dipped galvanized rigid steel conduit conforming to NEMA/ANSI C80.1.
      b. The bond between the PVC coating and the conduit surface: Greater than the tensile strength of the coating.
   2. Nominal 2 mil, minimum, urethane interior coating.
   3. Urethane coating on threads.
   4. Conduit: Epoxy prime coated prior to application of PVC and urethane coatings.

5. Female Ends:
    a. Have a plastic sleeve extending a minimum of 1 pipe diameter or 2 IN, whichever is less beyond the opening.
    b. The inside diameter of the sleeve shall be the same as the outside diameter of the conduit to be used with it.
6. Standards: NEMA/ANSI C80.1, UL 6, NEMA RN 1.

2.3 RIGID NON-METALLIC CONDUIT

A. Schedules 40 (PVC-40) and 80 (PVC-80):
1. Polyvinyl-chloride (PVC) plastic compound which includes inert modifiers to improve weatherability and heat distribution.
2. Rated for direct sunlight exposure.
3. Fire retardant and low smoke emission.
4. Shall be suitable for use with 90 DegC wire and shall be marked "maximum 90 DegC".
5. Standards: NEMA TC 2, UL 651.

2.4 FLEXIBLE CONDUIT

A. PVC-Coated Flexible Galvanized Steel (liquid-tight) Conduit (FLEX-LT):
1. Core formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked.
2. Extruded PVC outer jacket positively locked to the steel core.
3. Liquid and vaportight.
4. Standard: UL 360.

2.5 WIREWAY

A. General:
1. Suitable for lay-in conductors.
2. Designed for continuous grounding.
3. Covers:
    a. Hinged or removable in accessible areas.
    b. Non-removable when passing through partitions.
4. Finish: Rust inhibiting primer and manufacturers standard paint inside and out except for stainless steel type.
5. Standards: UL 870, NEMA 250.

B. Watertight (NEMA 4X rated) Wireway:
1. 14 GA Type 304 or 316 stainless steel bodies and covers without knockouts and 10 GA stainless steel flanges.
2. Cover: Fully gasketed and held in place with captive clamp type latches.
3. Flanges: Fully gasketed and bolted.

C. Dusttight (NEMA 12 rated) Wireway:
1. 14 GA steel bodies and covers without knockouts and 10 GA steel flanges.
2. Cover: Fully gasketed and held in place with captive clamp type latches.
3. Flanges: Fully gasketed and bolted.

2.6 CONDUIT FITTINGS AND ACCESSORIES

A. Fittings for Use with RGS:
1. Locknuts:
    a. Threaded steel or malleable iron.
    b. Gasketed or non-gasketed.

c. Grounding or non-grounding type.
2. Bushings:
a. Threaded, insulated metallic.
b. Grounding or non-grounding type.
3. Hubs: Threaded, insulated and gasketed metallic for raintight connection.
4. Couplings:
a. Threaded straight type: Same material and finish as the conduit with which they are used on.
b. Threadless type: Gland compression or self-threading type, concrete tight.
5. Unions: Threaded galvanized steel or zinc plated malleable iron.
6. Conduit bodies (ells and tees):
a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.
b. Standard and mogul size.
c. Cover:
1) Clip-on type with stainless steel screws.
2) Gasketed or non-gasketed galvanized steel, zinc plated cast iron or cast copper free aluminum.
7. Conduit bodies (round):
a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.
b. Cover: Threaded screw on type, gasketed, galvanized steel, zinc plated cast iron or cast copper free aluminum.
8. Expansion couplings:
a. 2 IN nominal straight-line conduit movement in either direction.
b. Galvanized steel with insulated bushing.
c. Gasketed for wet locations.
d. Internally or externally grounded.
9. Expansion/deflection couplings:
a. 3/4 IN nominal straight-line conduit movement in either direction.
b. 30-degree nominal deflection from the normal in all directions.
c. Metallic hubs, neoprene outer jacket and stainless steel jacket clamps.
d. Internally or externally grounded.
e. Watertight, raintight and concrete tight.
10. Standards: UL 467, UL 514B, UL 886.

B. Fittings for Use with PVC-RGS:
1. The same material and construction as those fittings listed under paragraph "Fittings for Use with RGS" and coated as defined under paragraph "PVC Coated Rigid Steel Conduit (PVC-RGS)" of this Section 16130.

C. Fittings for Use with FLEX-LT:
1. Connector:
a. Straight or angle type.
b. Metal construction, insulated and gasketed.
c. Composed of locknut, grounding ferrule and gland compression nut.
d. Liquid tight.
2. Standards: UL 467, UL 514B.

D. Fittings for Use with Rigid Non-Metallic PVC Conduit:
1. Coupling, adapters and conduit bodies:
a. Same material, thickness, and construction as the conduits with which they are used.
b. Homogeneous plastic free from visible cracks, holes or foreign inclusions.

c. Bore smooth and free of blisters, nicks or other imperfections which could damage the conductor.
2. Solvent cement for welding fittings shall be supplied by the same manufacturer as the conduit and fittings.
3. Standards: ASTM D2564, NEMA TC 3, UL 651, UL 514B.

E. Weather and Corrosion Protection Tape:
1. PVC based tape, 10 mils thick.
2. Protection against moisture, acids, alkalis, salts and sewage and suitable for direct bury.
3. Used with appropriate pipe primer.

2.7 ALL RACEWAY AND FITTINGS

A. Mark Products:
1. Identify the nominal trade size on the product.
2. Stamp with the name or trademark of the manufacturer.

2.8 OUTLET BOXES

A. Cast Outlet Boxes:
1. Zinc plated cast iron or die-cast copper free aluminum with manufacturers standard finish.
2. Threaded hubs and grounding screw.
3. Styles:
a. "FS" or "FD".
b. "Bell".
c. Single or multiple gang and tandem.
4. Accessories: 40 mil PVC exterior coating and 2 mil urethane interior coating.
5. Standards: UL 514A, UL 886.

B. Nonmetallic (PVC) Outlet Boxes:
1. Heavy duty cast type.

2.9 PULL AND JUNCTION BOXES

A. NEMA 4X Rated (metallic):
1. Body and cover: 14 GA Type 304 or 316 stainless steel.
2. Seams continuously welded and ground smooth.
3. No knockouts.
4. External mounting flanges.
5. Hinged door and stainless steel screws and clamps.
6. Door with oil-resistant gasket.

B. NEMA 12 Rated:
1. Body and cover:
a. 14 GA steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
b. Type 5052 H-32 aluminum, unpainted.
2. Seams continuously welded and ground smooth.
3. No knockouts.
4. External mounting flanges.
5. Non-hinged cover held closed with captivated cover screws threaded into sealed wells or hinged cover held closed with stainless steel screws and clamps.
6. Flat door with oil resistant gasket.

C. Miscellaneous Accessories:
   1. Rigid handles for covers larger than 9 SF or heavier than 25 LBS.
   2. Split covers when heavier than 25 LBS.
   3. Weldnuts for mounting optional panels and terminal kits.
   4. Terminal blocks: Screw-post barrier-type, rated 600 volt and 20 ampere minimum.
D. Standards: NEMA 250, UL 50.

2.10 SUPPORT SYSTEMS

A. Multi-conduit Surface or Trapeze Type Support and Pull or Junction Box Supports:
   1. Material requirements.
      a. Galvanized steel: ASTM A123 or ASTM A153.
      b. Stainless steel: AISI Type 316.
B. Single Conduit and Outlet Box Support Fasteners:
   1. Material requirements:
      a. Zinc plated steel.
      b. Stainless steel.
      c. Malleable iron.

2.11 OPENINGS AND PENETRATONS IN WALLS AND FLOORS

A. Cut neatly. See Section 02072 (Demolition, Cutting and Patching).

PART 3 EXECUTION

3.1 RACEWAY INSTALLATION - GENERAL

A. Shall be in accordance with the requirements of:
   1. NFPA 70.
   2. Manufacturer instructions.
B. Size of Raceways:
   1. Raceway sizes are indicated, if not indicated, then size in accordance with NFPA 70.
   2. Unless specifically indicated otherwise, the minimum raceway size shall be:
      a. Conduit: 3/4 IN.
      b. Wireway: 2-1/2 IN x 2-1/2 IN.
C. Field Bending and Cutting of Conduits:
   1. Utilize tools and equipment recommended by the manufacturer of the conduit, designed for the purpose and the conduit material to make all field bends and cuts.
   2. Do not reduce the internal diameter of the conduit when making conduit bends.
   3. Prepare tools and equipment to prevent damage to the PVC coating.
   4. Degrease threads after threading and apply a zinc rich paint.
   5. Debur interior and exterior after cutting.
D. Male threads of conduit systems shall be coated with an electrically conductive anti-seize compound.
E. The protective coating integrity of conduits, fittings, outlet, pull and junction boxes and accessories shall be maintained.
   1. Repair galvanized components utilizing a zinc rich paint.
   2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
   3. Repair PVC coated components utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the conduit; or a self-adhesive, highly

conformable, cross-linked silicone composition strip, followed by a protective coating of vinyl tape.
    a. Total nominal thickness: 40 mil.
4. Repair surfaces which will be inaccessible after installation prior to installation.

F. Remove moisture and debris from conduit before wire is pulled into place.
1. Pull mandrel with diameter nominally 1/4 IN smaller than the interior of the conduit, to remove obstructions.
2. Swab conduit by pulling a clean, tight-fitting rag through the conduit.
3. Tightly plug ends of conduit with tapered wood plugs or plastic inserts until wire is pulled.

G. Only nylon or polyethylene rope shall be used to pull wire and cable in conduit systems.

H. Where portions of a raceway are subject to different temperatures and where condensation is known to be a problem, as in cold storage areas of buildings or where passing from the interior to the exterior of a building, the raceway shall be sealed to prevent circulation of warm air to colder section of the raceway.

I. Fill openings in walls, floors, and ceilings and finish flush with surface.

J. All spare raceways shall be capped with threaded caps. Pull cords shall extend through tight fitting holes in the caps and shall be sealed after installation.

3.2 RACEWAY ROUTING

A. Raceways shall be routed in the field unless otherwise indicated. It is intended that all conduit possible be run embedded in the concrete structure in the viewing area/ladder structure area.
1. Conduit and fittings shall be installed, as required, for a complete system that has a neat appearance and is in compliance with all applicable codes.
2. Run in straight lines parallel to or at right angles to building lines.
3. Do not route conduits:
    a. Through areas of high ambient temperature or radiant heat.
    b. In suspended concrete slabs.
4. Conduit shall not interfere with, or prevent access to, piping, valves, ductwork, or other equipment for operation, maintenance and repair.
5. Provide pull boxes or conduit bodies as needed so that there is a maximum of 360 degrees of bends in the conduit run or in long straight runs to limit pulling tensions.

B. All rigid conduits within a structure shall be installed exposed.

C. Conduits shall be installed to eliminate moisture pockets.
1. Where water cannot drain to openings, provide drain fittings in the low spots of the conduit run.

D. Conduit shall not be routed on the exterior of structures except as specifically indicated.

E. Provide all required openings in walls, floors, and ceilings for conduit penetration.

3.3 RACEWAY APPLICATIONS

A. Permitted Raceway Types Per Wire or Cable Types:
1. Power wire or cables: All raceway types.
2. Control wire or cables: All raceway types.
3. Instrumentation cables: Metallic raceway except non-metallic may be used underground.

B. Permitted Raceway Types Per Area Designations:
1. Dry areas:
    a. RGS.

2. Wet areas exposed:
   a. PVC-RGS.

C. Permitted Raceway Types Per Routing Locations:
1. Conduit embedded in concrete:
   a. PVC-40.

D. FLEX-LT conduits shall be install as the final conduit connections to equipment.

E. NEMA 4X Rated Wireway:
1. Surface mounted in areas designated as wet.

F. NEMA 12 Rated Wireway:
1. Surface mounted in areas designated as dry.

G. Underground Conduit: See Section 16135 (Electrical: Exterior Underground).

3.4 CONDUIT FITTINGS AND ACCESSORIES

A. Rigid non-metallic conduit and fittings shall be joined utilizing solvent cement.
1. Immediately after installation of conduit and fitting, the fitting or conduit shall be rotated 1/4 turn to provide uniform contact.

B. Install Expansion Fittings:
1. Where conduits are exposed to the sun and conduit run is greater than 200 FT.
2. Elsewhere as indicated.

C. Install Expansion/Deflection Fittings:
1. Where conduits enter a structure.
   a. Except electrical manholes and handholes.
   b. Except where the ductbank is tied to the structure with rebar.
2. Where conduits span structural expansions joints.
3. Elsewhere as indicated.

D. Threaded connections shall be made wrench-tight.

E. Conduit joints shall be watertight:
1. Where subjected to possible submersion.
2. In areas classified as wet.
3. Underground.

F. Terminate Conduits:
1. In metallic outlet boxes:
   a. RGS:
      1) Conduit hub and locknut.
      2) Insulated bushing and two (2) locknuts.
      3) Use grounding type locknut or bushing when required by NFPA 70.
2. In NEMA 1 rated enclosures:
   a. RGS:
      1) Conduit hub and locknut.
      2) Insulated bushing and two (2) locknuts.
      3) Use grounding type locknut or bushing when required by NFPA 70.
3. In NEMA 12 rated enclosures:
   a. Watertight, insulated and gasketed hub and locknut.
   b. Use grounding type locknut or bushing when required by NFPA 70.
4. In NEMA 4X rated enclosures:
   a. Watertight, insulated and gasketed hub and locknut.
5. When stubbed up through the floor into floor mount equipment:
   a. With an insulated grounding bushing on metallic conduits.

b. With end bells on non-metallic conduits.

G. Threadless couplings shall only be used to join new conduit to existing conduit when the existing conduit end is not threaded and it is not practical or possible to cut threads on the existing conduit with a pipe threader.

3.5 CONDUIT SUPPORT

A. Permitted multi-conduit surface or trapeze type support system per area designations and conduit types:
   1. Dry areas:
      a. Galvanized system consisting of: Galvanized steel channels and fittings, nuts and hardware and conduit clamps.
   2. Wet areas:
      a. Stainless steel system.
   3. Conduit type shall be compatible with the support system material.
      a. Galvanized steel system may be used with RGS.
      b. Stainless steel system may be used with RGS and PVC-RGS.

B. Permitted single conduit support fasteners per area designations and conduit types:
   1. Dry areas:
      a. Material: Zinc plated steel, stainless steel and malleable iron.
      b. Types of fasteners: Straps, hangers with bolts, clamps with bolts and bolt on beam clamps.
   2. Wet areas:
      a. Material: Stainless steel.
      b. Types of fasteners: Straps, hangers with bolts, clamps with bolts and bolt on beam clamps; all stainless steel.
   3. Conduit type shall be compatible with the support fastener material.
      a. Zinc plated steel, steel protected with zinc phosphate and oil finish and malleable iron fasteners may be used with RGS.
      b. Stainless steel system may be used with RGS and PVC-RGS.

C. Conduit Support General Requirements:
   1. Maximum spacing between conduit supports per NFPA 70.
   2. Support conduit from the building structure.
   3. Do not support conduit from process, gas, air or water piping; or from other conduits.
   4. Provide hangers and brackets to limit the maximum uniform load on a single support to 25 LBS or to the maximum uniform load recommended by the manufacturer if the support is rated less than 25 LBS.
      a. Do not exceed maximum concentrated load recommended by the manufacturer on any support.
      b. Conduit hangers:
         1) Continuous threaded rods combined with struts or conduit clamps: Do not use perforated strap hangers and iron bailing wire.
   5. Conduit support system fasteners:
      a. Use sleeve-type expansion anchors as fasteners in masonry wall construction.
      b. Do not use concrete nails and powder-driven fasteners.

3.6 OUTLET, PULL AND JUNCTION BOX INSTALLATION

A. General:
   1. Install products in accordance with manufacturer's instructions.
   2. Fill unused punched-out, tapped, or threaded hub openings with insert plugs.

3. Size boxes to accommodate quantity of conductors enclosed and quantity of conduits connected to the box.

B. Outlet Boxes:
1. Mount device outlet boxes where indicated.
2. Set device outlet boxes plumb and vertical to the floor.
3. When an outlet box is connected to a PVC coated conduit, the box shall also be PVC coated.
4. Surface mounted: Cast metal with cast covers and stainless steel screws.
5. Embedded in concrete: PVC with stainless steel covers and screws.

C. Pull and Junction Boxes:
1. Install pull or junction boxes in conduit runs where indicated or required to facilitate pulling of wires or making connections.
   a. Make covers of boxes accessible.
2. Permitted uses of NEMA 4X metallic enclosure:
   a. Pull or junction box surface mounted in areas designated as wet and/or corrosive.
3. Permitted uses of NEMA 12 enclosure:
   a. Pull or junction box surface mounted in areas designated as dry.

END OF SECTION

SECTION 16135

ELECTRICAL: EXTERIOR UNDERGROUND

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for:
      a. Handhole.
      b. Underground conduits and ductbanks.

B. Related Sections:
   1. Section 02300 (Earthwork).
   2. Section 16130 (Raceway and Boxes).

1.2 DEFINITIONS

A. Concrete encased ductbank: An individual (single) or multiple conduit(s), arranged in one or more planes, encased in a common red concrete envelope.

1.3 SUBMITTALS

A. Product Data:
   1. Provide submittal data for all products specified in PART 2 of this Section 16135.
   2. Fabrication and/or layout drawings:
      a. Provide dimensional drawings of each manhole indicating all specified accessories and conduit entry locations.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Precast handholes:
      a. Utility Vault Co.
      b. Oldcastle Precast, Inc.
      c. Lister Industries.
      d. Or Approved Equal.

2.2 HANDHOLES

A. Precast Handholes:
   1. Fiberglass reinforced polymer concrete or steel reinforced cement concrete structures:
   2. Shall have an AASHTO live load rating of H-20 for full deliberate vehicle traffic.
   3. Mating edges: Tongue and groove type.
   4. Open bottom.
   5. Removable galvanized steel cover labeled “ELECTRICAL”.
   6. Cover extension rings as required.

2.3 UNDERGROUND CONDUIT AND ACCESSORIES

A. Concrete: 4000 psi colored red.

B. Conduit: See Section 16130 (Raceway and Boxes).

C. Duct Spacers/Supports:
   1. High density polyethylene or high impact polystyrene.
   2. Interlocking.
   3. Provide 2 IN minimum spacing between conduits.
   4. Accessories, as required:
      a. Hold down bars.
      b. Ductbank strapping.
D. Warning tape, plastic, 6 IN wide, marked “BURIED ELECTRICAL CONDUIT”.

PART 3 EXECUTION

3.1 GENERAL

A. Approximate location of handholes and routing of ductbanks as indicated.
   1. Field conditions may affect actual routing.
B. Handhole Locations:
   1. Approximately where indicated.
   2. As required for pulling distances.
   3. As required to keep pulling tensions under allowable cable tensions.
   4. As required for number of bends in ductbank routing.
   5. Shall not be installed in a swale or ditch.
   6. Determine the exact locations after careful consideration has been given to the location of other utilities, grading, and paving.
   7. Locations are to be approved by Owner prior to excavation and placement or construction of manholes and handholes.
C. Install products in accordance with manufacturer's instructions.
D. Install handholes in conduit runs where indicated or as required to facilitate pulling of wires or making connections.
E. Comply with Section 02300 (Earthwork), for trenching, backfilling and compacting.

3.2 HANDHOLES

A. Precast Handholes:
   1. For use in vehicular and non-vehicular traffic areas.
   2. Construction:
      a. Grout or seal all joints, per manufacturers instructions.
   3. Place handhole on a foundation of compacted 1/4 to 1/2 IN crushed rock or gravel a minimum of 8 IN thick and 6 IN larger than handholes footprint on all sides.
   4. Install so that the top of cover is 1 IN above finished grade.
      a. Where existing grades are higher than finished grades, install sufficient number of courses of curved segmented concrete block between top of handhole and manhole frame to temporarily elevate manhole cover to existing grade level.
   5. After installation is complete, backfill and compact soil around handholes.

6. Handhole size:
   a. As indicated or as required for the number and size of conduits entering.
   b. Minimum floor dimension of 1 FT x 2 FT and minimum depth of 2 FT.

3.3 UNDERGROUND CONDUITS

A. General Installation Requirements:
   1. Concrete encased ductbank with red concrete.
   2. Do not place concrete until conduits have been observed by Owner.
   3. Ductbanks shall be sloped a minimum of 4 IN per 100 FT or as indicated.
      a. Low points shall be at handholes.
   4. During construction and after conduit installation is complete, plug the ends of all conduits.
   5. Provide conduit supports and spacers.
      a. Place supports and spacers for rigid nonmetallic conduit on maximum centers as indicated for the following trade sizes:
         1) 1 IN and less: 3 FT.
         2) 1-1/4 to 3 IN: 5 FT.
         3) 3-1/2 to 6 IN: 7 FT.
      b. Place supports and spacers for rigid steel conduit on maximum centers as indicated for the following trade sizes:
         1) 1 IN and less: 10 FT.
         2) 1-1/4 to 2-1/2 IN: 14 FT.
         3) 3 IN and larger: 20 FT.
      c. Securely anchor conduits to supports and spacers to prevent movement during placement of concrete or soil.
   6. Stagger conduit joints at intervals of 6 IN vertically.
   7. Make conduit joints watertight and in accordance with manufacturer's recommendations.
   8. Accomplish changes in direction of runs exceeding a total of 15 degrees by long sweep bends having a minimum radius of 25 FT.
      a. Sweep bends may be made up of one or more curved or straight sections or combinations thereof.
   9. Furnish manufactured bends at end of runs.
      a. Minimum radius of 18 IN for conduits less than 3 IN trade size and 36 IN for conduits 3 IN trade size and larger.
   10. Field cuts requiring tapers shall be made with the proper tools and shall match factory tapers.
   11. After the conduit run has been completed:
      a. Prove joint integrity and test for out-of-round duct by pulling a test mandrel through each conduit.
         1) Test mandrel:
            (a) Length: Not less than 12 IN
            (b) Diameter: Approximately 1/4 IN less than the inside diameter of the conduit.
      b. Clean the conduit by pulling a heavy duty wire brush mandrel followed by a rubber duct swab through each conduit.
   12. Pneumatic rodding may be used to draw in lead wire.
      a. Install a heavy nylon cord free of kinks and splices in all unused new ducts.

   b. Extend cord 3 FT beyond ends of conduit.
13. Transition from rigid non-metallic conduit to rigid metallic conduit, per Section 16130 (Raceway and Boxes), prior to entering a structure or going above ground.
    a. Except rigid non-metallic conduit may be extended directly to handholes, pad mounted transformer boxes and other exterior pad mounted electrical equipment where the conduit is concealed within the enclosure.
    b. Terminate rigid PVC conduits with end bells.
    c. Terminate steel conduits with insulated bushings.
14. Place warning tape in trench 12 IN above ductbanks.
15. Placement of conduits stubbing into handholes shall be located to allow for proper bending radiuses of the cables.
16. Handholes shall be open bottom and installed on a minimum of 6 IN of compacted crushed gravel base.
17. All spare conduits shall be capped with threaded caps at each end. Pull cords shall be brought through tight fitting holes in the caps and sealed.

B. Concrete Encased Ductbank:
1. Ductbank system consists of conduits completely encased in minimum 2 IN of concrete and with separations between different cabling types as required in Section 16130 (Raceway and Boxes) or as indicated.
2. Install so that top of concrete encased duct, at any point:
    a. Is not less than 24 IN below grade.
    b. Is below pavement sub-grading.
3. Conduit supports shall provide a uniform minimum clearance of 2 IN between the bottom of the trench and the bottom row of conduit.
4. Conduit separators shall provide a uniform minimum clearance of 2 IN between conduits or as required in Section 16130 (Raceway and Boxes) for different cabling types.

END OF SECTION

SECTION 16140

WIRING DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Material and installation requirements for:
      a. Light switches.
      b. Receptacles.
      c. Device wallplates and coverplates.

B. Related Section:
   1. Section 16010 (Electrical: Basic Requirements).
   2. Section 16130 (Raceway and Boxes).

1.2 REFERENCES

A.	NEMA WD-1	Wiring Devices
B.	NEMA WD-6	Wiring Devices - Dimensional Requirements
C.	NEMA 5-20R	Receptacle Configuration
D.	UL 20	General Use Snap Switches
E.	UL 498	Attachment Plugs and Receptacles
F.	UL 514A	Metallic Outlet Boxes
G.	UL 943	Ground-Fault Circuit-Interrupters

1.3 SUBMITTALS

A. See Section 16010 (Electrical: Basic Requirements).

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Light switches and receptacles:
      a. Hubbell.
      b. Bryant.
      c. Pass & Seymour.
      d. Arrow Hart.
      e. General Electric.
      f. Leviton.
      g. Crouse-Hinds.
      h. Appleton Electric Co.
      i. Killark.
      j. Or Approved Equal.

2.2 LIGHT SWITCHES

A. General requirements:
   1. Toggle type, quiet action, heavy duty grade.
   2. Self grounding with grounding terminal.

3. Back and side wired.
4. Solid silver cadmium oxide contacts.
5. Rugged urea housing and one-piece switch arm.
6. Rated 20 A, 120/277 V AC.
7. Switch handle color: Ivory.
8. Types as indicated:
   a. Single pole.
   b. Double pole.
   c. 3-way.
   d. 4-way.
9. Standards: UL 20, UL 514A; NEMA WD-6.

B. Wallplate: Type 302 stainless steel. Single or multiple gang as required.

C. Wet Areas:
1. Corrosion resistant nickel plated metal parts.
2. Coverplate: Gasketed zinc plated malleable iron or copper free aluminum with stainless steel screws utilizing rocker, front mounted toggle or pull type switch. Single or multiple gang as required.

2.3 RECEPTACLES

A. General requirements unless modified in specific requirements paragraph of receptacles per designated areas:
1. Straight blade, all GFCI type, extra heavy duty grade.
2. Brass triple wipe line contacts.
3. One piece grounding system with double wipe brass grounding contacts and self grounding strap.
4. Back and side wired.
5. Rated 20 A, 125 V AC.
6. High impact nylon body.
7. Receptacle body color:
   a. Normal power: Ivory.
8. All outlets to be ground fault circuit interrupter: Feed-through type with test and reset buttons.
9. Duplex or simplex as indicated.
10. Configuration: NEMA 5-20R.
11. Standards: UL 498, UL 514A, UL 943; NEMA WD-1, WD-6.

B. Wallplate: Type 302 stainless steel.

C. Wet Areas:
1. Corrosion resistant nickel plated metal parts.

D. Special Purpose Receptacles and Covers:
1. NEMA configuration as indicated.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Mount devices where indicated and as scheduled in Section 16010 (Electrical: Basic Requirements).

C. See Section 16130 (Raceway and Boxes) for device outlet box requirements.

D. Where more than one receptacle is installed in an area, the receptacles shall be symmetrically arranged.
E. Provide blank plates for empty outlets.

END OF SECTION

SECTION 16410

SAFETY SWITCHES

PART 1 GENERAL

1.1 SUMMARY

A. Related Section:
   1. Section 16010 (Electrical: Basic Requirements).
   2. Section 16490 (Overcurrent and short Circuit Protective Devices).

1.2 REFERENCES

A. NEMA KS-1	Enclosed and Miscellaneous Distribution Equipment Switches.
B. UL 98	Enclosed and Dead-Front Switches.

1.3 SUBMITTALS

A. See Section 16010 (Electrical: Basic Requirements).
B. Product Data:
   1. Associate safety switch type and rating with connect equipment tag number.
C. Installation, Operation and Maintenance Manuals:
   1. Safety switches.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following safety switch manufacturers are acceptable:
   1. Eaton.
   2. General Electric Company.
   3. Square D Company.
   4. Siemens.
   5. Or Approved Equal.

2.2 SAFETY SWITCHES

A. General:
   1. Non-fusible or fusible as indicated.
   2. Suitable for service entrance when required.
   3. NEMA Type HD heavy-duty construction.
   4. Switch blades shall be fully visible in the OFF position with the enclosure door open.
   5. Quick-make/quick-break operating mechanism.
   6. Deionizating arc chutes.
   7. Double-break rotary action shaft and switchblade shall be manufactured as one common component.
   8. Clear line shields to prevent accidental contact with line terminals.
   9. Operating handle:
      a. Red and easily recognizable.
      b. Padlockable in the OFF position

c. Interlocked to prevent door from opening when the switch is in the ON position with a defeater mechanism.

B. Ratings:
1. Horsepower rated of connected motor.
2. Voltage and amperage: As indicated on Drawings.
3. Short circuit withstand: Equal to or greater than the upstream equipment.

C. Enclosures:
1. NEMA 4X rated (metallic):
a. Body and cover: Type 304 or 316 stainless steel.
b. No knockouts, external mounting flanges, hinged and gasketed door.
2. NEMA 12 rated:
a. Body and cover: Sheet steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
b. No knockouts, external mounting flanges, hinged and gasketed door.

D. Overcurrent and short circuit protective devices:
1. Fuses.
2. See Section 16490 (Overcurrent and Short Circuit Protective Devices) for overcurrent and short circuit protective device requirements.

E. Standards: NEMA KS-1, UL 98.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install as indicated and in accordance with manufacturer's instructions and recommendations.

B. Switches shall be installed adjacent to the equipment they are intended to serve unless otherwise indicated on the Drawings.

C. Permitted uses of NEMA 4X metallic enclosure:
1. Surface mounted in areas designated as wet or outdoors exposed to weather.

D. Permitted uses of NEMA 12 enclosure:
1. Surface mounted in areas designated as dry in non-architecturally finished areas.

END OF SECTION

SECTION 16412

SEPARATELY MOUNTED CIRCUIT BREAKERS

PART 1 GENERAL

1.1 SUMMARY

A. Related Sections:
   1. Section 16490 (Overcurrent and Short Circuit Protective Devices).

1.2 REFERENCES

A. UL 489 — Standard for Safety Molded Case Circuit Breakers, Molded Case Switches, and Circuit Breaker Enclosures

1.3 SUBMITTALS

A. Shop Drawings:
   1. Circuit breakers.
B. Installation, Operation, and Maintenance Manual:
   1. Circuit breakers.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Eaton.
   2. General Electric Company.
   3. Square D Company.
   4. Siemens.
   5. Or Approved Equal.

2.2 COMPONENTS

A. NEMA 4X rated:
   1. Body and cover: Type 304 or 316 stainless steel.
   2. No knockouts, external mounting flanges, hinged and gasketed door.
   3. Front operating handle padlockable in the OFF position and interlocked to prevent door from opening when the breaker is ON.
   4. Suitable for service entrance.
B. NEMA 12 rated:
   1. Body and cover: Sheet steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
   2. No knockouts, external mounting flanges, hinged and gasketed door.
   3. Front operating handle padlockable in the OFF position and interlocked to prevent door from opening when the breaker is ON.
   4. Suitable for service entrance.
C. Standards: UL 489.
D. Overcurrent and short circuit protective devices:
   1. Molded case circuit breaker.

2. See Section 16490 (Overcurrent and Short Circuit Protective Devices) for overcurrent and short circuit protective device requirements.
3. Factory installed.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install as indicated and in accordance with manufacturer's recommendations and instructions.
B. Permitted uses of NEMA 4X enclosure:
   1. Surface mounted in areas designated as wet or outdoors exposed to weather.
C. Permitted uses of NEMA 12 enclosure:
   1. Surface mounted in areas designated as dry.

END OF SECTION

SECTION 16441

PANELBOARDS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Lighting and appliance panelboards.
   2. Power distribution panelboards.
   3. Modifications or additions to existing panelboards.
B. Related Sections:
   1. Section 16010 (Electrical: Basic Requirements).
   2. Section 16490 (Overcurrent and Short Circuit Protective Devices).

1.2 REFERENCES

A. NEMA 250	Enclosures for Electrical Equipment (1000 Volts Maximum)
B. NEMA PB1	Panelboards
C. UL 50	Cabinets and Boxes
D. UL 67	Panelboards

1.3 SUBMITTALS

A. See Section 16010 (Electrical: Basic Requirements).
B. Shop Drawings:
   1. Panelboard layout with alphanumeric designation, branch circuit breakers size and type, as indicated in the panelboard schedules.
C. Installation, Operation, and Maintenance Manual:
   1. Panelboards.
   2. Panelboard breakers.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Eaton.
   2. General Electric Company.
   3. Square D Company.
   4. Siemens.
   5. Or Approved Equal.
B. Modifications to existing panelboards shall match existing panelboard.

2.2 MANUFACTURED UNITS

A. Standards: NEMA PB 1, NFPA 70, UL 50, UL 67.
B. Ratings as follows unless otherwise indicated:
   1. Current, voltage, number of phases, number of wires as indicated.
   2. Panelboards rated 240 V AC or less: 10,000 amp minimum short circuit rating.
   3. Panelboards rated 480 V AC: 14,000 amp minimum short circuit rating.

C. Construction:
   1. Service entrance rated as indicated.
   2. Interiors factory assembled and designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.
   3. Multi-section panelboards: Feed-through or sub-feed lugs.
   4. Main lugs: Solderless type approved for copper and aluminum wire.
D. Bus bars:
   1. Main bus bars: Copper sized to limit temperature rise to a maximum of 65 DegC above an ambient of 40 DegC. Drilled and tapped and arranged for sequence phasing of the branch circuit devices.
   2. Ground bus and isolated ground bus, when indicated: Solderless mechanical type connectors.
   3. Neutral bus bars: Insulated 100 percent rated or 200 percent rated, when indicated on the Drawings and with solderless mechanical type connectors.
E. Enclosure:
   1. Boxes: Code gage galvanized steel, furnish without knockouts.
   2. Trim assembly: Code gage steel finished with rust inhibited primer and manufacturers standard paint inside and out.
   3. Lighting and appliance panelboard:
      a. Trims supplied with hinged door over all circuit breaker handles.
      b. Trims for surface mounted panelboards, same size as box.
      c. Trims for flush mounted panelboards, overlap the box by 3/4 IN on all sides.
      d. Doors lockable with corrosion resistant chrome-plated combination lock and catch, all locks keyed alike.
      e. Nominal 20 IN wide and 5-3/4 IN deep with gutter space in accordance with NEC.
      f. Clear plastic cover for directory card mounted on the inside of each door.
      g. NEMA 3R or 12 rated: Door gasketed.
   4. Power distribution panelboard:
      a. Trims cover all live parts with switching device handles accessible.
      b. Less than or equal to 12 IN deep with gutter space in accordance with NEC.
      c. Clear plastic cover for directory card mounted front of enclosure.
      d. NEMA 3R or 12 rated: Doors gasketed and lockable with corrosion resistant chrome-plated combination lock and catch, all locks keyed alike.
   5. Overcurrent and short circuit protective devices:
      a. Main overcurrent protective device:
         1) Molded case circuit breaker.
      b. Branch overcurrent protective devices:
         1) Mounted molded case circuit breaker.
      c. See Section 16490 (Overcurrent and Short Circuit Protective Devices) for overcurrent and short circuit protective device requirements.
      d. Factory installed.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install as indicated, in accordance with the NEC, and in accordance with manufacturer's instructions.

B. Support panelboard enclosures from wall studs or modular channels support structure, per Section 16010 (Electrical: Basic Requirements).
C. Provide NEMA 1, 3R or 12 rated enclosure as indicated.
D. Provide panelboard labeling as specified in Section 16010 (Electrical: Basic Requirements).
E. Provide each panelboard with a typed directory:
   1. Identify all circuit locations in each panelboard with the load type and location served.
   2. Mechanical equipment shall be identified by Owner-furnished designation if different than designation indicated.
   3. Room names and numbers shall be final building room names and numbers as identified by the Owner if different than designation indicated.

END OF SECTION

SECTION 16442

MOTOR CONTROL EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Motor control centers and modifications and additions.
   2. Separately mounted motor starters (including those supplied with equipment).
   3. Manual motor starters.
   4. Arc flash calculations, labels and any recommendations to minimize PPE.

B. Related Sections:
   1. Section 16010 (Electrical: Basic Requirements).
   2. Section 16490 (Overcurrent and Short Circuit Protective Devices).
   3. Section 16493 (Control Equipment Accessories).

1.2 REFERENCES

A. NEMA 250	Enclosures for Electrical Equipment (1000 Volt Maximum)
B. NEMA ICS 2	Industrial Control Devices, Controllers, and Assemblies
C. UL 508	Industrial Control Equipment
D. UL 845	Electric Motor Control Centers

1.3 SUBMITTALS

A. See Section 16010 (Electrical: Basic Requirements).

B. Shop Drawings:
   1. Front elevation and plan drawing of the assembly.
   2. Conduit space locations within the assembly.
   3. Single line drawing.
   4. Unit wiring diagrams for motor starter controls.
   5. Starter and component schedule.
   6. Typical control power transformer size calculation for each starter size.
   7. Discrepancies between equipment sizes on drawing and actual installed equipment.

C. Quality Assurance/Control Submittals:
   1. Test Reports:
      a. Ground fault protection system test report signed by the supervising electrical foreman.

D. Installation, Operation, and Maintenance Manual:
   1. Motor control center.
   2. Starters.
   3. Relays.
   4. Circuit breakers.
   5. Control devices.
   6. Power monitor.
   7. Copy of Arc Flash Report.

1.4 QUALITY ASSURANCE

A. Verify motor horsepower loads, other equipment loads, and controls from approved Shop Drawings and notify Owner of any discrepancies.

B. Verify the required instrumentation and control wiring for a complete system and notify Owner of any discrepancies.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Allen-Bradley
   2. Eaton.
   3. General Electric Company.
   4. Square D Company.
   5. Siemens.
   6. Or Approved Equal.

B. Modifications to existing motor control centers shall match and be compatible with existing.

2.2 MOTOR CONTROL CENTERS

A. Ratings:
   1. 600 Volt class, 3 phase, 60 hertz with operating voltage and number of wires as indicated.
   2. Short circuit withstand rating: 65 KAIC symmetrical unless otherwise indicated.

B. Construction:
   1. Standards: UL 845.
   2. Totally enclosed, dead front, free standing assemblies. Bolted together to form a single assembly.
   3. Fabricate of not less than 14 GA steel with 16 GA steel doors in standardized units.
   4. Nominal size per section: 20 IN wide, 20 IN deep, and 90 IN high.
   5. Enclosure:
      a. NEMA 12:
         1) Dust-tight and drip-proof.
         2) Gasketed material round all doors, door cutouts, cover plates, side, top and back sheets.
         3) Gasketed bottom plate.
      b. NEMA 3R non-walk-in:
         1) Rainproof and sleet resistant.
         2) NEMA 1 gasketed enclosure with an outdoor house erected around it.
   6. Horizontal wireways:
      a. At the top, isolated from the main bus
      b. At the bottom.
      c. Easily accessible.
      d. Full length of the MCC.
   7. Vertical wireway:
      a. Located in each MCC section that accepts plug-in units.
      b. Connect to top and bottom wireways.
      c. Isolated from the unit interiors.
      d. Accessible through a separate hinged door.
      e. Cable tie supports to hold wiring in place.

8. Unit doors:
    a. Formed round corners and rolled edges.
    b. Continuous piano hinge.
    c. Held closed by means of captive fasteners.
    d. Fabricate to be a part of the structure and not part of the starter.
9. Unit cubicles:
    a. Draw-out type for motor starters through NEMA Size 5.
    b. Guide rails for supporting and aligning starters.
    c. Operating handle:
        1) With the unit stabs engaged and door closed the handle mechanism allows complete ON/OFF control of the unit disconnect and clear indication of the disconnect status.
        2) Circuit breaker and MCP operators includes a separate TRIPPED position.
        3) Mechanical interlock to prevent the opening of the door when the disconnect is in the ON position with a defeater mechanism.
        4) Mechanical interlock to prevent the placement of the disconnect in the ON position with the door open with a defeater mechanism.
        5) Non-defeatable interlock to prevent the installation or removal of a unit unless the disconnect is in the OFF position.
        6) Padlockable in the OFF position.
    d. Control panel:
        1) Provide control devices as indicated per Section 16493 (Control Equipment Accessories), the following devices are the minimum required.
            (a) Three position switch (hand-off-auto).
            (b) Red ON indicator light.
            (c) Green OFF indicator light.
    e. Control Power:
        1) Control power transformer:
            (a) 120 Volt secondary.
            (b) Fused on primary and secondary side.
            (c) Sized for 140 percent of required load.
    f. Minimum of one full size space unit (12 IN) for any combination magnetic motor starter or starter without overload relay.
    g. One-half full size space unit (6 IN) for circuit breakers 100 A and less.
    h. Effectively baffled to isolate any ionized gases which may occur within unit starter.
    i. Each unit shall have a HawkEye IR window installed in the door for IR scanning.
10. Externally mounted overload relay pushbutton.
11. Assemblies effectively ventilated to allow relocation of starters and other components:
    a. Within the assembly and with the same load.
    b. Without having to compensate for changes in location.
12. Finish: Rust inhibited primer and manufacturers standard paint inside and out.
13. Provide ample unrestricted space for conduit entry from the bottom.
14. Wiring: NEMA Class I, Type B.
15. Seismic label.

C. Buses:
1. Material: Silver-plated copper.
2. Main horizontal bus:
    a. 600 A unless otherwise indicated.

b. Extend the full-length of the MCC with provisions for splicing additional sections to either end.

3. Vertical buses
   a. 300 A minimum.
   b. Securely bolted to the horizontal main bus with joint easily accessible for maintenance.
   c. Completely isolated and insulated by means of a barrier.
   d. Extended full length of vertical section to distribute incoming power to each circuit breaker and starter in structure. Starters NEMA size 5 and larger and certain other components may be cable connected to the main bus with the approval of the Owner.
   e. Extend Vertical bus to spaces provided for future equipment.
4. Ground bus:
   a. Extend the full-length of the MCC with provisions for splicing additional sections to either end.
   b. 1/4 x 2 IN, 300 A tin-plated copper.
   c. Solidly grounded to each structure.
   d. Locate near bottom of structure.
   e. Provide for lug connection of equipment ground wires.

D. Overcurrent and Short Circuit Protective Devices:
1. Main device:
   a. Molded case circuit breaker.
2. Feeder devices:
   a. Molded case circuit breaker.
3. Motor protection with full voltage starters:
   a. Motor circuit protector.
4. Motor protection with VFD:
   a. Molded case circuit breaker.
5. See Section 16490 (Overcurrent and Short Circuit Protective Devices) for overcurrent and short circuit protective device requirements.
6. Factory installed.

E. Motor Starters: See requirements within this section.

2.3 SEPARATELY MOUNTED COMBINATION STARTERS

A. Standards:
1. NEMA 250, ICS 2.
2. UL 508.

B. Enclosure:
1. NEMA 4X rated:
   a. Body and cover: Type 304 or 316 stainless steel.
   b. No knockouts, external mounting flanges, hinged and gasketed door.
2. NEMA 12 rated:
   a. Body and cover: Sheet steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
   b. No knockouts, external mounting flanges, hinged and gasketed door.

C. Operating Handle:
1. With the door closed the handle mechanism allows complete ON/OFF control of the unit disconnect and clear indication of the disconnect status.

2. Circuit breaker and MCP operators includes a separate TRIPPED position.
3. Mechanical interlock to prevent to prevent the opening of the door when the disconnect is in the ON position with a defeater mechanism for use by authorized personnel.
4. Mechanical interlock to prevent the placement of the disconnect in the ON position with the door open with a defeater mechanism for use by authorized personnel.
5. Padlockable in the OFF position.
6. Exceptions: NEMA 7 and 9 enclosures.

D. External mounted overload relay pushbutton.

E. Control Devices:
1. Provide control devices as indicated on the Drawings.
2. Devices shall be accessible with the door closed.

F. Control Power Transformer:
1. 120V secondary.
2. Fused on primary and secondary side.
3. Sized for 140 percent of required load.

G. Fault current withstand rating: Equal to the rating of the electrical gear from which it is fed.

H. Motor Starters: See requirements within this Section.

I. Overcurrent and Short Circuit Protective Devices:
1. Motor protection with full voltage starters:
   a. Motor circuit protector.
2. Motor protection with reduced voltage starters:
   a. Molded case circuit breaker.
3. See Section 16490 (Overcurrent and Short Circuit Protective Devices) for overcurrent and short circuit protective device requirements.
4. Factory installed.

2.4 MOTOR STARTERS

A. Standards:
1. NEMA ICS 2.
2. UL 508.

B. Full Voltage Non-Reversing (FVNR) Magnetic Starters:
1. NEMA full size rated contactor.
   a. NEMA half sizes and IEC contactors are not permitted.
2. Double-break silver alloy contacts.
3. Overload relays:
   a. Ambient compensated, bimetallic type with interchangeable heaters, +/-24 percent adjustability, single phase sensitivity, an isolated arm contact and manual reset.
   b. Ambient insensitive, adjustable solid state type with phase loss protection, phase imbalance protection and manual reset.
4. Interlock and auxiliary contacts, wired to terminal blocks:
   a. Holding circuit contact, normally open.
   b. Overload alarm contact, normally open.
   c. Normally open auxiliary contact, for remote run status.
   d. Additional field replaceable auxiliary contacts as required per the Sequence of Operation.
   e. Two additional normally open spare field replaceable auxiliary contacts.

2.5 MANUAL MOTOR STARTERS

A. Standards:
   1. NEMA 250, ICS 2.
   2. UL 508.
B. Quick-make, quick-break toggle mechanism that is lockable in the OFF position.
C. Types:
   1. Horsepower rated, for ON/OFF control.
   2. Horsepower rated, for ON/OFF control and thermal overload protection. Switch to clearly indicate ON, OFF, and TRIPPED position.
D. Voltage and current ratings and number of poles as required for the connected motor.
E. Enclosures:
   1. NEMA 4X rated:
      a. Type 304 or 316 stainless steel.
      b. No knockouts, external mounting flanges.
   2. NEMA 12 rated:
      a. Body and cover: Sheet steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
      b. No knockouts, external mounting flanges.

2.6 SYSTEM ARC FLASH

A. Arc flash labels shall be provided for and affixed to motor control center, see Section 16010 (Electrical: Basic Requirements).

PART 3 EXECUTION

3.1 INSTALLATION

A. Install as indicated and in accordance with manufacturer's recommendations and instructions.
B. Mounting height for surface mounted equipment: See Section 16010 (Electrical: Basic Requirements).
C. Mount MCC on 4 IN high concrete pad:
   1. Install two 4 IN wide channel sills flush in pads to support and maintain alignment of the MCC.
   2. Align front of MCC with top edge of pad chamfer.
D. Overload Heaters:
   1. Size for actual motor full load current of the connected motor.
   2. For motors with power factor correction capacitors, size to compensate for the capacitors effect on load current.
E. Combination and Manual Starter Enclosures:
   1. Permitted uses of NEMA 4X enclosure:
      a. Surface mounted in areas designated as wet or outdoors exposed to weather.

3.2 FIELD QUALITY CONTROL

A. Test all breakers and control circuits/starters for proper operation.

END OF SECTION

SECTION 16490

OVERCURRENT AND SHORT CIRCUIT PROTECTIVE DEVICES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Low voltage circuit breakers.
   2. Low voltage fuses.
B. Related Sections:
   1. Section 16010 (Electrical: Basic Requirements).

1.2 REFERENCES

A. NEMA AB1	Molded Case Circuit Breakers
B. UL 489	Molded Case Circuit Breakers and Circuit Breaker Enclosures
C. UL 943	Ground Fault Circuit Interrupters

1.3 SUBMITTALS

A. See Section 16010 (Electrical: Basic Requirements).
B. Product Data:
   1. Descriptive literature on all equipment proposed.
C. Installation, Operation, and Maintenance Manual:
   1. Circuit breakers.
   2. Fuses.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Circuit breakers:
      a. Eaton.
      b. General Electric Company.
      c. Square D Company.
      d. Siemens.
      e. Or Approved Equal.
   2. Fuses:
      a. Bussmann, Inc.
      b. Littlefuse, Inc.
      c. Gould Shawmut.
      d. Or Approved Equal.

2.2 CIRCUIT BREAKERS

A. Molded case type:
   1. General:
      a. Standards: NEMA AB 1, UL 489.
      b. Unit construction.

c. Over-center, toggle handle operated.
d. Quick-make, quick-break, independent of toggle handle operation.
e. Manual and automatic operation.
f. All poles open and close simultaneously.
g. Three position handle: on, off and tripped.
h. Molded-in ON and OFF markings on breaker cover.
i. One-, two- or three-pole as indicated.
j. Current and interrupting ratings as indicated.
k. Bolt on type.

2. Thermal magnetic type:
   a. Inverse time overload and instantaneous short circuit protection by means of a thermal magnetic element.
   b. Frame size 150 amp and below:
      1) Non-interchangeable, non-adjustable thermal magnetic trip units.
   c. Frame sizes 225 to 250 amp:
      1) Interchangeable and adjustable instantaneous thermal magnetic trip units.
   d. Ground Fault Circuit Interrupter (GFCI) Listed:
      1) Standard: UL 943.
      2) One- or two-pole as indicated.
      3) Class A ground fault circuit.
      4) Trip on 5 mA ground fault (4-6 mA range).
   e. HACR listed:
      1) Heating, air conditioning and refrigeration applications.
3. Solid state trip type:
   a. Inverse time overload, instantaneous short circuit and ground fault protection by means of a solid state trip element, associated current monitors and flux shunt trip mechanism.
   b. Frame size 400 amp and above:
      1) Interchangeable current sensor or rating plug:
      2) Adjustable long time pickup setting. Adjustable from 50 to 100 percent of the current sensor or rating plug.
      3) Adjustable short time pickup setting.
      4) Adjustable instantaneous pick-up.
      5) Fixed ground fault pickup.
4. Motor circuit protector:
   a. Adjustable instantaneous short circuit protection by means of a magnetic or solid state trip element.
   b. Sized for the connected motor.

PART 3 EXECUTION

3.1 INSTALLATION

A. Current and interrupting ratings as indicated.
B. Series rated systems not acceptable.
C. Devices shall be ambient temperature compensated.
D. Molded case circuit breakers shall incorporate the following, unless otherwise indicated:
   1. Frame sizes 250 amp and less shall be thermal magnetic type.
   2. Frame sizes 400 amp and larger shall be solid state trip type.

a. Current sensor or rating plugs long time pickup setting shall be set so that the indicated trip level is near the 75 percent trip point.

3. Motor circuit protectors sized for the connected motor.

3.2 FIELD QUALITY CONTROL

A. Adjustable Circuit Breakers:

1. Set all circuit breaker adjustable taps as defined on the Drawings.
2. Test all circuit breakers for proper operation.

END OF SECTION

SECTION 16493

CONTROL EQUIPMENT ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Operator control devices (selector switches, pushbuttons, indicator lights, etc.).
   2. Control devices (timers, relays, contactors, etc.).
   3. Control panels and operator stations.
   4. Wiring termination equipment in fish ladder structure.

B. Related Sections:
   1. Section 16010 (Electrical: Basic Requirements).

1.2 REFERENCES

A. NEMA ICS 2	Industrial Control Devices, Controllers, and Assemblies
B. NEMA 250	Enclosures for Electrical Equipment (1000 Volt Maximum)
C. UL 50	Standard for Enclosures for Electrical Equipment
D. UL 508	Industrial Control Equipment

1.3 SUBMITTALS

A. See Section 16010 (Electrical: Basic Requirements).

B. Installation, Operation, and Maintenance Manual:
   1. Control Devices.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Pilot Devices:
      a. Eaton.
      b. Allen Bradley.
      c. Or Approved Equal.
   2. Relays:
      a. Idec.
      b. Potter & Brumfield.
      c. Allen-Bradley.
      d. Or Approved Equal.
   3. Terminal Blocks:
      a. Phoenix Contact.
      b. Allen-Bradley.
      c. Or Approved Equal.
   4. Enclosures:
      a. Hoffman Engineering Co.
      b. Wiegmann.
      c. B-Line Circle AW.Adalet.

d. Or Approved Equal.

2.2 PILOT DEVICES

A. General Requirements:
1. Standards: NEMA ICS 2, UL 508.
2. Heavy-duty NEMA 4/13 watertight/oiltight.
3. Heavy-duty NEMA 4/4X corrosion resistant.
4. Heavy-duty factory sealed, explosion-proof and dust ignition-proof (Class I and II).
5. Mounting hole: 30.5 mm.
6. Contact blocks: 10 amp, NEMA A600 rated, number as required to fulfill functions shown or specified.
7. Legend plate marked as indicated or specified.

B. Selector Switches:
1. Two, three- or four-position rotary switch as required to fulfill functions shown or specified.
2. Maintained contact type.
3. Knob or lever type operators.

C. Pushbuttons:
1. Non-illuminated type:
   a. Protective boot.
   b. Momentary contact.
   c. Standard flush and mushroom operators.
   d. Red colored buttons for START or ON and green color for STOP or OFF.
   e. Emergency stop pushbuttons: Mushroom head operator and maintained contact.
2. Illuminating type:
   a. Protective boot.
   b. Momentary contact.
   c. Standard flush operator.
   d. Serves as both pushbutton control and indicating light.
   e. Red colored lenses for START or ON and green color for STOP or OFF.
   f. LED light unit with lens and panel gasket.

D. Indicating Lights:
1. Allowing replacement of bulb without removal from control panel.
2. Lamp: LED, 120 V or 24 V as required.
3. Full voltage type.
4. Push-to-test indicating lights.
5. Glass lens.
6. Color code lights as follows:
   a. Red: ON or running; valve open.
   b. Amber: Standby; auto mode; ready.
   c. Green: OFF or stopped; valve closed.
   d. Dark grey: Fail or off-line.
   e. Yellow: Alarm or error.
   f. Orange: Manual mode.
   g. Purple: Transition.
   h. White: Power available.

E. Lockout Stop Switches:
1. Pushbutton.

2. Install lockout device so when engaged the pushbutton is maintained in the contact open position.

2.3 RELAYS

A. General Requirements:
   1. Standards: NEMA ICS 2, UL 508.
B. Control Relays:
   1. General purpose (ice cube) type:
      a. Plug-in housing.
      b. Clear polycarbonate dust cover with clip fastener.
      c. Coil voltage: 120 V AC or as required.
      d. Contacts:
         1) 10 amp continuous.
         2) Silver cadmium oxide.
         3) Minimum of 3 SPDT contacts.
      e. Sockets: DIN rail mounted.
      f. Internal neon or LED indicator is lit when coil is energized.
      g. Manual operator switch.
   2. Industrial type:
      a. Coil voltage: 120 V AC or as required.
      b. Contacts:
         1) 10 amp, NEMA A600 rated.
         2) Double break, silver alloy.
         3) Convertible from normally open to normally closed or vice versa, without removing any wiring.
         4) Expandable from 2 poles to 12 poles.
      c. Provide contacts for all required control plus two spares.
C. Time Delay Relays:
   1. General purpose type:
      a. Timing modes: On and Off delay, interval, one shot and repeat cycle.
      b. Plug-in housing.
      c. Polycarbonate dust cover with clip fastener.
      d. Coil voltage: 120 V AC or as required.
      e. Contacts:
         1) 10 amp continuous.
         2) Silver cadmium oxide.
         3) Two normally open and two normally closed DPDT contacts.
      f. Sockets: DIN rail mounted.
      g. External timing adjustment knob.
      h. Timing ranges: 0.05 seconds to 16.65 HRS.
      i. Repeat accuracy: $\pm$1 percent.
   2. Solid State industrial type:
      a. Timing modes: On and Off delay and repeat cycle.
      b. Industrial housing.
      c. Coil voltage: 120 V AC or as required.
      d. Contacts:
         1) 5 amp, NEMA B150 rated.
         2) Silver alloy.

3) Convertible On Delay and Off Delay contacts.
4) One normally open and one normally closed timed contacts.
5) One normally open and one normally closed instantaneous contacts.

e. Furnish with "on" and "timing out" indicators.
f. External timing adjustment knob.
g. Timing ranges: 0.05 seconds to 10 HRS.
h. Repeat accuracy: ±1 percent.

3. Mechanical industrial type:
   a. Timing modes: On and Off delay.
   b. Coil voltage: 120 V AC or as required.
   c. Contacts:
      1) 10 amp, NEMA A600 rated.
      2) Double break, silver alloy.
      3) Convertible On Delay and Off Delay contacts.
      4) Convertible normally open and normally closed timed contacts.
      5) Convertible normally open instantaneous contacts.
   d. External timing adjustment knob.
   e. Timing ranges: 0.2 – 60 sec or 5 – 180 sec.
   f. Repeat accuracy: greater than ±10 percent.

2.4 MISCELLANEOUS DEVICES

A. Run Time Meters:
   1. Six-digit wheels including a 1/10 digit.
   2. Non-reset type.
   3. Time range in hours.
   4. Automatic recycle at zero.
   5. Accuracy: 1 percent.
   6. Sealed against dirt and moisture.
   7. Tamperproof.

2.5 TERMINATION EQUIPMENT IN ENCLOSURES

A. General Requirements:
   1. Modular type with screw compression clamp.
   2. Screws: Stainless steel.
   3. Current bar: Nickel-plated copper allow.
   4. Thermoplastic insulation rated for -40 to +90 DegC.
   5. Wire insertion area: Funnel-shaped to guide all conductor strands into terminal.
   6. End sections and end stops at each end of terminal strip.
   7. Machine-printed terminal markers on both sides of block.
   8. Spacing: 6 mm.
   9. Wire size: 22-12 AWG.
   10. Rated voltage: 600 V.
   11. Din rail mounting.
   12. This paragraph applies to equipment in wall or floor mounted enclosures in dry locations.

B. Standard-type block:
   1. Rated current: 30 A.
   2. Color: Gray body.

C. Bladed-type disconnect block:
   1. Terminal block with knife blade disconnect which connects or isolated the two sides of the block.
   2. Rated current: 10 A.
   3. Color:
      a. Panel control voltage leaves enclosure - normal: Gray body, orange switch.
      b. Foreign voltage entering enclosure: Orange body, orange switch.
D. Grounded-type block:
   1. Electrically grounded to mounting rail.
   2. Terminal ground wires and analog cable shields.
   3. Color: Green and yellow body.
E. Fuse Holders:
   1. Blocks can be ganged for multi-pole operation.
   2. Spacing: 9.1 mm.
   3. Wire size: 30-12 AWG.
   4. Rated voltage: 300 V.
   5. Rated current: 12 A.
   6. Fuse size: 1/4 x 1-1/4.
   7. Blown fuse indication.
   8. DIN rail mounting.

2.6 ENCLOSURES

A. Control Panels:
   1. NEMA 4X rated:
      a. Body and cover: 14 GA Type 304 or 316 stainless steel.
      b. Seams continuously welded and ground smooth.
      c. No knockouts.
      d. External mounting flanges.
      e. Hinged door and stainless steel screws and clamps.
      f. Door with oil-resistant gasket.
   2. NEMA 12 enclosure:
      a. Body and cover: 14 GA steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
      b. No knockouts.
      c. External mounting flanges.
      d. Non-hinged stainless steel cover held closed with captivated cover screws threaded into sealed wells or hinged cover held closed with stainless steel screws and clamps.
      e. Flat door with oil resistant gasket.
   3. Control Panel Miscellaneous Accessories:
      a. Back plane mounting panels: Steel with white enamel finish or Type 304 stainless steel.
      b. Interiors shall be white or light gray in color.
      c. Wire management duct:
         1) Bodies: PVC with side holes.
         2) Cover: PVC snap-on.
         3) Size as required.
      d. Rigid handles for covers larger than 9 SF or heavier than 25 LBS.
      e. Split covers when heavier than 25 LBS.

f. Floor stand kits made of same material as the enclosure.
g. Weldnuts for mounting optional panels and terminal kits.

4. Standards: NEMA 250, UL 50.

B. Operator Control Stations:
1. NEMA 4X rated:
a. Type 304 or 316 stainless steel body.
b. Gasketed Type 304 or 316 stainless steel cover.
c. Number of device mounting holes as required.

2.7 WIRING TERMINATION EQUIPMENT IN STRUCTURE

A. General: This Paragraph 2.7 applies to equipment in the fish ladder structure which is wet and damp and subject to flooding. See details on electrical drawings.
B. Terminal Blocks:
1. Barrier screw type.
2. Marine grade, brass or plated brass.
3. 600 volt, 20 ampere rating.
4. Closed back.
C. Wire Termination Lugs.
1. Marine grade, non insulated.
2. Tinned copper or brass.
3. Full ring type for permanent wiring.
4. Spade type with upturned ends (flanged) for removable devices.
D. Shrink Tube:
1. Marine grade, polyolefin, dual wall.
2. 3:1 shrink ratio, minimum.
3. Adhesive liner inside which flows and bonds when heated.
4. UL listed, MIL-25053/4.

2.8 MAINTENANCE MATERIALS

A. Provide 10 percent replacement lamps for indicating lights.
B. Provide 5 percent replacement caps for indicating lights.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install as indicated and in accordance with manufacturer's recommendations and instructions.
B. Control Panels:
1. Size as required to mount the equipment.
2. Permitted uses of NEMA 4X enclosure:
a. Surface mounted in areas designated as wet or outdoors exposed to weather.
3. Permitted uses of NEMA 12 enclosure:
a. Surface mounted in areas designated as dry architecturally or non-architecturally finished areas.
C. Operator Control Stations:
1. Permitted uses of NEMA 4X enclosure:
a. Surface mounted in areas designated as wet or outdoors exposed to weather.

3.2 FIELD QUALITY CONTROL

A. See Section 16010 (Electrical: Basic Requirements).

END OF SECTION

SECTION 16500

INTERIOR AND EXTERIOR LIGHTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   A. Material and installation requirements for:
      1. Interior building lighting fixtures.
      2. Exterior building and Site lighting fixtures.
      3. Lighting poles.
      4. Lighting control.
B. Related Sections:
   1. Section 16010 (Electrical: Basic Requirements).
   2. Section 16125 (Wire and Cable: 600 Volt and Below).

1.2 REFERENCES

A. UL 198C High-Interrupting-Capacity Fuses, Current Limiting Type

1.3 SUBMITTALS

A. See Section 16010 (Electrical: Basic Requirements).
B. Product Data:
   1. Identify fixtures by Fixture Schedule number.
   2. Fixture data sheet including:
      a. Photometric performance data including candlepower distribution and coefficient of utilization (CU) table.
      b. Fixture EPA's for pole mounted fixtures.
   3. Pole data shall include:
      a. Pole wind loading.
      b. Anchor bolt template.
C. Installation, Operation, and Maintenance Manual:
   1. Lighting Fixtures.

1.4 MAINTENANCE

A. Furnish a minimum of 10 percent of total of each type and amperage of fuses for fixtures indicated to be fused.
B. Spare parts are to be stored in a box clearly labeled as to its contents.

PART 2 PRODUCTS

2.1 LIGHTING FIXTURES

A. See schedule on drawings.

2.2 GENERAL REQUIREMENTS

A. All lighting fixtures and electrical components:
   1. UL labeled.
   2. Fixtures complete with mountings and cord and plug where shown.
   3. Rated for area classification as indicated.

B. No live parts normally exposed to contact.
C. When intended for use in wet areas: Mark fixtures "Suitable for wet locations."
D. When intended for use in damp areas: Mark fixtures "Suitable for damp locations" or "Suitable for wet locations."

2.3 LAMPS

A. LED: As specified with fixture.

2.4 POLES

A. As scheduled or noted on the Drawings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Locate fixtures as indicated.
B. Mount lighting fixtures at heights indicated in Section 16010 (Electrical: Basic Requirements) or per fixture schedule or as indicated.
C. Install exterior fixtures so that water can not enter or accumulate in the wiring compartment.
D. Ground fixtures.

3.2 POLE INSTALLATION

A. Mount as shown on drawings.
B. Protect pole finish during installation. Repair damage to pole finish with manufacturer approved repair kit.
C. Ground poles as indicated.
D. Conductors:
   1. See Section 16125 (Wire and Cable - 600 Volt and Below) for required underground conductors.
   2. Use interior building wire, as specified in Section 16125 (Wire and Cable - 600 Volt and Below), from pole base to fixture, #12 AWG minimum.
E. Overcurrent and Short Circuit Protection:
   1. Protect each phase with a UL Class CC fuse:
      a. Size: 3 times load current.
      b. Standard: UL 198C.
   2. Fuseholder:
      a. Watertight, in-line and break-a-way style.
      b. Accept up to a 30 Amp, 600 Volt fuse.
      c. Neutral conductor shall utilize a fuseholder with a solid copper rod.
      d. Conductor terminal: Adequate size for the installed conductors.

3.3 LIGHTING CONTROL

A. Fixtures controlled as detailed on Drawings.

3.4 ADJUST AND CLEAN

A. Adjust and clean fixtures prior to final acceptance.

END OF SECTION

SECTION 16973

ACCEPTANCE TESTING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for acceptance testing.

1.2 SUBMITTALS

A. Quality Assurance/Control Submittals:
   1. Test Reports:
      a. Test reports signed by the technician performing the test including the following information:
         1) Summary of Project.
         2) Description of equipment/components tested.
         3) Visual inspection report.
         4) Description of tests.
         5) Test results including appropriate test forms.
         6) Conclusions and recommendations.
         7) Identification of test equipment used.
   2. Conductor megger testing results.

1.3 SYSTEM DESCRIPTION

A. General:
   1. Completely coordinate with work of all other trades.
B. All equipment included in Division 16 shall be provided with manufacturer's test certification. Additional equipment and system testing requirements are specified in this Section.
C. Tests and inspections not specifically itemized herein but required to ensure that the equipment is ready for commercial operation shall be performed by Contractor.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

A. General:
   1. The acceptance tests shall be performed per NETA's Acceptance Testing Specifications For Electrical Power Distribution Equipment and Systems.
   2. The following paragraphs identify items to be tested and a brief list of the required tests per NETA. Additional tests not listed in the NETA document are also listed when required.
   3. Repairs shall be made when test values do not meet known acceptable values.
B. 600 V Cables:
   1. Perform visual and mechanical inspections:

   a. See the NETA document for requirements.
2. Perform electrical tests:
   a. Insulation resistance test.
   b. Connection resistance measurements.
   c. Continuity test.
3. Compare test values with known acceptable values.
4. Contractor may perform testing using megger.
5. Maintain record of all testing.
6. Megger each conductor after pulling and prior to connection.

C. System Functional Test:
1. Perform test upon completion of equipment acceptance tests.
2. The test is to prove the correct interaction of all sensing, processing and action devices.
3. Develop a test plan and parameters for the purpose of evaluating the performance of the system.
4. Perform the following tests:
   a. Verify the correct operation of all interlock safety devices for fail-safe functions in addition to design function.
   b. Verify the correct operation of all sensing devices, alarms and indicating devices.
5. Systems to be set:
   a. Set adjustments in adjustable circuit breakers.

END OF SECTION